Master of Science
Renewable Energy Engineering

2020-21 Assessment Report

Electrical Engineering and Renewable Energy Department

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1 Program Mission and Educational Objectives

1.1 Program Mission

The Master of Science in Renewable Energy Engineering (MSREE) program goal is to provide graduates for careers in areas of renewable energy engineering including but not limited to solar PV, 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. MSREE graduates will enter renewable energy engineering careers as leaders in design, site analysis, product, application, test, quality control, and sales.

The MSREE progra

2 Program History and Description

2.1 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. In 2008, the BSRES degree was discontinued and replaced by the Bachelor of Science degree in Renewable Energy Engineering (BSREE). Analysis of the marketplace and observed growth in career options across the renewable energy fields revealed significant opportunities for graduates with a solid energy engineering education. Building upon this strong foundation of renewable energy engineering education, the MSREE was launched in the Portland-Metro campus in 2012. In 2013, an accelerated, concurrent degree option was launched for exceptional undergraduate students in the BS Renewable Energy Engineering and BS Electrical Engineering programs. The MSREE concurrent degree was launched in Klamath Falls in 2016. Full time offering of the MSREE program was extended to the Klamath Falls campus for the first time in 2018.

We anticipate MSREE graduates will enter energy engineering careers as leaders in the fields of power engineering, PV/semiconductor processing engineering, facilities and energy management, energy system integration engineering, HVAC and hydronics engineering, design and modeling engineering for net-zero energy buildings, biofuels plant and operations engineering, energy systems control engineering, power electronics engineering, utility program management, as researchers and educators in renewable energy fields, as well as in the roles of LEED accredited professionals (AP) and 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. MSREE graduates with strong interests in research and academia will be well situated to pursue further advanced degrees at PhD granting institutions.

2.2 Program Description

The MSREE program is designed to help students to understand and apply the principles of energy and power concepts to the next generation of technologies improving battery storage, building energy systems, grid integration of renewables and solar and thermal energy systems.

2.2.1 Degree Requirements

The Master of Science in Renewable Energy Engineering is a rigorous curriculum that requires 54 credit hours and approximately two years to complete.

2.2.2 Area of Focus

Students working toward the MSREE degree must complete REE specialization sequences from the list below. Based on the career goals and interest they may choose one of the sequences listed below. One sequence constitutes thr[e)4(d z5o9(on t]TJET7)4(s)9(pu(s)-41s)-4(i)12(gne)5(d)22(to)19(he)3(lp)22(s)-4(tude)3(nt)4IET7)4(s)9(ther)9

Fuel Cell Systems
Geothermal Energy
Global Energy Issues
Hydro Power Systems and Integration
Photovoltaic Systems and Processes
Wind Power Systems and Integration

In addition to the specialization sequence, students must complete the following required courses

Research Methods/Innovation I, II and III
Energy Engineering I, II and III
Graduate Research/Project/Thesis

2.3 Industry Relationships

The REE programs have strong relationships with industry, particularly through the program-level Industry Advisory Council (IAC) and REE alumni. The IAC has been instrumental in the success of the REE program. Representatives from corporations, government institutions and non-profit organizations comprise the IAC, giving the BSREE and MSREE 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.

2.4 Program Locations

Among the advantages that make Oregon Tech an ideal indusand MSREE

3 Cycle of Assessment for Program Outcomes

3.1 Program Outcomes

The MSREE program builds on the engineering knowledge students gained as undergraduates. The MSREE program outcomes are these:

(a) an ability to identify, formulate, and solve energy-related engineering problems.

(b) an ability to communicate effectively.

(c) an ability to independently acquire knowledge of contemporary technical, political, and economic issues related to energy.

MSREE students who are graduating from the accelerated BS+MSREE degree program are required to meet the program level outcome of the undergraduate program as well as the institutional-level essential student learning outcomes (ESLOs).

3.2 Assessment Methodology

The assessment of the program outcomes was reviewed, and decision has been made to consider REE 599 Graduate Thesis/Project course to evaluate the program outcomes. The MSREE outcome assessment cycle was revised and year 2018-19 was used to assess all three outcomes using REE 599 Graduate Thesis/Project. This course involves the final work of students in the MSREE degree and provides a window into the three program outcomes. Starting in AY 2019-20, each outcome will be assessed each year, following the new MSREE outcome assessment cycle presented in Table 2.

Students taking REE 599 have to present a written thesis or project and defend it in front of a committee composed by their advisor, a member of the department, and an external committee member. The three members of the committee read the written document prior to the defense. Department faculty who are members of the students committees but not their REE 599 advisors will be assigned with the assessment of outcomes. Assessment year 2018-19 has been used as a resetting point, considering all three outcomes, to continue with a regular 3-year cycle, as shown in Table .2

3.3 Assessment Cycle

Table 2. MSREE Outcome Assessment Cycle

	2018-19	2019-20	2020-21
(a) Problem Solving	REE 599	REE 599	
(b) Communication	REE 599		REE 599
(c) Independent/Contemporary	REE 599		

academic years 2016-17 and 2017-18 led to the decision that REE 599 Graduate Thesis/Project was the best course to evaluate the program outcomes.

Table 3. MSREE Curriculum Mapping

Course	Outcome A	Outcome B	Outcome C
Graduate Research Methods/ Innovation - Required			
REE 511 Research Methods I	-	F	-
REE 512 Research Methods II	-	F	-
REE 513 Research Methods III	-	F	-
Energy Engineering - Required			
REE 515 Energy Engineering I	-	-	F,P
REE 516 Energy Engineering II	-	-	F
REE 517 Energy Engineering III	-	-	F
Power Systems Engineering - Elective			
REE 529 Power Systems Analysis	F,P	-	-
REE 549 Power Systems Protection and Control	F,P	-	-
REE 569 Grid Integration of Renewables	F,P	-	-
Energy Efficient Building Systems [2] Elective			
REE 533 Heating, Ventil/AC	F	-	-
REE 553 Energy Systems Mange/Audt	F,P	-	-
REE 573 Energy Efficient Build design	F,P	-	-
Photovoltaic Systems and Processes - Elective			
REE 545 Applied Photvoltaics	F,P	-	-
REE 565 Semiconductor Process Engg	F,P	-	-
REE 525 Solid-State Physics/Photovoltaics	F,P	-	-
REE 5xx Elective			
REE 5xx Elective I	Varies		
REE 5xx Elective II			

4 Summary of Assessment Activities & Evidence of Student Learning

The assessment methodology is discussed and revised periodically by the department meeting during convocation. The assessment is conducted annually by two different methods, one based on the criteria statement in Table.2 and another based on the indirect assessment conducted for the graduated students as an

institutional learning outcomes.

The MSREE faculty conducted formal assessment during the 2020-21 academic year using direct measures, such as designated assignments and evaluation of coursework normally assigned. Additionally, the student outcomes were assessed using indirect measures, primarily results from a graduate

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 direct assessments is analyzed and the faculty come up with a plan for continuous improvement, which specifies what changes will be implemented to the curriculum to improve outcome performance.

In addition to direct assessment measures, indirect assessment of the student outcomes is performed on an annual basis through a graduate exit survey.

The results of the direct and indirect assessment, as well as the conclusions of the faculty discussion at the Closing-the-Loop meeting are included in the annual MSREE Assessment Report, which is reviewed by the Department Chair and the Director of Assessment for the university. The suggested changes to the curriculum are presented and discussed with all the department faculty at the annual Convocation meeting in Fall, as well as with the Industry Advisory Board at the following IAB meeting. If approved, these changes are implemented in the curriculum and submitted to the University Graduate Council (if catalog changes are required) for the following academic year.

4.2 AY2020-21 Targeted Direct Assessment Activities

The sections below describe the 2020-21 targeted assessment activities and detail the performance of students for each of the assessed outcomes. Unless otherwise noted, the tables report the number 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. Outcomes (b), was assessed for academic year 2020-21 by means of six theses or projects completed during the year by graduating students of the MSREE program under the course denoted REE 599. These students conducted their graduate research or thesis under three different advisors. Dr. H.J. Corsair advised one student. Dr. Slobodan Petrovic advised two students and Dr. Eklas Hossain advised three students.

The minimum acceptable performance level for all outcomes is to have 80% or more 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.

4.2 Targeted Assessment for Outcome (b): an ability to communicate effectively

This outcome was assessed in REE 599

(Very much / Quite a bit / Some / Very little)

(2.a) An ability to identify formulate, and solve energy-related engineering problems
(2.b) An ability to communicate effectively
(2.c) An ability to independently acquire knowledge of contemporary technical, political, and economical issues related to energy

A total of 6 students graduated in AY2020-21, but only 1 student out of 5 graduated students (N=1) filled out

OUTCOME C RUBRIC INDEPENDENTLY ACQUIRE KNOWLEDGE OF CONTEMPORARY TECHNICAL, POLITICAL, AND ECONOMIC ISSUES RELATED TO ENERGY

COURSE:_____ STUDENT NAME:_____ GRADE_____

Students must demonstrate the following Program Outcome C). an ability to independently acquired knowledge of contemporary technical, political and economic issues related to energy.				
CRITERIA	1-DEVELOPING	2-ACCOMPLISHED	3-EXEMPLARY	SCORE
KNOWLEDGE OF CONTEMPORARY ISSUES IN CONTEXT	Lists and recognizes socio-economic, political, and environmental issues	Contextualizes information, organizes information by categories, recognizing relevance to specific examples	Identifies how information is interrelated; Applies contextualized information to actual situations	
IDENTIFYING, GATHERING AND ANALYZING INFORMATION.	Identifies tools needed to conduct research and improve skills	Explains how what has been learned will improve research; Develop independent learning skills.	Applies what has been learned to a project; Independent research conducted.	