Renewable Energy Technology
(Electro-Mechanical Technology as of Fall 2017)
Program Review
2017-18

Section One: Mission and Goals

A. Describe the mission of the program

Mission:
The Electro-Mechanical Technology (EM-Tech) program at Columbia Gorge Community College provides transformative, relevant, high quality training for community members seeking employment in a broad array of industries, including advanced manufacturing, renewable energy and unmanned aerial systems.

CGCC offers comprehensive premier workforce training in a broad range of advanced technology industries by providing:

1. A technical program taught by experienced instructors held to the highest academic standards.

2. Industry endorsed skills training using standard technology and tools for safety, mechanical and electronic applications.

3. Facilitation of employment and career pathway opportunities.

Goals:
1. Increase and sustain enrollment in the RET (EM-Tech) program.

2. Establish solid base of qualified full-time instructors that can teach in multiple technical areas.

3. Grow relationships and alignment opportunities with high school programs.

B. Describe program alignment with CGCC Mission/Core Themes

The RET program closely aligns with CGCC's Mission and Core Themes by Building Dreams (opportunities) for students to achieve technical training that provides family wage jobs in today's workforce; Transforming Lives (Education) by teaching skills that are relevant and transferrable to multiple careers; and Strengthening Our Community (Partnerships) by maintaining an active STEM Advisory Committee with local employers

that helps keep program curriculum current, provides student internship opportunities, and ultimately hires program graduates.

Section Two: Previous Review's Recommendations, Action and Analysis

A. List recommendations from previous reviews

1. Design and implement Mechanical Engineering Technology (MET) career track for second year.
2. Faculty mentor/volunteer at related high school programs
3. Consider a third full-time faculty for the program to meet instructional needs
4. Revamp RET 102 and use as a marketing/recruitment tool
5. Develop equipment replacement plan
6. Sell contracted time on training tower
7. Fully integrate review and assessment tools

B. Summarize actions taken in response to recommendations

1. After much discussion and deliberation, instead of adding a MET track to the second year of the program, the decision was made to change the name of the entire program to Electro-Mechanical Technology. Faculty felt this decision eliminated the need to create a separate MET track when in reality the skill sets for MET were already contained with the current program. In addition, the name change better reflected the diversity of jobs graduates of the program were finding.
2. Tom Lieurance volunteers annually for the middle school Robotics Tournaments and high school and middle school Wind Challenge Event. Jim Pytel guides program tours when school and community groups visit and mans a program booth for Insitu's career fair and at the NSF annual ATE Conference.
3. The program has managed to meet instructional needs with the existing two full-time faculty. However, if enrollment remains strong and industry expectations continue to drive changes to the program, there will be a need for a third full-time faculty.
4. Revamp of RET 102 did not happen due to a focus on National Science Foundation funding opportunities, including CREATE.
5. An equipment replacement plan is in place. Due to the institution's budget challenges, faculty attempt to leverage outside funding from industry and grants to help meet equipment replacement needs.
6. While initially there was a great deal of interest from local organizations to contract for the training tower, that interest has waned and we are no longer seeking contracts.
7. The RET program, since its inception, has been in a continuous improvement mode based on industry feedback. Review and assessment tools are utilized to further inform this improvement.

C. Please describe other actions taken that were not based on previous review recommendations. What assessment, evidence, or need prompted these actions?

Fall 2016, the RET program went from a limited entry program with a math 95 prerequisite to open enrollment with a math 65 (B or better) prerequisite. Students are no longer required to apply to participate in the program. Any student who meets the prerequisites for a program course can take the course. Any student who meets the prerequisites for the program can enter the program. This change was brought as a result of former student recommendations, as well as efforts to increase enrollment.

D. Provide results and analysis of each action taken.

1. The name change from Renewable Energy Technology to Electro-Mechanical Technology was formally enacted fall 2017. It is still too early to tell whether this change will have an impact on the number of students in the program.
2. The program has seen an increase in the number of students enrolling right out of high school. Whether that has something to do with faculty presence beyond campus is hard to tell.
3. The addition of a part-time lab instructor funded by NSF in 2015-17 confirms the need for additional faculty in the program. Increased enrollment warrants doubling labs and increasing student management. Curriculum changes have increased technical classes and the need for faculty who know the technical content. From increased coverage in the labs to the ability to teach classes and provide consistent recitation sessions and tutoring, there is a need for another full-time instructor in the program.
4. N/A
5. Faculty are able to maintain current equipment needs with the Perkins grant and Caithness funds.
6. N/A
7. While the program review and assessment tools play a role in program improvement, workforce expectations are the focus. We depend heavily on the STEM Advisory Committee to help keep RET training current and relevant to workforce needs - and we credit this focus as the reason our graduates are sought by local employers.

Section Three: Current Department Assessment - Describe, Assess, Analyze and Identify Needs

A. Student Learning

1. Course-Level Outcome Achievement

Program faculty are consistent with participation in course-level assessment each academic year**.** According to assessment results, students are achieving RET course outcomes 80-100% of the time. Faculty do their best to work with students who are struggling with course content or may have personal circumstances that impacts their

success in a particular course. With the addition of a lab instructor funded by an NSF grant 2015-17, the increased lab coverage allows for more individualized attention for those students and greater retention potential. However, there is strong correlation between student absences and course success. Those students who are absent, late to class or have missing or poorly done work are typically not successful in achieving course outcomes.

To improve attainment of course-level student learning outcomes, the following course changes were made:
-Introduction to Wind Turbine Operations - increased credits from 1 to 2 to adequately cover content and ensure student learning outcomes are met.
-Digital Electronics sequence - Reduced from 3 courses to 2 in an effort to focus content and remove topics no longer relevant to workforce needs.

2. **Degree-Certificate/Program-level Outcomes**
   Prior to 2013-14, only one course (EET 113) was being used to assess outcomes achievement of the RET Certificate. Faculty added additional courses (EET 120,122 and RET 101) in 2013-14 and moved the percentage who received a C or better on the final for each course, as well as lab grades from 70% to 75%.

   For the AAS Degree in 2013-14, 75% receiving a C or better on finals and labs in EET 272 and 223 and RET 122 was used to determine achievement of degree outcomes. Faculty were encouraged the following year to consider increasing the percentage earning a C or better in these courses in 2014-15 to 80%, but no changes were made. Faculty continue to use the same percentage as the program appears to be achieving desired goals.

3. **Core Learning Outcomes (degrees only)**
   Assessment of Core Learning Outcomes began in 2015-16, with results and analysis posted fall 2016. College-wide planning for curricular changes will occur throughout 2016-17 with implementation through 2019. Examples of assessment-driven changes regarding Core Learning Outcomes will be provided in the 2021-22 General Education Program Review and 2022-23 EM-Tech Program Review. Further information on student achievement of Core Learning Outcomes and plans for increasing student achievement of the first Core Learning Outcomes: Communication can be found on the college's Institutional Assessment of Core Learning Outcomes webpage.

B. Curriculum

1. **Alignment with professional and national standards and/or university transfer**
   -AWEA seal of approval.
   -Articulation with Embry Riddle for general education requirement.
   -Articulation with Oregon Institute of Technology's Electrical Engineering Technology program.

During fall of 2014, the program added RET 103 - Wind Turbine Safe Access and Rescue. The following year, the course was combined with RET 101 - Intro to Wind Turbine Operations. Also during this time, EET 121, 122, and 123 were changed, condensing three courses into two 200 level courses: EET 221 - Semiconductor Devices/Circuits; and EET 222 - Op Amp Circuits. EET 242 - Microcontroller Systems was added in spring 2015. In fall 2016, the program math prerequisite was changed to completion of MTH 65 (Intermediate Algebra) with a "B" or better or scoring into MTH 95 on the college placement test, and MTH 111 became an elective. Also during this time, limited entry into the program was changed to open enrollment.

The STEM Advisory Committee, representing a diversity of employers, meets bi-annually to review the program's curriculum. Specific changes, like those mentioned above, align with industry standards are made based on feedback from the committee, and in consultation with program faculty.

The composition of the STEM Advisory Committee was revised from primarily commercial wind and hydro power representation to a group more representative of the region's expanding industries, including advanced manufacturing, food processing, and UAS manufacturing, while maintaining the contributions from our renewable energy partners. Meetings are held twice per year. The committee provides input on curriculum content development, jobs outlook, and subject matter experts.

The curriculum in the program continues to evolve based on the evolution of local industries and their growing and changing workforce needs. Faculty anticipate significant curriculum changes over the next two years to continue to align with local jobs.

The US Department of Labor Bureau of Labor Statistics *Occupational Outlook Handbook* states that wind turbine service technicians and solar photovoltaic installers are two of the ten fastest growing occupations projected for 2016-2026. The median annual wage for electro-mechanical technicians was $55,610 in May 2016. EM-Tech program staff are contacted throughout the academic year by companies recruiting graduates. Staff observe that there are not enough graduates to fill vacancies locally and nationally.

2. Enrollment

A. Course Enrollment - The three- year data for course enrollment (Fall 2013-Spring 2016) indicates enrollment remained close to the same each year in all courses. Variances showed a slight decline of 2-3 students in some classes, which is attributed to part-time student schedules.

B. Degree/Certificate Enrollment - Between summer of 2012 and spring of 2016, 87 students completed their RET certificate. Forty-five of those students completed the RET AAS degree. Seventy-two students enrolled in RET as their major - an average of 18 students per year.

C. Student Retention/Grad Rates - Course retention data showed of the 21 courses considered over 3 years, a total of 717 students (duplicated) registered for the courses, but only 68 dropped a course (9.5%). The highest drop was in winter 2014 when 12 students enrolled in EET 112 and 5 ended up dropping, however, 19 students enrolled in the same class the following year and none dropped.

Program graduation rates have declined since spring 2012 when 32 students earned their RET certificate and 34 earned their AAS degree. The table below reflects that decline.

Graduation Year	RET Certificates Awarded	RET AAS Degrees Awarded	Total
2013	26	17	43
2014	9	10	19
2015	10	7	17
2016	9	11	20

The decline is attributed to the leveling off of wind energy jobs. The demand decreased by 2014. However, graduation rates have remained somewhat consistent from 2014-2016 with an increase in 2016. We continue to see an increase in enrollment in the program with 32 total students enrolled in 2017-18.

C. Teaching and Faculty Development

1. **Evaluate your department's incorporation of instructional best practices and their effectiveness on student learning.**

   The RET program, under Tom Lieurance's design, started as a limited entry, hands-on lab program. The limited entry naturally created a cohort environment for those students who were accepted into the program. The hands-on labs provided students the opportunity to apply the technical knowledge they were learning from the lectures in order to understand its relevance.

   While limited entry transitioned to open entry in Fall 2016, we find that students still create a cohort environment within the technical classes. Students support and guide each other in the labs, which in turns leads to study groups outside of class. The program continues to be lab focused.

   Jim Pytel has received international notoriety for his flipped classroom approach to learning. He has addressed a well-documented and growing need for technicians trained in electronics, mechanics, hydraulics, and motor control by providing online educational

resources to support a flipped classroom approach to teaching technical subjects. Students watch lectures at the time and place of their own choosing at their own pace and concept engagement and application takes place in the classroom with the guidance of an instructor. The lecture content is available for review at all times for those individuals that may require repeat exposure to a particular topic. Research indicates that active learning strategies are more effective than traditional passive learning methods in improving students' conceptual understanding. In addition, the flipped classroom approach allows students a degree of flexibility for those with work and family obligations to attend a program of study, but with reduced commute time and expense. The activity based learning and lab exercises inside the classroom foster a cohort environment where students look to each other to support their learning through study groups and lab partners. The benefit of a cohort program is the fact that people learn better as they study as part of a group. Cohort learning provides an interactive and dynamic setting for students to grow their knowledge and skills.

2. **Describe your department's professional development activities since the last review and evaluate their effectiveness to improve teaching and learning.**

Year	Tom Lieurance	Jim Pytel
2012-13	● EET SAC @ PCC ● Atmel Technical Training ● Forklift Certification	● Tractel Training ● NSF ATE FPOA Training ● Renewable Energy Learning Exchange (Austraila)
2013-14	● EET SAC @ PCC	● Renewable Energy Learning Exchange (Germany)
2014-15	● SolWest Renewable Energy Conference	● NSF ATE Conference - Washington, DC
2015-16	● Diligent PLC seminar ● Hi Tech (High Impact Technology Exchange) Conference	● NSF ATE Conference - Washington, DC
2016-17	● FESTO Instructor Training	● NSF ATE Conference - Washington, DC

All professional development RET faculty choose to attend are pertinent to program curriculum and are used to improve and/or update course content.

3. **Describe how your department faculty have supported the college's mission and vision outside their primary teaching responsibilities. This can include college committee work, community outreach, co-curricular activities.**

Tom served for several years as the CTE representative on the college's Curriculum

Committee. He volunteers at the annual Robotics tournaments and is lead judge for the annual Wind Challenge.

Jim attends outreach activities to promote the RET program and provides on-campus tours of the program upon request. He creates awareness of CGCC by presenting at state and national conferences and through his development of online teaching and learning resources that are viewed internationally.

4. **Use data to analyze and evaluate whether the quantity and balance of full and part time faculty is adequate to meet the needs of the program.**
   As mentioned earlier in the Enrollment section of this review, the RET (now EM-Tech) program continues to see an increase in enrollment with 24 total students enrolled in 2016-17 and 32 in 2017-18. As technology evolves in the industries this program serves, the demand for adequately trained technicians will continue to grow. Instructors trained in the latest technologies are imperative for keeping the program current with industry needs. The two full-time faculty currently in the program are challenged to keep up with teaching responsibilities, student needs, lab and equipment management, and updating curriculum to align with industry. A third full-time faculty would help balance the load. Should the Corp of Engineers begin enrolling apprentices in the program, there is no doubt three full-time faculty will be necessary.

D. Budget

1. **Analyze and describe adequacy of budget for meeting the needs of the program/ department.**

   The current budget for the EM-Tech department (130) is adequate until the Caithness funds end in 2021. The Caithness funds have allowed for lab improvements and new and replacement equipment. Faculty recommend the college begin to invest in new and replacement equipment for the program starting in 2018-19 and gradually increase the equipment budget to a minimum of $5,000 by 2021.

Section Four: Recommendations

Based on the analysis of the needs identified in Sections Two and Three:

A. Provide recommendations for the next review cycle.

These recommendations result from feedback and discussions with faculty, program staff, and STEM committee members. Emerging technologies, industry needs and faculty professional development will continue to influence the direction of the program.

1. Apply for and receive a second National Science Foundation grant to continue to develop flipped classes in the second year of the program and to purchase state of the art equipment aligned with local industry.
2. In collaboration with SOAR, target market the program to incumbent workers including USACE, and partner businesses such as Cardinal Glass.
3. Continue with course development, consolidation and exploring offering specialized options.
4. With double labs for all first courses and some second year, consider a third full time faculty for the program to meet instructional needs.
5. Provide relevant faculty development opportunities.

B. How will the program track and assess progress on its recommendations?

1. NSF grant is awarded and grant deliverables are met.
2. SOAR and program staff and faculty target market to regional employers and track outcomes of each visit.
3. STEM Advisory Committee recommends and guides course updates and/or new course development.
4. Enrollment, curriculum updates and course expertise warrant a third full-time faculty.
5. Faculty participate in annual professional development that is relevant to the program and addresses changing industry practices and technologies.