Renewable Energy Engineering
2013-14 Assessment Report

Department of Electrical Engineering and Renewable Energy

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Editing Faculty

Frank Rytkonen, P.E.

Contents

1 Introduction

1.1 Program Design and Goals

The Bachelor of Science in Renewable Energy Engineering (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 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 instrumentation. BSREE graduates will enter renewable energy engineering careers as design, site analysis, product, application, test, quality control, and sales engineers.

1.2 Program History

In 2005, the Oregon Institute of Technology (Oregon Tech) began offering its new Bachelor of Science degree in Renewable Energy Systems program (BSRES) at its satellite campus in Portland, Oregon. The BSRES degree was the first of its kind in North America, and it was created to prepare graduates for careers in various fields associated with renewable energy. These included, but were not limited to, energy management, energy auditing, energy systems planning, energy economics, energy policy and development, carbon accounting and reduction, and energy-related research, as stated in Oregon Tech's 2005-06 catalogue.

In 2008, however, the BSRES degree was discontinued and replaced by the Bachelor of Science degree in Renewable Energy Engineering (BSREE). Analysis of the market place and observed growth in career options across the renewable energy fields revealed significant opportunities for graduates with a solid energy engineering education. By design, the original BSRES program was built atop a firm engineering foundation, and the curriculum could generally be described as near engineering-level. But the title of the degree, Renewable Energy Systems, a dearth of 300-level mathematics coursework and the absence of several key engineering fundamentals courses prevented the degree from being considered a full engineering degree program, particularly one that could be accredited as by the Engineering Accreditation Commission of ABET, Inc. By stating engineering as a principle programmatic focus, the career potential for graduates expanded beyond those previously stated to also include engineering-related career paths such as electrochemical systems engineering, energy systems design engineering, building systems engineering and modeling, hydronics engineering, power electronics engineering, HVAC engineering, and power systems engineering.

We anticipate BSREE graduates will enter energy engineering careers as power engineers, PV/semiconductor processing engineers, facilities and energy managers, energy system integration engineers, HVAC and hydronics engineers, design and modeling engineers for net-zero energy buildings, LEED accredited professionals (AP), biofuels plant and operations engineers, energy systems control engineers, power electronics engineers, utility program managers, as well as renewable energy planners and policy makers. Graduates of the program will be able to pursue a wide range of career opportunities, not only within the emerging fields of renewable energy, but within more traditional areas of energy engineering as well. Without a mechanism for obtaining professional licensure, these graduates would either not be able to advance in their careers or they would not find employment in these fields to begin with. Our survey of the renewable energy industry cluster in the Pacific Northwest convinced us that an engineering degree, the BSREE degree, was the only suitable option for our students.

1.3 Industry Relationships

The BSREE 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 REE program. Twenty representatives from corporations, government institutions and non-profit organizations comprise the IAC, giving the BSREE 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.

1.4 Program Locations

Among the advantages that make Oregon Tech an ideal institution for offering the BSREE program is the benefit of having campuses in two distinctive locations – one in urban Portland in proximity to the Pacific Northwest’s energy industry cluster, and the second in rural Southern Oregon with exceptional natural energy resources. The Portland campus allows students to leverage their classroom experience within internships at the Northwest's world-class energy and power companies. The Klamath Falls campus has unique energy advantages and is already a leading geothermal research facility. In addition, the climate makes it ideally suited to applied research in the field of solar energy.

2 Program Mission, Educational Objectives and Outcomes

2.1 Program Mission

The mission of the Renewable Energy Engineering degree program is to prepare students for the challenges of designing, promoting and implementing renewable energy solutions within society's rapidly-changing energy-related industry cluster, particularly within Oregon and the Pacific Northwest. Graduates will have a fundamental understanding of energy engineering and a sense of social responsibility for the implementation of sustainable energy solutions. The department will be a leader in providing career ready engineering graduates for various renewable energy engineering fields. Faculty and students will engage in applied research in emerging technologies and provide professional services to their communities.

2.2 Program Educational Objectives

Program educational objectives are broad statements that describe the career and professional accomplishments that the program is preparing graduates to achieve. The Program Educational Objectives (PEOs) of Oregon Tech's Bachelor of Science in Renewable Energy Engineering program are:

- BSREE graduates will excel as professionals in the various fields of energy engineering.
- BSREE graduates will be known for their commitment to lifelong learning, social responsibility, and professional and ethical responsibilities in implementing sustainable engineering solutions.
- BSREE graduates will excel in critical thinking, problem solving and effective communication.

2.3 Relationship Between Program Objectives and Institutional Objectives

These program educational objectives map to the Oregon Tech's institutional mission statement and core themes by offering statewide educational opportunity in an innovative and rigorous applied degree program in engineering oriented toward graduate success and an appreciation for the role of the engineer in public service.

2.4 Student Outcomes

The BSREE student outcomes (SOs) include ABET's EAC a - k[1]. All of these are listed here:

(a) an ability to apply knowledge of mathematics, science, and engineering

(b) an ability to design and conduct experiments, as well as to analyze and interpret data

(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

(d) an ability to function on multi-disciplinary teams

(e) an ability to identify, formulate, and solve engineering problems

(f) an understanding of professional and ethical responsibility

[1] Three additional student outcomes [(l) an ability to apply the fundamentals of energy conversion and applications, (m) an understanding of the obligations for implementing sustainable engineering solutions, and (n) an appreciation for the influence of energy in the history of modern societies] were deleted in 2012-13 based on the recommendation of experienced ABET evaluators (visiting Oregon Tech to evaluate the electrical engineering program for accreditation) with the Industry Advisory Council's concurrence.

(g) an ability to communicate effectively

(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

(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".

3 Assessment of Student Outcomes

3.1 Introduction and Method

Table 1 shows the minimum outcomes assessed during each academic year. Assessment of the student outcomes will be conducted over a three year-cycle, following the pattern starting in 2010-11 (during the 2009-10 academic year, all outcomes were assessed in order to establish a baseline). In addition to program assessment, faculty members participate in assessment of Institutional Student Learning Outcomes (ISLOs).

3.2 Assessment Cycle

Table 1 – BSREE Outcome Assessment Cycle

		2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
(a)	Fundamentals		√			√	
(b)	Experimentation			√			√
(c)	Design		√			√	
(d)	Teamwork		√			√	
(e)	Engineering Problems	√			√		
(f)	Ethics			√			√
(g)	Communication			√			√
(h)	Impact of Solutions			√			√
(i)	Life-long Learning	√	√*		√	√	
(j)	Contemporary Issues	√			√		
(k)	Engineering Tools	√			√		
* indicates the outcome from the previous year has been selected to be reassessed							
as part of the continuous improvement process							

3.3 Assessment Activities & Evidence of Student Learning

3.3.1 Introduction

The BSREE faculty conducted formal assessment during the 2013-14 academic year using direct measures, such as comprehensive ABET Projects and ABET Assignments.[3] Additionally, the student outcomes were assessed using indirect measures, namely results from student evaluations based on methods developed by the IDEA Center[4] and senior exit surveys.

[3] ABET Projects and ABET Assignments refer to projects and assignments especially designed by Oregon Tech BSREE faculty to go beyond the assessment of course outcomes in order to assess more general program-level outcomes including the ABET a-through-k outcomes.

[4] The IDEA Center, www.theideacenter.org

3.3.2 Assessment of Program Educational Objectives

During the 2012-13 academic year, the Dean of the College of Engineering, Technology and Management pointed out that the Engineering Accreditation Commission does not require assessment of program educational objectives. Therefore, with the concurrence of the department chair, no PEOs are assessed. However, the Industry Advisory Council will continue to be polled on an annual basis regarding their approval of the PEOs.

3.3.3 Methods for Assessment of Student Outcomes

The BSREE conducts direct and indirect assessments. The direct assessment process using assignments specifically designed to measure ABET-style outcomes. The indirect assessment process derives assessment data from course evaluations and from senior exit surveys.

Direct Measure: ABET Assignments

This direct assessment process links specific tasks within engineering course assignments to ABET student outcomes and then on to program educational objectives in a systematic way based on ABET rubrics.[5] The student outcomes are evaluated as part of the course curriculum primarily by means of comprehensive ABET assignments specifically designed to measure program-level outcomes in addition to course-level outcomes. These assignments typically involve a project or lab requiring the student to apply math, science, and engineering principles learned in the course to solve a particular problem requiring the use of modern CAD tools and engineering equipment, working in teams, and writing a project report or giving an oral presentation. ABET assignments are designed to assess several fundamental student outcomes at once.

An ABET multi-outcome rubric is used to perform direct assessment of these assignments. A systematic, rubric-based process is then used to quickly assess tasks within assignments and link them directly to a group of student outcomes. Evaluations of these outcomes are then gathered and accounted in outcome-specific tables, analyzed and then individually summarized. Summaries for all outcomes are then compiled into a comprehensive student outcome summary for each course. The outcome summary is then evaluated for relevance with respect to the program objectives. The summary of outcomes is formatted and organized such that it is suitable for inclusion in an ABET review document.

The mapping process aims to systemize the assessment of engineering coursework, and to provide a mechanism that facilitates the design of engineering assignments that meet the ABET-relevant ("a" through "k") outcomes, particularly those that are more distant from traditional engineering coursework. Rather than considering how the outcomes match the assignment, the assignment is designed to map to the student outcome s.

By assessing multiple outcomes per assignment, the number of assessed assignments may be reduced and assignments become more relevant to the student outcome s, since the assignments are designed with the general student outcomes in mind. Additionally, incorporating multiple outcomes in a single assignment provides for a richer assignment, one that takes into account a wider range of engineering issues.

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[5] "ABET rubrics" refer to rubrics especially designed by Oregon Tech BSREE faculty to assess ABET projects based on program-level outcomes.

Indirect Measure: Senior Exit Surveys

At Oregon Tech, senior exit surveys are conducted using the Qualtrics survey platform. The sections below describe the assessment performed using the senior exit surveys in 2012-13.

3.3.4 2013-14 Targeted Direct Assessment Activities

The sections below describe the 2013-14 targeted assessment activities and detail the performance of students for each of the assessed outcomes. Unless otherwise noted, the tables report the percentage of students performing at a developing level, accomplished level, and exemplary level for each performance criteria, as well as the percentage of students performing at an accomplished level or above.

The minimum acceptable performance level for all outcomes was to have 80% or above of the students performing at the accomplished or exemplary level for all performance criteria. The summary data presented in this section represent the percentages of students meeting course-specific criteria.

3.3.4.1 Targeted Assessment of Outcome (e)

An ability to identify, formulate, and solve engineering problems

Performance Criteria:

E1	Identify and define an engineering problem
E2	Articulate the problem in engineering terms
E3	Develop solutions appropriate for the problem

Assessment e1: [REE 469, Spring 2013 – Klamath Falls]

This outcome was not assessed.

Assessment e2: [REE 454, Winter 2014 – Wilsonville]

This outcome was assessed using a course project designing a power system protection scheme. The students were divided into groups of two and asked to develop a protection scheme for the electrical system in a combined cycle power plant. After developing the scheme, they were required to model the scheme in standard industry software.

Fifteen students were assessed in Winter 2013 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 2 below 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 student outcome.

Table 2 Targeted Assessment for Outcome (e).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(e) an ability to identify, formulate, and solve engineering problems				
E1: Identify and define an engineering problem	0%	19%	81%	100%
E2: Articulate the problem in engineering terms	19%	81%	0%	81%
E3: Develop solutions appropriate for the problem	0%	59%	41%	100%

3.3.4.2 Targeted Assessment of Outcome (i)

an ability to engage in independent learning and recognize the need for continual professional development

Performance Criteria:

I1	Demonstrate an awareness that knowledge must be gained
I2	Identify, gather and analyze information
I3	Recognize the acquisition of knowledge is a continuous process

Assessment i1: [REE 419, Fall 2013 – Klamath Falls]

This outcome was assessed using a final research paper or project assignment from students in the EE 419 Power Electronics Senior Class. Students were given a list of possible research topics or projects to choose from dealing with either Power Electronic Devices or Power Converters such as Power Diodes, Thyristors, IGBT, Power MOS, Power Converters, PWM Rectifiers, Charge Controllers, MPPT, LabVIEW project and more.

The students needed to conduct independent research for the paper or project using both class (internal) and external information. Then they needed to analyze information for paper report or project design. The assignment focused on developing good research skills to solve technical problems or issues.

Six students (out of 12) were assessed in the Fall term of 2013 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 3 below 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 understanding of the need for continual professional development and acquiring knowledge in engineering careers.

Table 3 Targeted Assessment for Outcome (i).

Performance Criteria	1 -Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(i) an ability to engage in independent learning and recognize the need for continual professional development				
I1: Demonstrate an awareness that knowledge must be gained	0%	0%	100%	100%
I2: Identify, gather and analyze information	0%	50%	50%	100%
I3: Recognize the acquisition of knowledge is a continuous process	0%	50%	50%	100%

Assessment i2: [REE 469, Spring 2013 – Wilsonville]

This outcome was assessed using two assignments. The first assignment required each student to select and read two recent technical research papers or a textbook chapter and provide a written summary of the material. The second assignment required each student to attend a technical conference or seminar related to the course, meet three people from industry and learn about their jobs, and provide a written summary of the material presented and the industry contacts they made.

Fifteen students were assessed in Spring 2013 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 8 below 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 student outcome. Students met or exceeded expectations.

Table 4 Targeted Assessment for Outcome (i).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(i) an ability to engage in independent learning and recognize the need for continual professional development				
I1: Demonstrate an awareness that knowledge must be gained	0%	0%	100%	100%
I2: Identify, gather and analyze information	7%	80%	13%	93%
I3: Recognize the acquisition of knowledge is a continuous process	0%	0%	100%	100%

3.3.4.3 Targeted Assessment of Outcome (j)

A knowledge of contemporary issues

Performance Criteria:

J1	Demonstrate knowledge of contemporary issues
J2	Recognize the temporal nature of contemporary issues
J3	Recognize the historical pretext of contemporary issues

b

Assessment j1: [REE 345/407, Spring 2013 – Klamath Falls]

This outcome was assessed using a customized quiz in two different elective classes for the REE program. The first class REE 345 Wind Power Systems (Junior Elective Class) used a quiz (take-home) that focused on the increasing energy usage for generation of a society's electrical power. Students were asked to write some brief position statements with regard to:

- Define the contemporary issues involved in moving towards a wind power system?
- Discuss how these issues have evolved over the last 10-20 years?
- How has technology helped with these issues?

The second class REE 407 Geothermal Power Plants (Senior Sequence Course) used a similar quiz with the same three questions applied to geothermal power systems

Sixteen total students(Five in REE 345 and Ten in REE 407) were assessed in the Spring Term of 2013 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 5 below summarizes the results of this targeted assessment. The results indicate that the minimum acceptable performance level of 80% was not met on all performance criteria for this program outcome. The result for the performance criteria on historical pretext was below 70%. Analyzing the assessment data indicated the lower performance was due to misunderstanding the quiz questions. Many students responded more on design impacts and lost sight of the bigger picture focus of contemporary issues. It is recommended that this assignment be redeveloped and this outcome assessed with an improved assignment with more explanations during the next normal assessment cycle for this outcome. Students met or exceeded expectations; they demonstrated their abilities to explain basic contemporary issues, and the historical or time nature of such issues.

Table 5 Targeted Assessment for Outcome (j).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(j) a knowledge of contemporary issues				
J1: Demonstrate knowledge of contemporary issues	20%	33%	47%	80%
J2: Recognize the temporal nature of contemporary issues	13%	47%	40%	87%
J3: Recognize the historical pretext of contemporary issues	27%	67%	7%	73%

Assessment j2: [REE 337, Fall 2013 – Wilsonville]

This outcome was assessed using an individual research paper, in which the students studied a material of their interest and its applications in the renewable energy field. The students were expected to demonstrate their knowledge of contemporary issues through the motivation of the paper, and description of current processing and characterization techniques used in the material they choose. The application and conclusion sections of the paper served to demonstrate their proficiency in recognizing the temporal nature of the contemporary issue, and the historical notes served to demonstrate their recognition of the historical pretext of the contemporary issue.

Nineteen students were assessed in Fall 2013 using the performance criteria listed below. The minimum acceptable performance level was to have above 80% of the students performing at the proficiency or high efficiency level in all performance criteria. The table below summarizes the results of this targeted assessment.

Table 6 below 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 student outcome. All, with exception of two students who did not submit the assignment, demonstrated proefficiency or high proefficiency in their knowledge of contemporary issues, and in recognizing the temporal nature of the issue and the historical pretext.

Table 6 Targeted Assessment for Outcome (j).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(j) a knowledge of contemporary issues				
J1: Demonstrate knowledge of contemporary issues	11%	37%	53%	89%
J2: Recognize the temporal nature of contemporary issues	16%	0%	84%	84%
J3: Recognize the historical pretext of contemporary issues	11%	16%	74%	90%

3.3.4.4 Targeted Assessment of Outcome k

An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice

Performance Criteria:

K1	Demonstrate proficiency with engineering software: CAD, FEA, programming, data analysis, etc
K2	Demonstrate proficiency with engineering hardware: test/measurement equipment, prototyping, etc

Assessment k1: [EE 419, Fall 2013 – Klamath Falls]

This outcome was assessed using a final lab project report from students in the EE 419 Power Electronics Senior Class. Students were given a list of possible lab projects to choose from dealing with either Power Electronic Devices or Power Converters such as Power Diodes, Thyristors, IGBT, Power MOS, Power Converters, PWM Rectifiers, Charge Controllers, MPPT, LabVIEW project and more.

Ten students were assessed in Fall term of 2013 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 7 below 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 utilize basic engineering tools (both hardware and software) to solve technical problems and deliver project design reviews.

Table 7 Targeted Assessment for Outcome (k).

Performance Criteria	1 -Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice				
K1: Demonstrate proficiency with engineering software	0%	60%	40%	100%
K2: Demonstrate proficiency with engineering hardware	0%	40%	60%	100%

Assessment k2: [REE 413, Spring 2013 – Wilsonville]

This outcome was assessed using a design laboratory in electric power inverter development. Students needed to apply simulation software to validate their designs and then implement their designs in hardware and test them.

Twenty students were assessed in Spring 2013 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 8 below 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 student outcome. Students met or exceeded expectations.

Table 8 Targeted Assessment for Outcome (k).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice				
K1: Demonstrate proficiency with engineering software	0%	20%	80%	100%
K2: Demonstrate proficiency with engineering hardware	0%	40%	60%	100%

3.3.4.4 Targeted Assessment of Outcome h – Wilsonville Only

The broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context

Performance Criteria:

H1	Identify impacts of engineering solutions
H2	Understand impacts in various contexts

Assessment h1: [REE 469, Spring 2013 – Wilsonville]

This outcome was assessed using an oral presentation assignment. The assignment required each student to develop a presentation on a topic related to issues implementing grid integration of renewable energy sources, and after presenting to the class, answer questions related to the impacts of the engineering solutions related to grid integration.

Fifteen students were assessed in Spring 2013 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 9 below 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 student outcome. Only one student struggled with presenting impacts related to their proposed solution.

Table 9 Targeted Assessment for Outcome (i).

Performance Criteria	1 - Developing	2 - Accomplished	3 - Exemplary	% Students ≥ 2
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context				
H1: Identify impacts of engineering solutions	0%	13%	87%	100%
H2: Understand impact in various contexts	7%	13%	80%	93%

3.3.4.5 Summary of Direct Measure Assessment for 2013-14

Strengths

The results indicated that REE graduates will be able to identify, formulate, and solve engineering problems, engaging in independent learning and recognize the need for continual professional development, a knowledge of contemporary issues, and able use the techniques, skills, and modern engineering tools necessary for engineering practice.

Weaknesses

There were no official weaknesses identified, though some areas within various outcomes where the percentage of students assessed were only slightly over the criteria set for demonstrating achievement.

Recommendations

None.

3.3.4.6 Direct Measure Assessment Outcome-Specific Discussion

(e) An ability to identify, formulate, and solve engineering problems

Assessment of this outcome showed great success in ability to identify, formulate, and solve engineering problems. Almost all students demonstrated accomplished or exemplary performance in the assessments. As no assessment of this outcome was available on the Klamath Falls campus, this will be reassessed in a later assessment cycle.

(i) An ability to engage in independent learning and recognize the need for continual professional development

Assessment of this outcome showed great success in the ability to engage in independent learning and recognize the need for continual professional development. Assessed students grasped that engineering is a career that will require these skills as long as they practice.

(j) A knowledge of contemporary issues

Assessment of this outcome showed great knowledge of contemporary issues. Students are highly aware of modern issues related to policy, markets, infrastructure, and environmental issues as related to renewable energy engineering.

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

Assessment of this outcome showed great success in the areas of ability to use modern engineering tools along with analytical and design techniques and skills in engineering practice. Use of software that is commonly used in industry aids students in the achievement of this outcome.

3.3.5 2013-14 Senior Exit Survey Indirect Assessments

3.3.5.1 Methodology for Assessment of Student Outcomes using Senior Exit Surveys

At Oregon Tech, graduating seniors are asked to complete an exit survey delivered online via the Qualtrics survey tool. One of the questions in the survey asks students to determine, for each student outcome, whether they think they are "inadequately prepared," "prepared," or "highly prepared" to meet that outcome. A result of "inadequately prepared" is scored as a 1, a result of "prepared" is scored as a 2, and a result of "highly prepared" is scored as a 3.

The minimum acceptable performance level is 80% of students believing that they are "prepared" or "highly prepared" for each assessed student outcome.

3.3.5.2 Indirect Assessment of Student Outcomes using Senior Exit Surveys

Twenty-five REE students responded to the senior exit survey question on student outcomes. Table 10 shows the results for the AY 2013-14 assessed student outcomes. Table 11 provides additional detailed statistics for the assessed outcomes. Both tables were obtained from the Qualtrics survey tool. The minimum acceptable performance level of 80% at the level of "prepared" or "highly prepared" was achieved for each outcome.[6]

Table 10 Student Exit Survey Indirect Assessment

Student Outcome	1 - Inadequately prepared	2 - Prepared	3 - Highly prepared	% Students ≥ 2
e. an ability to identify, formulate, and solve engineering problems	0.00%	40.00%	60.00%	100%
i. an ability to engage in independent learning and recognize the need for continual professional development	0.00%	36.00%	64.00%	100%
j. a knowledge of contemporary issues	4.00%	36.00%	60.00%	96%
k. an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice	4.00%	32.00%	64.00%	96%

Table 11 Student Exit Survey Detailed Statistics

Statistic	e.	i.	j.	k.
Min Value	2	2	1	1
Max Value	3	3	3	3
Mean	2.60	2.64	2.56	2.60
Variance	0.25	0.24	0.34	0.33
Standard Deviation	0.51	0.49	0.58	0.58
Total Responses	25	25	25	25

[6] An alternative means of achieving the minimum acceptable performance level would be a mean of 1.8, which is equivalent to 80% of respondents at the level of "prepared" or "highly prepared."

3.3.5.3 Summary of Senior Exit Survey Indirect Measure Assessment for 2013-14

Strengths

All 25 respondents to the senior exit survey believe they are either prepared or highly prepared for outcomes (i) and (j). Only two respondents believe that they are inadequately prepared with regard to outcome (j), and only two respondents believe they are inadequately prepared with regard to outcome (k).

Weaknesses

No weaknesses were noted.

Recommendations

None.

4 Changes Resulting from Assessment

4.1 Changes to 2013-14 Assessment Methods Resulting from the 2012-13 Assessment

The assessments conducted during the 2012-13 academic year revealed the following areas of recommended improvement (shown in italics). The 2013-14 actions taken are shown following each recommendation.

1. *Due to completing only one of the assigned direct assessments for outcome (h), reassess outcome (h) in 2013-14 at the Wilsonville campus.*

   This outcome was reassessed in a class containing a majority of the graduating seniors. No significant problems were identified.
2. *Revisit IDEA Center indirect mapping with faculty and provide training on how to use the mapping consistently as a faculty.*

   With faculty concurrence, the use of IDEA Center evaluation mapping was put on hold until the methods of using it for assessment can be clarified.
3. *Discuss criterion F3 with the faculty. Some faculty believe that this criterion should be deleted or amended.*

   With faculty concurrence, criterion F3 will continue to be assessed.

4.2 Recommended Changes to Curriculum Resulting from the 2013-14 Assessment

1. *None noted. However, during the course of the academic year, a curriculum committee began meeting to review the state of the REE curriculum and will develop proposals related to curricular change for future academic years. This is due to several voiced faculty concerns regarding the program content.*

2. *Reassess outcome (e) on the Klamath Falls campus during a later assessment cycle.*

Appendix A - Mapping Between Student Outcomes and the BSREE Curriculum

Table 12 - Mapping between BSREE engineering courses and the Student Outcomes. Check marks indicate the faculty has identified the outcome as assessable in a particular class.

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
CHE 260	√	√		√	√		√			√	
ECO 357	√					√	√	√	√	√	
EE 221	√	√		√	√		√				√
EE 223	√	√		√	√		√				√
EE 225	√	√		√	√		√				√
EE 321	√	√	√	√	√		√		√		√
EE 343	√			√	√	√	√	√	√	√	
EE 419	√	√	√	√	√		√	√			√
EE 456	√	√	√	√	√	√	√				√
ENGR 211	√				√		√				√
ENGR 266	√	√			√						√
ENGR 355	√				√		√				√
ENGR 465	√	√	√	√	√	√	√	√	√	√	√
ENV 427	√					√	√		√	√	
HIST 356							√				
MECH 318	√	√		√	√		√				√
MECH 323	√				√						√
MECH 433	√	√		√	√		√			√	√
REE 201	√					√	√	√		√	
REE 243	√	√		√	√		√		√	√	√
REE 253	√	√	√	√	√		√				√
REE 331	√	√	√	√	√		√	√	√	√	√
REE 333	√	√	√	√	√	√	√	√	√	√	√
REE 335	√	√	√	√	√	√	√	√	√	√	√
REE 337	√				√					√	√
REE 344	√			√	√	√	√	√		√	√
REE 345	√				√	√		√		√	√
REE 346	√	√	√	√	√		√	√		√	√
REE 347	√				√	√		√		√	√
REE 348	√		√		√	√	√	√		√	√
REE 412	√		√		√	√	√	√		√	√
REE 413	√		√		√		√				√
REE 439	√	√	√	√	√		√				√
REE 451	√		√		√						√
REE 453	√		√		√				√	√	√
REE 454	√		√		√	√			√	√	√
REE 455	√	√	√	√	√	√	√			√	√
REE 463	√	√	√	√	√	√	√		√		√