Renewable Energy Systems Program
2007-08 Assessment Report

Introduction

The Renewable Energy Systems program was implemented at the Portland campus in 2005 with an initial enrollment of ten students. As of fall 2007, the program was added at the Klamath Falls campus. The enrollment has grown to 67 students, with 58 students in Portland and nine students in Klamath Falls in fall 2007.

Program Mission, Objectives and Student Learning Outcomes

During the fall 2007 convocation, the program faculty agreed upon the following mission, objectives and student learning outcomes statements for the program.

Program Mission

The Renewable Energy Systems degree program prepares students for the challenges of designing, promoting and implementing renewable energy systems in society's rapidly-changing energy-related industries. The department will be a leader in providing career-ready candidates for the Pacific Northwest Region's renewable and sustainable engineering fields. Faculty and students will engage in applied research in emerging technologies and provide professional services to their communities.

Program Educational Objectives

In support of this mission, the program graduates are expected to demonstrate the following program educational objectives:

1. Establish a firm understanding of the fundamentals of energy, based on the concepts of science and mathematics, such that graduate excel as professionals in the various fields of energy engineering.

2. Provide open-ended engineering problems, practical working examples and opportunities for applied senior projects via partnerships with industry and other institutions such that graduates become creative, independent leaders who are ready for immediate employment.

3. Convey the importance of becoming life-long learners and responsible citizens who think critically, communicate effectively and are aware of professional and ethical responsibilities in implementing sustainable engineering solutions.

Student Learning Outcomes

Students in the Renewable Energy Systems program must demonstrate:

(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

(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) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) an ability to apply the fundamentals of energy
(m) an understanding of the obligations for implementing sustainable engineering solutions
(n) an appreciation for the influence of energy in the history of modern societies

Assessment Cycle for Student Learning Outcomes

The program faculty will assess the student learning outcomes in a three-year cycle according to the schedule shown in the table below.

RES PROGRAM OUTCOME ASSESSMENT TIMELINE						
SCHOOL YEAR						
PROG OUT	**2007/8**	**2008/9**	**2009/10**	**2010/11**	**2011/12**	**2012/13**
A		X			X	
B	X			X		
C			X			X
D	X			X		
E			X			X
F			X			X
G	X			X		
H		X			X	
I		X			X	
J		X			X	
K	X			X		
L			X			X
M		X			X	
N			X			X

Three-year cycle for assessment of student learning outcomes.

Summary of 2007-08 Assessment Activities
During the 2007-08 academic year, the program faculty assessed outcomes A (math/Science Apps), B (Lab Skills), C (Design Prob), D (Teamwork), G (Communication) and L (Concepts of Energy). There were a mix of assignments used such as Lab Reports, Oral Presentations, Project Papers and Research Papers. These student learning outcomes are mapped to the RES curriculum, shown in Appendix A.

This is a new program on the Klamath Falls campus in the year 2007-08 so the assessment at KF was done using a small cohort of freshman and two sophomores. This program has been also offered on the Portland campus since 2005 so the assessment done

here used some sophomore and senior classes to get a good mix of students for the assessment study.

Outcome a: an ability to apply knowledge of mathematics, science, and engineering
This outcome was assessed using a class/lab project report proposal. This course is upper division with students that will have a high degree of proficiency in math, science, and engineering.

RES OUTCOME SUMMARY FOR: RES-A (EAC-A) An ability to apply knowledge of mathematics, science and engineering									
PERFORMANCE CRITERIA	PERCENTAGE > =2 in a COURSE								AVERAGE
	CRS(412) PD	CRS ()	CRS()	CRS()	CRS()	CRS	CRS	CRS	PERCENT
Use of math, science and engineering principles to predict and analyze solve problems.	100%								100%
Apply fundamental concepts to solve technical problems	100%								100%
Sample Size	13								

STRENGTHS:
As expected, student performance for this outcome was exceptional. All students in the sample set performed at either an accomplished or exemplary level. The raw data showed a fairly equal distribution between accomplished and exemplary.

WEAKNESSES
None at this time.

RECOMMENDATIONS:

It appears the program has adequately addressed this outcome. The students can apply math, science and engineering to problems. It was discussed at the 5/12/2008 meeting and decided that due to the lack of more data this outcome needs to be assessed in lower division classes and use more and varied assignments to obtain more data.

Outcome b: an ability to design and conduct experiments, as well as to analyze and interpret data.
This outcome was assessed in two lab assignment in REE 221. This course had a mix of sophomores, juniors and seniors from both the RES and EET programs.

REE OUTCOME SUMMARY FOR: REE-B (EAC-B) The ability to design and conduct experiments as well as analyze and interpret data (Labwork)									
PERFORMANCE CRITERIA	PERCENTAGE > 2 in a COURSE								AVERAGE
	REE(221)	REE(221)	CRS	CRS	CRS	CRS	CRS	CRS	PERCENT
Design an experiment	NA	NA							NA
Conduct an experiment	100%	100%							100%

Analyze results and data	100%	100%							100%
Interpret results and data	100%	NA							100%
Improve a design or process	100%	100%							100%
Sample Size	6	6							

STRENGTHS:
This outcome is considered a strong point of the program due to our focus and emphasis on hands on applications. The data above supports this expectation. Even though this is a small sample it is what we expect. Most courses in the program have labs assigned with the course to support the emphasis on applications and a hands-on experience for the students.

WEAKNESSES:
The only one of note is in the design of experiments performance criteria. This course is open to a mix of sophomores, juniors and seniors and this is not expected of a sophomore lab. With this mix students were not expected to design an experiment.

RECOMMENDATIONS:
None at this current time except collect and analyze more data in future classes. The RES program needs to insure that this outcome remains a program strength to continue to provide an applications driven experience for students. The program needs to assess this outcome in courses that do require the design of an experiment

Outcome 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.

This outcome was assessed in winter 2008 in a project design class on a major project. This is the same class and project that was used to assess outcome A.

RES OUTCOME SUMMARY FOR:RES-C (EAC-C) An ability to design a system, component or process to meet desired needs									
Within realistic constraints such as economic, environmental, social, political etc. (Major Project)									
PERFORMANCE CRITERIA	PERCENTAGE > =2 in a COURSE								AVERAGE
	CRS(412)	CRS()	CRS( )	CRS( )	CRS( )	CRS( )	CRS( )	CRS( )	PERCENT
Define design problem	100%								100%
Design Strategy	100%								100%
Employs models/simulations	100%								100%
Evaluates solutions	100%								100%
Selects best design solution	100%								100%
Sample Size	13								

STRENGTHS:
The program project classes are very focused on student learning in the area of project design and implementation. This is a strength of all department programs and the students are well prepared by the time they reach the upper division project classes.

WEAKNESSES:
None were noted at this present time based on the assessment.

RECOMMENDATIONS:
None at this current time except collect and analyze more data in future classes to see if this trend holds up under time.

Outcome d: an ability to function on multi-disciplinary teams
The Teamwork outcome was assessed in the freshman Introduction to Engineering with a sample size of 17 students (a mix of EE/REE). The assignment was for each group to design and build an enclosure (LEGO Blocks) to protect a light bulb dropped from 20 feet.

REE OUTCOME SUMMARY FOR: REE-D (EAC-D) An ability to function on multi-disciplinary teams (Teamwork)									
PERFORMANCE CRITERIA	PERCENTAGE > 2 in a COURSE								AVERAGE
	CRS(101) -17	CRS	CRS	CRS	CRS	CRS	CRS	CRS	PERCENT
Team Development	58.80%								59%
Team Participation	100.00%								100.00%
Team Communication	100%								100.00%
Reaching a group consensus	100%								100%

STRENGTHS:
Considering that this was a freshman class the groups performed well on this assignment. Two groups had some problems selecting a leader and deciding on what methodology to do (development). The participation and communication was fine and all groups completed the task. This outcome will be assessed again in some later courses. The main focus of this experiment was to get the freshman in teams and work as a team.

WEAKNESSES:
The main weakness was in the development of the team. They had some difficulty in selecting a leader and dividing up tasks but this is not unusual for a freshman class. The outcome will be assessed again to see if this is a problem later in classes where they have more course work involving approaches that involve teamwork such as SPE 321 Small Group Processes.

RECOMMENDATIONS:
None at the present time but it may be addressed later especially in the Senior Project Sequence where teamwork is stressed.

Outcome g: an ability to communicate effectively
Fall 2007 Assessment was done in REE221 (EET407) and later in Winter term in EE 102 (taken by RES Students). This included a collection from four oral presentations (REE221) and four group project presentations (EE102). It was also assessed in Portland on the Introduction to RE Course Research Paper and an upper division project paper. The results are shown below in the following table:

PERFORMANCE CRITERIA	AVERAGE				
	CRS(221)	CRS(102)	CRS(201)	CRS(412)	PERCENT
Organizing an Oral Presentation	60%	65%			62.50%
Answering Questions(oral)	100%	70%			85.00%
Performance of presentation(oral)	100%	70%			85.00%
Gathering Information	100%	82%		84.5%	88.00%
Content and Org.(written)	NA		96%	100%	98%
Techniques (Written)	NA		84%	69%	77%
Conclusions (Written)	NA		91%	69%	80%
Sample Size	5	17	23		

It was expected that this outcome would be a program strength and the data does support this. The RES program requires that all students take a minimum of two speech classes and four writing courses. Many upper division technical courses also have writing and oral presentation requirements to reinforce this outcome.

STRENGTHS:
Overall this outcome showed an exceptional level of performance for 5 of the 7 performance criteria defined (range of 96% to 84%). All 5 were above our target of 80% of students at a level of two or above. During the department discussion it was pointed out that the student presentations and reports for the capstone senior project are always well done and very professional.

WEAKNESSES:
The only weakness discussed here involved the performance criteria for organizing the oral presentation. The percentage here was 62.5% which under our 80% target. Both assignments had this PC as a definite weakness. It was felt that the students did not approach this assignment with the same intensity as a senior project presentation. This could be resolved in the assignments by stressing the importance of preparation and practice on this assignment. It was also noted that the performance in the upper division course had dropped off some and this may be a concern. Are we not reinforcing these learning outcomes in soph/jr years?

RECOMMENDATIONS:
The assignments that had good performance results for preparation actually used a discussion of preparation before the assignment. It was felt that the students did not approach this assignment with the same intensity as a senior project presentation. This could be resolved in the assignments by stressing the importance of preparation and practice on this assignment and revisit this outcome next year.

Outcome l: an ability to apply the fundamentals of energy
This outcome was assessed in a project based class on a project proposal and specification.

RES OUTCOME SUMMARY FOR: RES-L (RES-L) An ability to apply the fundamentals of energy									
PERFORMANCE CRITERIA	PERCENTAGE > =2 in a COURSE								AVERAGE
	CRS(412) PD	CRS ()	CRS()	CRS()	CRS()	CRS	CRS	CRS	PERCENT
Understand the fundamentals of energy systems	100%								100%
Develop an efficient energy distribution system for a society	100%								100%
Sample Size	13								

STRENGTHS:
This assessment evaluation was done in an upper division class on a project design report. The expectations were well defined and students had many courses prior to this one that would build the level of competence. The students did as expected.

WEAKNESSES:
None noted for this single assignment.

RECOMMENDATIONS:

It appears the program has adequately addressed this outcome. The students can apply math, science and engineering to problems. It was discussed at the 5/12/2008 meeting and decided that due to the lack of more data this outcome needs to be assessed in lower division classes and use more and varied assignments to obtain more data.

Summary of Student Learning Outcomes

SLO a: an ability to apply knowledge of mathematics, science, and engineering

Strengths: Students met or exceeded expectations in use of math, science and engineering principles to predict, analyze and solve problems, and in applying fundamental concepts to solve technical problems.

Areas needing improvement: None at this time.

SLO b: an ability to design and conduct experiments, as well as to analyze and interpret data.

Strengths: Students met or exceeded expectations in conducting an experiment, analyzing results and data, interpreting results and data, and improving a design or process.

Areas needing improvement: None at this time.

SLO 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.

Strengths: Students met or exceeded expectations for defining a design problem, designing a strategy, employing models/simulations, evaluating solutions, and selecting a best design solution.

Areas needing improvement: None at this time.

SLO d: an ability to function on multi-disciplinary teams

Strengths: Freshmen students demonstrated an acceptable ability to participate in a team, communicate within the team, and reach group consensus.

Areas needing improvement: At the freshman level, students had some difficulty with selecting a leader and dividing up tasks. This outcome will be assessed at the upper-division level after students have taken SPE 321 Small Group and Team Processes.

SLO g: an ability to communicate effectively

Strengths: Students met or exceeded expectations for performing and oral presentation and answering questions during the presentation. This was also true for written communication where students met or exceed expectation for gathering information, organizing content, demonstrating writing technique, and drawing conclusion.

Areas needing improvement: Improvement is needed in student ability to organize an oral presentation. In the classes involved, REE 221 and EET 102, the instructors will stress the importance of preparation and practice on future assignments and revisit this outcome next year.

SLO l: ability to apply the fundamentals of energy

Strengths: Students met or exceeded expectations for understanding the fundamentals of energy and developing an efficient energy distribution system for a society.

Areas needing improvement: None at this time.

Appendix A

PROGRAM OUTCOME CURRICULUM COURSE MAPPING

RES PROGRAM COURSE MATRIX														
COURSE NUMBER	PROGRAM OUTCOMES													
	a	b	c	D	e	f	g	h	I	j	k	l	m	n
EE 101 (F, FR)				X			X							
EE 102 (W, FR)		X		X		Z	X		Y					
EE 103 (S, FR)		X	Z				X		Y		X			
EE 131 (W, FR)		X		X							X			
EE 221 (F, SO)	Y	X												
EE 223 (W, SO)											X		Y	
HIST 356 (F, SO)								Y		Y				Z
EET 407 (F,SO) (REE221)		X		X			X				X			
REE 241 (S, SO)	Y												Y	
REE 242 (S,SO)														
REE 251 (S,SO)	Y												Y	
REE 252 (S, SO)														
EE 321 (F, JR)					Z									
ENGR 355 (F, JR)														
REE 331 (F, JR)			Z											
REE ELC (F, JR)												Z		
EE 311 (F, JR)														
MECH 218 (W, JR)														
REE 315 (W, JR)														
REE 316 (W, JR)														
REE ELC (W, JR)														
EE 419 (S, JR)					Z									
REE 339 (S, JR)														
MECH 323 (S, JR)						Z								
EE 343 (F, SR)														
MECH 436 (F, SR)														
REE 421 (F, SR)														
REE 449 (F, SR)														
REE 412 (W, SR)														
REE 463 (W, SR)														
REE 459 (W, SR)														
REE 413 (S, SR)														
REE 439 (S, SR)														
REE 455 (S, SR)														
REE ELC (S, SR)														
REE 344 (JR)*														
REE 345 (JR)*														
REE 346 (JR)*														
REE 347 (JR)*														
REE 348 (JR)*														
REE 451 (SR)*														
REE 465 (SR)*														

Note: X = 2007/08, Y = 2008/09, Z = 2009/10 (KF Plan)
Note*: Elective Courses not offered every year