Proposal Transmittal Sheet

Full Category I and Abbreviated Category I Proposals

Submit proposals to: Office of Academic Programs, Assessment, and Accreditation
314 Waldo Hall – Oregon State University

Attach Transmittal Sheet; Proposal; Library Evaluation (performed by the Library for Full Category I proposals), Letters of Support (external to OSU); Liaison Correspondence (internal to OSU), External Review (new graduate program proposals), and Budget Information (both OSU and HECC budget sheets for Full Category I proposals and OSU budget sheets for Abbreviated Category I proposals)

Full Category I Proposals: New Programs

Final Approval--for new degrees, extension to OSU's branch campus, and substantive changes:
Higher Education Coordinating Commission (HECC)

Final Approval-- for new certificate programs: OSU Provost

Check one:

- [x] **New Degree Program**
- [ ] **New Certificate Program**
- [ ] **Extend Program to OSU Branch Campus**
- [ ] **Substantive Change**

Abbreviated Category I Proposals: Other Proposals

Final Approval--for new academic units, renames, reorganizations, and, suspensions: OSU Provost

Final Approval-- for terminations: OSU Board of Trustees

Check one:

- [ ] **Establish:** new college, school, department or program
- [ ] **Rename:** change the name of an existing academic program or academic unit
- [ ] **Reorganization:** move the responsibility of an academic program from one academic unit to another; reorganize existing academic unit(s), including mergers and splits
- [ ] **Suspension (or Reactivation):** suspend an academic program (maximum period: three years)
- [ ] **Termination:** terminate an academic program or academic unit

Title of Proposal:

OSU-Cascades Bachelor of Science in Engineering Science

Proposed Effective Term:

Fall 2020

School/Department/Program:

n/a

College:

College of Engineering

I certify that the above proposal has been reviewed by the appropriate Program, Department, School, and College administrators and committees. I approve this proposal.

***Sign* (College Dean)**	***Date*** 1/15/19	**Print (College Dean)** *Julie Gess-Newsome*
Sign (Dean of Academic Affairs, OSU-C)	***Date*** 1/15/19	**Print (*Dean of Academic Affair, OSU-C*)** *Rebecca Johnson*
Sign (VP, OSU-Cascades)	***Date***	**Print (*VP, OSU-Cascades*)**

Source: Office of Academic Programs, Assessment and Accreditation (2-10-15; rev 1-8-16)

Institution: Oregon State University
College/School: College of Engineering
Department/Program: BS, Engineering Science

Executive Summary

An Engineering Science (ESC) program designed to provide students with a strong foundation in engineering fundamentals is proposed. The base of the T-shaped curriculum is a common core built from select courses across several engineering disciplines (industrial, electrical, and mechanical) as well as the science and mathematics courses required by those programs. The depth of the curriculum is provided by technical electives. Electives from a variety of different engineering disciplines will be offered, and students can specialize by taking courses focused in a single area. The degree awarded will be a Bachelor of Science in Engineering Science. Some of the many fields students graduating from this program will be ready to work in are industrial, electrical, mechanical, design, and process engineering. Additionally, they will be eligible for graduate studies in any of these fields. It should also be noted that some of the engineering science programs currently in place across the country are used as a launch pad for medical or law school. This is a goal of this program as well.

The Engineering Science program will be offered face-to-face at the Oregon State University-Cascades (OSU-Cascades) campus in Bend. This will be the second engineering program offered at this location. The Energy Systems Engineering program, the first OSU-Cascades engineering program, was established in 2010 and has experienced steady enrollment growth since its inception. It currently has 117 students. The population change of Deschutes County, where OSU-Cascades is located, from April 1, 2010 to July 1, 2016 was reported by the US Census to be 14.9% [1]. Additionally, the Bend-Redmond metropolitan area was the third-fastest-growing area of this kind from July 2015 to July 2016 [2]. The Bureau of Labor Statistics projects employment of mechanical engineers will grow by 5% from 2014 to 2024 while that of electrical and industrial engineers will hold steady [3]. The population growth of central Oregon paired with this employment data demonstrates a strong need for the proposed ESC program in Bend. Finally, there are only eleven ABET accredited engineering science programs in the nation. Just over half of those ABET accredited programs are offered at public institutions, the closest of which is located at Colorado State University.

An investigation of similar programs at peer and aspirational peer institutions was performed and their curriculum used as a model. The proposed ESC curriculum meets the Accreditation Board for Engineering and Technology (ABET) general criteria for baccalaureate level programs and covers all the topics needed for students to sit for their professional engineer (PE) licensure exam. It should be noted that some of the top undergraduate engineering schools in the country (e.g. Harvey Mudd College and Olin College) offer similar programs. Additionally, Pennsylvania State University, also a land, space, sun, and sea grant institution, offers an engineering science program as part of its honor college. Due to the multidisciplinary nature of the proposed program, which will be housed in the College of Engineering, the curriculum can be constructed largely from existing engineering classes. The impact and uniqueness of the program is through a thoughtful integration of courses across disciplines rather than the creation of new courses. Therefore only four unique courses are required, allowing for fast implementation. A staffing plan for the proposed program has been mapped out and budgeted for by OSU-Cascades.

[1] United States Census Bureau, (2016, July 01) Quick Facts, [Online]. Available: https://www.census.gov/quickfacts/fact/table/deschutescountyoregon/RHI805210
[2] K. Spurr, (2017, March 23) Census: Deschutes, Crook county growth among nation's fastest, [Online]. Available: http://www.bendbulletin.com/localstate/5170792-151/census-deschutes-crook-county-growth-among-nations-fastest
[3] United States Census Bureau, (2016, July 01) Quick Facts, [Online]. Available: https://www.census.gov/quickfacts/fact/table/deschutescountyoregon/RHI805210

HIGHER EDUCATION COORDINATING COMMISSION

Proposal for a New Academic Program

Institution: Oregon State University (Cascades Campus)

College/School: College of Engineering

Department/Program Name: Engineering Science

Degree and Program Title: BSES, Bachelor of Science in Engineering Science

1. **Program Description**

   a. Proposed Classification of Instructional Programs (CIP) number. 14.1301

   b. Brief overview of proposed program

   An engineering program must prepare students for not only today's technological and societal challenges but also those of the future. These challenges are becoming more and more complex as well as multidisciplinary in nature. An engineering science program that provides the students with a strong, broad foundation in engineering fundamentals rather than in a specific engineering discipline is proposed for this reason. The objective of this proposed program would be to prepare students to be engineers but not pigeonhole them into a single discipline therefore addressing the emerging need for dynamic, agile, and flexible engineers [1].

   The disciplinary foundation of the proposed engineering science program is engineering. The degree awarded upon completion of this program would be a Bachelor of Science in Engineering Science. The curriculum would have a common core built from select courses across several engineering disciplines (industrial, electrical, and mechanical) as well as the science and mathematics courses required by all these programs. Technical electives in these different disciplines would be offered allowing a student to either gain exposure to several different fields by taking an assortment of those courses or to specialize in a particular area by taking technical electives focused in one of the concentration areas. An investigation of similar programs at peer and aspirational peer institutions was performed and their curriculum used as a model. It should be noted that some of the top engineering schools in the country (e.g. Harvey Mudd College and Olin College) offer similar programs. Additionally, Pennsylvania State University, also a land, space, sun, and sea grant offers an engineering science program as part of its honor college.

   c. Course of study

   The proposed curriculum for the four year, engineering science baccalaureate degree is detailed in Table 1. The degree is 180 credit hours of work, as required for a bachelor of science by Oregon State University. Eighty-two credit hours are in the major and sixty-one

of those credit hours are at the upper division. In the proposed curriculum, every term requires a minimum of 12 credit hours, ensuring full-time status for students receiving financial aid. All existing courses leveraged by this degree were integrated into the curriculum during the quarter they are traditionally offered to prevent multiple offerings and ensure maximum enrollment.

Table 1: Four-year Engineering Science curriculum.

Year 1	Term	Course No	Course Title	CH
	Fall	CH 231	General Chemistry	4
	Fall	CH 261	Laboratory for Chemistry 231	1
	Fall	MTH 251	Differential Calculus	4
	Fall	WR 121	English Composition	3
	Fall	ESC 111	Introduction to Engineering	3
	Year 1, Fall term, CH total			15
	Winter	CH 232	General Chemistry	4
	Winter	MTH 252	Integral Calculus	4
	Winter	CS 161	Introduction to Computer Science I	4
	Winter	XXX XXX	Perspectives - Social Processes and Institutions	3
	Year 1, Winter term, CH total			15
	Spring	MTH 254	Vector Calculus I	4
	Spring	COMM 111	Public Speaking	3
	Spring	CS 162	Introduction to Computer Science II	4
	Spring	XXX XXX	Perspectives - Western Culture	3
Year 1, Spring term, CH total				14
Year 1, CH total				44
Year 2	**Term**	**Course No**	**Course Title**	**CH**
	Fall	MTH 256	Applied Differential Equations	4
	Fall	PH 211	General Physics with Calculus	4
	Fall	ENGR 201	Electrical Fundamentals I	3
	Fall	ENGR 211	Statics	3
	Year 2, Fall term, CH total			14
	Winter	MTH 264	Introduction to Matrix Algebra	2
	Winter	PH 212	General Physics with Calculus	4
	Winter	ENGR 212	Dynamics	3
	Winter	WR 327	Technical Writing	3
	Winter	ENGR 202	Electrical Fundamentals II	3
	Year 2, Winter term, CH total			15
	Spring	ST 314	Introduction to Statistics for Engineers	3
	Spring	PH 213	General Physics with Calculus	4
	Spring	ENGR 248	Engineering Graphics - 3-D Modeling	3
	Spring	*ENGR 203*	*Electrical Fundamentals III*	*3*
	Spring	XXX XXX	Perspectives - Biological Science	4
Year 2, Spring term, CH total				17
Year 2, CH total				46

Table 1 continued on next page.

Year 3	Term	Course No	Course Title	CH
	Fall	*ECE 271*	*Digital Logic Design*	*3*
	Fall	*ECE 272*	*Digital Logic Design Laboratory*	*1*
	Fall	IE 425	Industrial Systems Optimization	4
	Fall	ME 311	Introduction to Thermal - Fluid Sciences	4
	Fall	XXX XXX	Perspectives - Difference, Power, & Discrimination	3
	Year 3, Fall term, CH total			15
	Winter	CS 290	Web Development	4
	Winter	*ECE 322*	*Electronics I*	*3*
	Winter	IE 415	Simulation and Decision Support Systems	4
	Winter	XXX XXX	Synthesis - Science, Technology, & Society	3
	Year 3, Winter term, CH total			14
	Spring	ESE 330	Modeling and Analysis of Dynamic Systems	4
	Spring	ESC 340	Introduction to Experimentation	4
	Spring	ESC 350	Engineering Materials	4
	Spring	XXX XXX	Perspectives - Literature & Arts	3
Year 3, Spring term, CH total				15
Year 3, CH total				44
Year 4	**Term**	**Course No**	**Course Title**	**CH**
	Fall	ESC 497	ESC Capstone Design (WIC)	4
	Fall	ME 331	Introductory Fluid Mechanics	4
	Fall	ESE 430	Feedback Control Systems	4
	Fall	ESE 470	Energy Distribution Systems	4
	Year 4, Fall term, CH total			16
	Winter	ESC 498	ESC Capstone Design (WIC)	4
	Winter	IE 471	Project Management for Engineers	3
	Winter	ESC 440	Computational Methods for Engineers	4
	Winter	XXX XXX	Free Elective	4
	Year 4, Winter term, CH total			15
	Spring	XXX XXX	Fitness	3
	Spring	ENGR 390	Engineering Economy	3
	Spring	XXX XXX	Perspectives - Cultural Diversity	3
	Spring	XXX XXX	Free Elective	3
	Spring	XXX XXX	Synthesis - Contemporary Global Issues	3
Year 4, Spring term, CH total				15
Year 4, CH total				46
Four Year Plan, CH total				180

Overall, 54 credit hours of baccalaureate core classes are integrated into the proposed curriculum. Table 2 provides a detailed mapping. All baccalaureate core requirements are met.

Table 2: Mapping of baccalaureate core courses required by the proposed curriculum.

Baccalaureate Core Courses			
	Area	Title	CH
Skills			
	Fitness		3
	Mathematics	MTH 251 - Differential Calculus	4
	Speech	COM 111 - Public Speaking	3
	Wrting I	WR 121 - English Composition	3
	Writing II	WR 327 - Technical Writing	3
Perspective			
	Biological Science		4
	Cultural Diversity		3
	Literature and Arts		3
	Physical Science	PH 211 - Physics with Calculus	4
	Physical Science	CH 231+261	5
	Social Processes and Institutions		3
	Western Culture		3
	Difference, Power, and Discrimination		3
Synthesis			
	Contemporary Global Issues		3
	Science, Technology, and Society		3
WIC			
	Writing Intensive Course	ESC Capstone Design	4
	Writing Intensive Course		
		Totals	
		Skills	16
		Perspective	28
		Synthesis	6
		WIC	4
		Overall Total	54

Initially, the proposed Engineering Science Program will offer the curriculum outlined in Table 1. Due to the multidisciplinary nature of the proposed program, the curriculum was purposefully constructed from existing engineering classes wherever possible. The impact and uniqueness of the program should be through exposure to courses across disciplines. Therefore the content of existing courses was carefully reviewed and those that mapped to

the goals of the proposed program adopted. The result was only four unique courses will need to be created. As the program grows, concentrations in different engineering fields will be offered. Students will be allowed to substitute technical electives in their area of concentration for the upper level engineering courses required by the base Engineering Science Program. The timing and order these concentrations will be offered in will be decided by enrollment, demand and facilities. Specific courses for those concentrations have not yet been identified, they will be dictated by the expertise of the faculty hired. An example of how a concentration would be implemented is provided:

> Energy Systems Engineering Concentration: replace from Years 3 and 4 Curricula any three of the following courses: ECE 322, IE 425, IE 415, CS 290, ME 331, or ESC 350 with ESE 355, ESE 450, and ESE 471. Additionally, students will be given the option of a capstone design project focused in their concentration area.

d. Program Delivery

The Engineering Science program will be housed in the College of Engineering. The program will be offered face-to-face at the OSU-Cascades campus in Bend. The first two years of the program includes courses that can be taken at OSU-Cascades or community college. The second two years must be taken at OSU-Cascades. Following the same performance based model used by many of the other schools in the College of Engineering continued enrollment in the program will be based on cumulative OSU GPA and successful course completion rate.

e. Faculty:

The proposed program is composed of forty-five classes that are already offered at OSU-Cascades (baccaulaureate core, general engineering, mechanical engineering, electrical engineering, industrial engineering, and business), four new offerings (highlighted in gray in Table 1), and three courses offered already in main campus (in italics in Table 1), but not yet offered at OSU-Cascades. It should be noted that ESC 497/498 are listed in Table 1, and may appear to be new offerings, but will be cross-listed with the currently offered ESE 497/498. Given this significant overlap and the projected enrollment shown in Fig. 2 (located in Section 4a), the following staffing plan for engineering specific faculty is proposed:

- AY 2019 – 2020: Instructor
- AY 2020 – 2021: Part-time instructors (Two individuals to teach one course each)
- AY 2021 – 2022: Instructor and part-time instructors (Four individuals - one course each)
- AY 2022 – 2023: Tenure track assistant professor

The initial instructor hire will cover the new offerings. Initially, the remaining courses that overlap the ESE program will be taught by the current ESE faculty: two Instructors, one Assistant Professor, and one Associate Professor. These faculty all hold a PhD and have extensive industrial experience. As Engineering Science enrollment grows more ESE courses will be over capacity and additional sections will need to be offered, so a second instructor hire is proposed in AY 2021 – 2022. Finally, the proposed concentrations will require

additional coverage. Assuming a start date of September 2019, historical enrollment data for the Energy Systems Engineering program, and the projected Engineering Science enrollment, it is proposed that an engineering (discipline – to be determined) tenure track hire be made in AY 2022 – 2023. This individual should be followed by a second tenure track hire in a different engineering field to ensure research in all engineering disciplines covered by the program are represented.

f. Adequacy of faculty resources – full-time, part-time, adjunct.

Part-time faculty will be used judiciously to enhance program offerings. In the past, the ESE program garnered very good accreditation reviews due to the use of excellent, well-experienced part-time faculty from the community. A similar approach will be employed by this program. It is anticipated that part-time faculty will be hired in AY 2020 – 2021 and AY 2021 – 2022 to cover a total of six courses. Additionally, 1/3 of an advisor will be added for every 100 students enrolled.

g. Other staff.

Recruitment, enrollment, and advising will be handled by current staff until program growth dictates the addition of new staff members.

h. Adequacy of facilities, library, and other resources.

The proposed program would add six new classes to the curriculum and, with growth, would require additional sections of existing courses. Seventy-five percent of the courses require a standard classroom, a need that can be met with the existing facilities. The remaining courses, highlighted in Table 3, require special facilities. Those facilities, with the exception of a machine shop, are currently available at OSU – Cascades in the form of the chemistry laboratory (TYK 304) and the flex laboratory (TYK 310). Table 4 quantifies the increased demand the proposed program would put on these two rooms. Even the largest demand, 10 hours in the fall, can be met with the existing facilities. Additionally, a new STEAM-focused building, scheduled for 2021, will completely address any additional burden associated with this new program. That new building will also address the need for a machine shop. In the interim, temporary shop space will be rented from one of the many facilities in Bend. Bend High School, Central Oregon Community College, and the DIY Cave all have exceptional facilities that can be rented in the short-term.

The adequacy of the library is addressed by the attached letter of support.

Table 3: Courses requiring special facilities.

Year 1	**Term**	**Course No**	**Course Title**	**Room**
	Fall	CH 261	Laboratory for Chemistry 231	TYK 304
	Fall	ESC 111	Introduction to Engineering Design	TYK 310
Year 2	**Term**	**Course No**	**Course Title**	
	Fall	PH 211	General Physics with Calculus	TYK 310
	Fall	ENGR 201	Electrical Fundamentals I	TYK 310
	Winter	PH 212	General Physics with Calculus	TYK 310
	Winter	ENGR 202	Electrical Fundamentals II	TYK 310
	Spring	PH 213	General Physics with Calculus	TYK 310

	Spring	ENGR 203	Electrical Fundamentals III	TYK 310
			Table 3: continued on next page	

Year 3	Term	Course No	Course Title	
	Fall	ECE 322	Electronics I	TYK 310
	Spring	ESC 340	Introduction to Experimentation	TYK 310
	Spring	ESC 350	Engineering Materials	TYK 310
Year 4	**Term**	**Course No**	**Course Title**	
	Fall	ESC 497	ESC Capstone Design	Shop
	Winter	ESC 498	ESC Capstone Design	Shop

Table 4: Additional hours the OSU-Cascade laboratories will be utilized by this program.

Term	Room	Additional Hours (per week)
Fall	TYK 310	10
Fall	TYK 304	3
Winter	TYK 310	4
Spring	TYK 310	8

i. Anticipated start date:
The first year this program would be offered fall 2019.

2. **Relationship to Mission and Goals**

a. Manner in which the proposed program supports the institution's mission, signature areas of focus, and strategic priorities.

The addition of the proposed program would be in strong alignment with the mission of Oregon State University. An engineering science program would provide the people of Oregon and beyond, through education and research, the skills needed to improve economic and environmental progress directly and social and cultural progress indirectly. For example, consider Amar Bose and the company he founded in 1964, the Bose Corporation. In 2015, Bose had 3.5 billion in sales. The Bose product line includes an energy efficient series that uses 50% less energy than comparable sound systems. Like many products today, Bose headphones and speakers are an excellent example of engineering growing economic and environmental progress. Bose products indirectly improve social and cultural progress as well through the delivery of music of all types to people of all types. There is a multitude of examples of this kind. A student with a broad engineering background steeped in fundamentals, like that provided by the proposed program, would be well poised to continue this tradition. It should also be noted that some schools advertise engineering science programs as launch pads for law and medical degrees, which only further emphasizes the alignment of such a program with OSU's mission. Finally, by adding an Engineering Science Program, OSU would be expanding their engineering offerings to include a program already

offered by Pennsylvania State University (PSU), the other land, sea, space, sun grant university. Currently US News ranks OSU #143 for National Universities and #75 for Best Undergraduate Engineering Programs while PSU is ranked #50 and #18 respectively.

Because today's technological and societal challenges are becoming more and more complex and multidisciplinary in nature, the proposed program would provide students with a strong, broad foundation in engineering fundamentals rather than in a specific engineering discipline. A comprehensive program of this nature would provide students with the solid background required to contribute to any of the three Signature Areas identified in the OSU mission statement. For example, through their training in electrical fundamentals, electronics, and energy distribution, a student in the proposed Engineering Science Program could work as a power engineer for a wind turbine company, addressing Advancing Science in Sustainable Earth Ecosystems. A student taking engineering graphics, material science, and capstone design could be employed in the medical device field, addressing Improving Human Health and Wellness. Historically engineers have been Promoting Economic Growth and Social Progress, so students of this program would be well-positioned to continue doing so.

It is stated on the Oregon State University – Cascades website that the campus strives to be a 'major contributor to the vitality of the unique Central Oregon community and environment'. The population change of Deschutes County, where OSU-Cascades is located, from April 1, 2010 to July 1, 2016 was reported by the US Census to be 14.9% [2]. Additionally, the Bend-Redmond metropolitan area was the third-fastest-growing area of this kind from July 2015 to July 2016 [3]. Therefore, providing a second strong engineering program to the rapidly growing Central Oregon region is directly in line with this campus goal. Additionally, Cascades has stated that 'it will be a destination of choice for students, faculty and staff seeking teaching and research excellence within a dynamic, inclusive and student-centered campus community'. The proposed program by definition is dynamic. Its inherent flexibility will allow both students and faculty to essentially 'choose their own adventure'. Studies indicate this generation highly values both feeling valued and adventure. The proposed program directly addresses these values which makes the proposed program and therefore OSU- Cascades a destination of choice.

3. **Accreditation**

The engineering science curriculum falls under the Accreditation Board for Engineering and Technology (ABET) general criteria for baccalaureate level programs. ABET guidelines state that the program curriculum must include:

- a minimum of 30 semester credit hours (45 quarter credit hours) of a combination of college-level mathematics and basic sciences with experimental experience appropriate to the program
- a minimum of 45 semester credit hours (67.5 quarter credit hours) of engineering topics appropriate to the program, consisting of engineering and computer sciences and engineering design, and utilizing modern engineering tools
- a broad education component that complements the technical content of the curriculum and is consistent with the program educational objectives

- a culminating major engineering design experience that 1) incorporates appropriate engineering standards and multiple constraints, and 2) is based on the knowledge and skills acquired in earlier course work

All ABET curriculum specifications are met by the proposed curriculum as is detailed in Table 5. There are over 45 CH of college level math and science. The ABET requirements indicate some of these courses should have experimental experience. Thirty-six percent of the math and science courses of the proposed curriculum have an experimental component. The number of credit hours required for engineering topics is 67.5; the proposed curriculum has 95 CH. Included are engineering, computer sciences, and engineering design courses, as required. Given the nature of the proposed program, the curriculum is inherently broad. In addition, of the 180 CH, 50 CH are neither math, science, nor engineering in nature, therefore the broad education requirement is well met. Finally, the curriculum includes ESC 497/498 which is the two quarter long capstone design experience, which solidly addresses the last of ABET guidelines.

Table 5: Comparison of credit hours in curriculum dedicated to each ABET curriculum specification and number of credit hours required.

Course No	Title	CH	ABET Required CH
MTH 251	Differential Calculus	4	
MTH 252	Integral Calculus	4	
MTH 254	Vector Calculus I	4	
MTH 256	Applied Differential Equations	4	
MTH 264	Introduction to Matrix Algebra	2	
ST 314	Introduction to Statistics for Engineers	4	
CH 231	General Chemistry	4	
CH 261	Laboratory for Chemistry 231	1	
CH 232	General Chemistry	4	
PH 211	General Physics with Calculus	4	
PH 212	General Physics with Calculus	4	
PH 213	General Physics with Calculus	4	
XXX XXX	Perspectives - Biological Science	4	
	Math and Science Total	47	45
	Math and Science Courses with Experimental Component	17	
ENGR 201	Electrical Fundamentals I	3	
ENGR 211	Statics	3	
ENGR 212	Dynamics	3	

ENGR 202	Electrical Fundamentals II	3	
ENGR 248	Engineering Graphics - 3-D Modeling	3	
ENGR 203	Electrical Fundamentals III	3	
			Table 5 continued on next page
ENGR 390	Engineering Economy	3	
ESC 111	Introduction to Engineering	3	
ESC 440	Computational Methods for Engineers	4	
ESC 340	Introduction to Experimentation	4	
ESC 350	Engineering Materials	4	
ESC 497	ESC Capstone Design	4	
ESC 498	ESC Capstone Design	4	
ESE 330	Systems	4	
ESE 430	Feedback Control Systems	4	
ESE 470	Energy Distribution Systems	4	
ME 311	Intro to Thermal - Fluid Sciences	4	
ME 331	Introductory Fluid Mechanics	4	
ECE 271/272	Digital Logic Design\Laboratory	4	
ECE 322	Electronics I	3	
IE 425	Industrial Systems Optimization	4	
IE 415	Simulation and Decision Support Systems	4	
IE 471	Project Management for Engineers	4	
CS 161	Introduction to Computer Science I	4	
CS 162	Introduction to Computer Science II	4	
CS 290	Web Development	4	
	Engineering Total	95	67.5

Accreditation of this program will be sought. ABET program eligibility requirements indicate a program must have one graduate before requesting an initial accreditation review. Based on the proposed timeline, a review could be requested in 2023. The majority of the programs within the College of Engineering are accredited, therefore, guidelines are already in place and will be used during the years prior to the initial visit to ensure a successful review.

4. **Need**

a. Anticipated fall term headcount and FTE enrollment over each of the next five years.

The OSU-Cascades Energy Systems Engineering (ESE) Program was established in 2010. It is the only engineering program of its kind offered in the state of Oregon and one of five accredited programs in the country. The program has had strong enrollment growth as demonstrated by the graduation numbers shown in Figure 1. The proposed Engineering Science would also be the only one in Oregon. Additionally, there are only eleven ABET

accredited engineering science programs in the nation. Just over half of these programs are offered at public institutions, with the closest housed at Colorado State University. Enrollment trends comparable to that of the Energy Systems Engineering Program are expected for the Engineering Science Program due to these similarities. Projected enrollment for the next five years is shown in Figure 2. Note, each year five transfer students are expected to enter the program during their junior year. This is based on trends experienced in the ESE program.

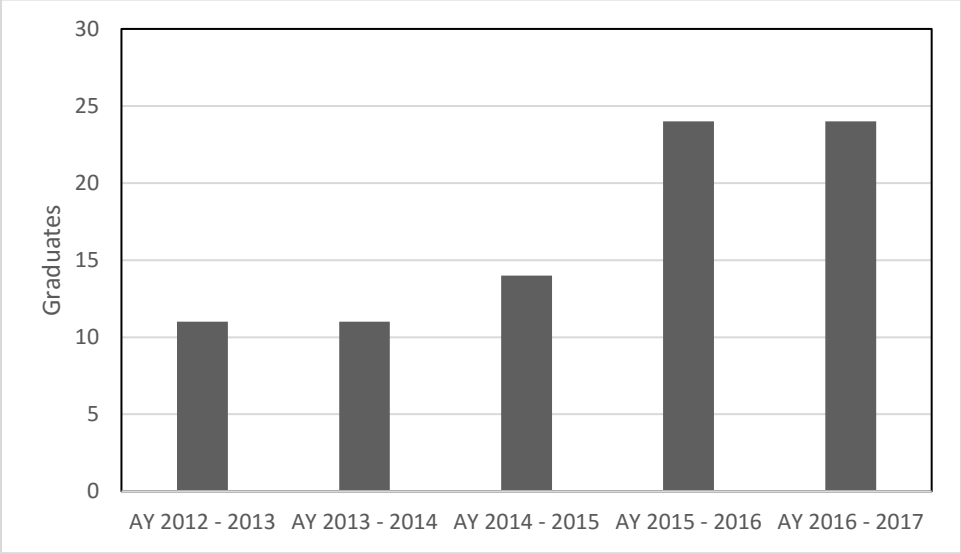

Figure 1: Number of graduates from the Energy Systems Engineering program in the past five years.

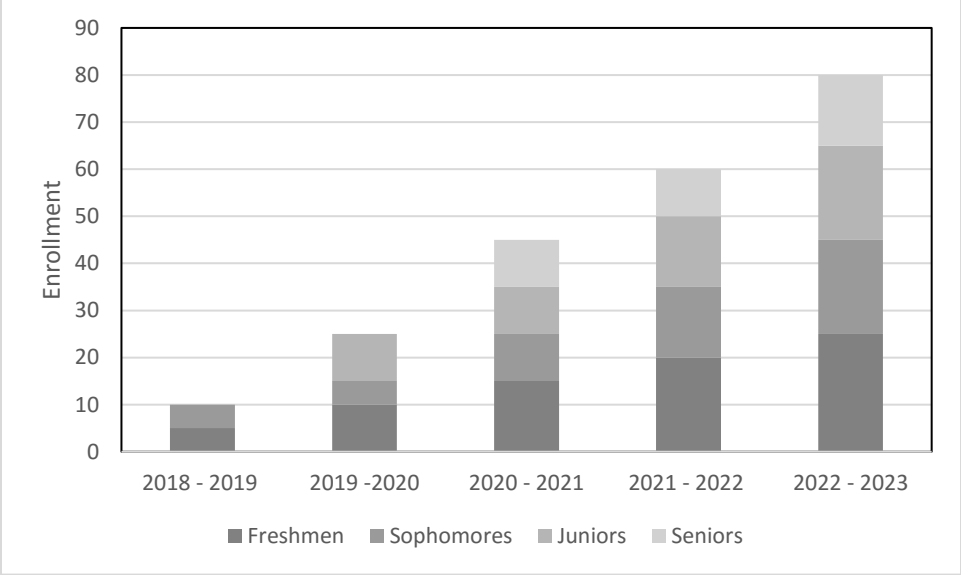

Figure 2: Engineering Science enrollment projections

b. Expected degrees/certificates produced over the next five years.

It is anticipated that ten engineering science baccalaureate degrees will be awarded in spring 2022. In the five years that follow, trends similar to that shown in Figure 1 are expected. The only degree conferred by the program will be a Bachelor of Science in engineering science.

c. Characteristics of students to be served (resident/nonresident/international; traditional/ nontraditional; full-time/part-time, etc.).

This program will serve resident, nonresident, and international students. It will be composed of traditional and nontraditional as well as full-time and part-time students.

d. Evidence of market demand.

Only three of the seven public institutions of higher education in Oregon offer engineering programs. None of those intuitions currently offer an engineering science (or similar) program. The ability to customize as well as the flexibility of this program will appeal to today's student as it directly addresses many of the values attributed to millennials [4]. An engineering science program would provide an additional program for the large engineering student body at OSU. Although the proposed program is broad, the opportunity for areas of concentration in more traditional engineering disciplines would attract students interested in but not eligible for the OSU-Corvallis programs.

e. If the program's location is shared with another similar Oregon public university program, the proposal should provide externally validated evidence of need (e.g., surveys, focus groups, documented requests, occupational/employment statistics and forecasts).

This program's location will not be shared with similar programs. Additionally, this will be the only program of its kind offered at a public institution in Oregon.

f. Estimate the prospects for success of program graduates (employment or graduate school) and consideration of licensure, if appropriate. What are the expected career paths for students in this program?

The proposed engineering science program that would provide students with a strong, broad foundation in engineering fundamentals rather than in a specific engineering discipline is proposed. The product would be dynamic, agile, and flexible engineers capable of doing a variety of engineering jobs rather than only one specific discipline. Some of the many fields students graduating from this program would be ready to work in are industrial, electrical, mechanical, design, and process engineering. Additionally, they would be eligible for graduate studies in any of these fields. It should also be noted that some of the engineering science programs currently in place across the country are used as a launch pad for medical or law school. This would be a goal of this program as well.

Two national databases indicate a 6% employment growth rate in general engineering. Additionally, Central Oregon business community members were asked if they felt a student with an engineering science degree would be employable. Those polled were from a variety of different areas including biotech, venture capital, aerospace engineering, and the Oregon Department of Energy. The response was overwhelmingly yes. The professional engineer (PE) licensure is often earned by engineers (but is not necessary). The license requires a Bachelor's degree in Engineering from an ABET accredited school, demonstrable

engineering experience under the supervision of another licensed engineer, as well as successful completion of two tests. The first exam, the fundamentals of engineering (FE) test is offered in seven different disciplines. It is anticipated that students from this program would take FE Other Disciplines. The topics covered by this FE exam include: math; probability and statistics; chemistry; instrumentation and data acquisition; ethics and professional practice; safety, health, and environment; engineering economics; statics; dynamics; strength of materials; materials science; fluid mechanics; electricity, power, and magnetism; heat, mass, and energy transfer. Those topics are mapped to the proposed curriculum in Table 6. In general, each topic is covered in multiple courses. Additionally, the Central Oregon Professional Engineers of Oregon indicated they felt the engineering science program would prepare students to successfully obtain their PE.

Table 6: Courses in the proposed curriculum mapped to FE topics

Course No	Course Title	FE Topic
CH 231	General Chemistry	Chemistry
CH 261	Laboratory for Chemistry 231	Chemistry
MTH 251	Differential Calculus	Mathematics and Advanced Engineering Mathematics
ESC 111	Introduction to Engineering	Ethics and Professional Practice; Saftey, Health, and Environment
CH 232	General Chemistry	Chemistry
MTH 252	Integral Calculus	Mathematics and Advanced Engineering Mathematics
CS 161	Introduction to Computer Science I	Instrumentation and Data Acquisition
MTH 254	Vector Calculus I	Mathematics and Advanced Engineering Mathematics
MTH 256	Applied Differential Equations	Mathematics and Advanced Engineering Mathematics
PH 211	General Physics with Calculus	Dynamics
ENGR 201	Electrical Fundamentals I	Electricty, Power, and Magnetism; Instrumentation and Data Acquisition
ENGR 211	Statics	Statics; Strength of Materials
MTH 306	Matrix and Power Series Methods	Mathematics and Advanced Engineering Mathematics
PH 212	General Physics with Calculus	Dynamics
ENGR 212	Dynamics	Dynamics
ENGR 202	Electrical Fundamentals II	Electricty, Power, and Magnetism; Instrumentation and Data Acquisition
ST 314	Introduction to Statistics for Engineers	Probability and Statistics
PH 213	General Physics with Calculus	Electricty, Power, and Magnetism
ENGR 203	Electrical Fundamentals III	Electricty, Power, and Magnetism
ME 311	Introduction to Thermal - Fluid Sciences	Fluid Mechanics and Dynamics of Gases, Heat, Mass, and Energy Transfer
IE 415	Simulation and Decision Support Systems	Probability and Statistics
ESC 340	Introduction to Experimentation	Instrumentation and Data Acquisition
ESC 350	Engineering Materials	Materials Science; Strength of Materials
ESC 497	ESC Capstone Design	Ethics and Professional Practice
ME 331	Introductory Fluid Mechanics	Fluid Mechanics and Dynamics of Liquids
ESC 440	Computational Methods for Engineers	Mathematics and Advanced Engineering Mathematics
ENGR 390	Engineering Economy	Engineering Economics

5. **Outcomes and Quality Assessment**

a. Expected learning outcomes of the program.

The Engineering Science Program will use the ABET student learning outcomes to assess the program. Additionally, educational outcomes that provide extended assessment of the program after graduation have been developed. The Engineering Science Program educational outcomes would align with those of other programs within the OSU College of

Engineering. Within three years of graduation engineering science students will have:

1. obtained professional employment within a field closely related to engineering or entered graduate school for an engineering related field or a professional program such as medical or law
2. created value by applying engineering fundamentals and strong problem solving skills to improve economic, environmental, social and cultural progress
3. embarked on a pursuit of lifelong learning
4. effectively and efficiently communicate ideas to a diverse audience
5. achieved Engineer in Training (EIT) certification by passing the Fundamentals of Engineering exam and gained experience required for professional licensure

Each of the Engineering Science Program educational outcomes will be paired with a related ABET defined student outcome. The ABET student outcomes and their program educational outcomes mappings are shown in Table 7.

Table 7: Program and student outcome mapping

Program Outcome	Related Student Outcome
1, 2, 5	(1) an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics
1,2	(2) an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
2, 3, 4	(3) an ability to communicate effectively with a range of audiences
1, 2, 3	(4) an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts
1,2, 4, 5	(5) an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives
1,2	(6) an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
3	(7) an ability to acquire and apply new knowledge as needed, using appropriate learning strategies

b. Methods by which the learning outcomes will be assessed and used to improve curriculum and instruction.

The curriculum outlined in Table 1 will be mapped to the student outcomes detailed in Table 7. Each student outcome will be assessed in three different classes. The curriculum was evaluated and student outcomes mapped to appropriate courses, shown in Table 8.

Table 8: ABET student outcomes mapped to specific courses in the curriculum

Year 1	Course No	Course Title	ABET Student Outcome
	ESC 111	Introduction to Engineering	3, 4, 5
Year 2			
	ENGR 202	Electrical Fundamentals II	1, 2, 7
Year 3			
	ME 311	Introduction to Thermal - Fluid Sciences	2, 4, 7
	ESC 340	Introduction to Experimentation	4, 6, 7
Year 4			
	ESC 497	ESC Capstone Design	1, 3, 5
	ESC 498	ESC Capstone Design	2, 4, 6
	ESC 440	Computational Methods for Engineers	1, 3, 6

Using the mapping in Table 8, the ABET student outcomes will be assessed using the following methods:

1. Assignments will be designed to assess the learning outcome(s) assigned to that class. Wherever possible the type of assignment will be varied.
2. Samples of the graded assignments will be collected. A minimum of three samples will be collected and they will represent the high, average, and low grade of the assignment.
3. At the end of each term, the data from the collected samples will be analyzed. Data to be analyzed includes average score, standard deviation, minimum, and maximum grade for each assignment.
4. Assignments with low average student scores will be used to identify areas for curriculum and instruction improvement.
5. The results of the assessment will be summarized in an executive summary and discussed by the faculty at the end of the academic year.

First and second year courses in the curriculum will be assessed to establish a baseline, but the majority of the courses assessed will be upper division. The lower division classes selected for the assessment involve group work and/or a laboratory component. So, in addition to the traditional assessment tools of exams and homework, there will be rubrics created for all laboratory assignments and written work to ensure a robust evaluation. The upper division courses selected require the students to employ a large variety of skills to be successful and therefore well demonstrate if progress has been made toward achieving the majority of the student learning outcomes. Similar to the early curriculum courses, these classes allow a wide variety of assessment tools to be employed.

c. Nature and level of research and/or scholarly work expected of program faculty; indicators of success in those areas.

Cutting-edge, externally-sponsored research with an engineering focus is expected of tenure track faculty. Indicators of success include:

1. Secure $250,000/yr in external funding
    i. Support a team of graduate students

ii. Support undergraduate researchers

2. A robust dissemination record
   i. Publication in journals highly regarded by their peers
   ii. Presentations at key conferences

Instructors will be responsible for 80% teaching, 10% maintaining currency, and 10% service.

6. **Program Integration and Collaboration**

a. Closely related programs in this or other Oregon colleges and universities.

Of the seven public higher education institutions in Oregon, three have engineering programs. Additionally, two private schools in Oregon offer engineering programs. Closely related programs within those programs include:

1. Oregon Institute of Technology:
   a. Electrical Engineering
   b. Mechanical Engineering
   c. Renewable Energy Engineering
2. Portland State University:
   a. Electrical Engineering
   b. Mechanical and Materials Engineering
3. Oregon State University:
   a. Electrical Engineering
   b. Mechanical Engineering
   c. Industrial Engineering
4. George Fox University
   a. Bachelor of Science in Engineering with four concentrations (civil, computer, electrical, and mechanical)
5. University of Portland
   a. Electrical Engineering
   b. Mechanical Engineering

b. Ways in which the program complements other similar programs in other Oregon institutions and other related programs at this institution. Proposal should identify the potential for collaboration.

This would be the only program of this kind in Oregon.

c. If applicable, proposal should state why this program may not be collaborating with existing similar programs.

N/A

d. Potential impacts on other programs.

From 2014 to 2015 the number of bachelor's of science degrees awarded from an engineering program grew by 7.5%. An upward trend that started in 2007. The Bureau of Labor Statistics projects employment of mechanical engineers will grow by 5% from 2014 to

2024 while that of electrical and industrial engineers will hold steady. Anecdotal evidence indicates technology companies are bracing for the 'silver tsunami'. They indicate a large portion of their workforce is preparing to retire and the supply for replacements is low, especially in engineering. All these facts indicate strong demand for engineers and that an additional engineering program would not negatively impact any of the current programs.

7. External Review

The proposed program is not a graduate level program.

References.

[1] The National Academy of Engineering, 2004, *The Engineer of 2020: Visions of Engineering in the New Century*. Washington, D.C: The National Academies Press.

[2] United States Census Bureau, (2016, July 01) *Quick Facts,* [Online]. Available: https://www.census.gov/quickfacts/fact/table/deschutescountyoregon/RHI805210

[3] K. Spurr, (2017, March 23) *Census: Deschutes, Crook county growth among nation's fastest,* [Online]. Available: http://www.bendbulletin.com/localstate/5170792-151/census-deschutes-crook-county-growth-among-nations-fastest

Revised May 2016

From:	Claudia TorresGaribay
To:	Webb, Rebecca
Cc:	H J Corsair; Teshome Jiru
Subject:	RE: OSU-Cascades Engineering Science Program (proposed) (Submitted via Website)
Date:	Wednesday, October 18, 2017 5:38:17 PM

Becca,

After looking at the documents you sent we think that the proposed BS in Engineering Science does not compete with our BS in Electrical Engineering. We also consider that does not compete with our BS in Renewable Energy Engineering if the electives are not focused on renewable energy technologies.

Good luck with the launching of your program.

Regards,
Claudia

From: Webb, Rebecca [mailto:rebecca.webb@osucascades.edu]
Sent: Monday, October 9, 2017 1:32 PM
To: Claudia TorresGaribay <Claudia.TorresGaribay@oit.edu>
Subject: RE: OSU-Cascades Engineering Science Program (proposed) (Submitted via Website)

Hi, Claudia:
The proposed curriculum and executive summary are attached to this email. Thank you for your willingness to look it over.
Becca

Rebecca Webb, PhD | Program Lead & Instructor
Energy Systems Engineering
541.322.3167 | rebecca.webb@osucascades.edu
osucascades.edu

From: Claudia TorresGaribay [mailto:Claudia.TorresGaribay@oit.edu]
Sent: Monday, October 9, 2017 11:04 AM
To: Webb, Rebecca <rebecca.webb@osucascades.edu>
Cc: Eve Klopf <Eve.Klopf@oit.edu>; Mason Terry <Mason.Terry@oit.edu>; Teshome Jiru <Teshome.Jiru@oit.edu>; Aaron Scher <Aaron.Scher@oit.edu>
Subject: RE: OSU-Cascades Engineering Science Program (proposed) (Submitted via Website)

Hi Rebecca,

Thank you for contacting us and thank you for sharing the positive feedback from our alumni. I'm sharing it with the BSEE and BSREE program directors in my department. Please send us a link or an

attachment to be able to take a look to your curriculum and we'll get back to you soon afterwards.

Regards,
Claudia

Claudia Torres Garibay, Ph.D.
Associate Professor and Department Chair
Electrical Engineering and Renewable Energy Department

Oregon Institute of Technology
27500 SW Parkway Ave., Wilsonville, OR 97070
claudia.torresgaribay@oit.edu | 503-821-1248

www.oit.edu

From: webmaster@oit.edu [mailto:webmaster@oit.edu]
Sent: Friday, October 6, 2017 1:51 PM
To: Claudia TorresGaribay <Claudia.TorresGaribay@oit.edu>
Subject: OSU-Cascades Engineering Science Program (proposed) (Submitted via Website)

From: Rebecca Webb(rebecca.webb@osucascades.edu)

Message:
Dr. Torres-Garibay: My name is Rebecca Webb and I am the Program Lead for the Energy Systems Engineering program at OSU-Cascades. FYI, since starting at OSU I have met many of your graduates. They always have wonderful things to say about the EERE program. Sometimes it seems like we only hear negative feedback, so I thought this might be nice to hear. I'm sure you are very busy now that the term has started, but I have a quick question for you. OSU-Cascades is proposing a new 4-year B.S. degree program in Engineering Science. We are hopeful that it complements rather than competes with the other engineering programs in the state and fills an unmet need. I'd like to hear your opinion. Would you have time to take a quick look at our proposed curriculum and provide your thoughts? Thanks, Rebecca

Referring Page: http://www.oit.edu/academics/engineering-technology-management/eere/faculty

From: Kevin Grove
To: Webb, Rebecca
Subject: RE: Engineering Science at OSU-Cascades
Date: Wednesday, October 18, 2017 2:03:47 PM

Hi Becca,

I think this looks good and like an interesting program. I have a few questions for you. Have you talked to any local industry about their thoughts on the program? Are there any employers in Bend, Central Oregon, or Oregon that say they would like to employ students coming out of this kind of program? Will GE 101 count for your ESC 101? I think it is important for students to be able to transfer as many credits from COCC as possible to OSU-C and as seamlessly as possible if they want to take their first two years at COCC.

Thanks,

Kevin

From: Webb, Rebecca [mailto:rebecca.webb@osucascades.edu]
Sent: Monday, October 9, 2017 1:33 PM
To: Kevin Grove <kgrove@cocc.edu>
Subject: RE: Engineering Science at OSU-Cascades

Hi, Kevin:
Thanks for your help. The curriculum and executive summary are attached.
Becca

From: Kevin Grove [mailto:kgrove@cocc.edu]
Sent: Monday, October 9, 2017 8:39 AM
To: Webb, Rebecca <rebecca.webb@osucascades.edu>
Subject: RE: Engineering Science at OSU-Cascades

Hi Becca,
Off to a good start hear and I hope things are going well for you, too. That sounds interesting. I don't know anything about an Engineering Science degree but will look into it. It looks like Vanderbilt has a program. I think in general more options for engineering students in Bend is a good thing. I would be happy to take a quick look at the curriculum and give you my thoughts.

Thanks,
Kevin

From: Webb, Rebecca [mailto:rebecca.webb@osucascades.edu]
Sent: Friday, October 6, 2017 1:36 PM
To: Kevin Grove <kgrove@cocc.edu>
Subject: Engineering Science at OSU-Cascades

Hi, Kevin:
I hope your fall term is going well. Quick question for you. OSU-Cascades is proposing a new 4-year B.S. degree program in Engineering Science. The first two years of the program are very similar to that of the ESE program, so I think that the new program would help populate COCC's engineering offerings as well as provide a second, local, 4-year engineering degree opportunity for your students. I'd like to hear your opinion. Would you have time to take a quick look at our proposed curriculum and provide your thoughts?
Thanks,
Becca

From: James McNames
To: Webb, Rebecca
Cc: Sung Yi; James Hook; ren su; Bob Bass; Donald Duncan; Branimir Pejcinovic
Subject: Re: OSU-Cascades Engineering Science
Date: Monday, October 16, 2017 4:47:47 PM

Rebecca,

I looked over the program in Engineering Science. It does not appear to compete with either of the programs offered by my department in Electrical Engineering or Computer Engineering. I don't have enough information to make any judgement about whether it would serve an unmet need or not. Please let me know if you need any other information from us. Good luck with your new program.

Regards,
James

> On Oct 10, 2017, at 8:54 AM, Webb, Rebecca <rebecca.webb@osucascades.edu> wrote:
>
> Hi, James:
> The proposed curriculum and associated executive summary are attached. If you have any question, please let me know. Thank you for your time, I appreciate it.
> Becca
>
> Rebecca Webb, PhD | Program Lead & Instructor
> Energy Systems Engineering
> 541.322.3167 | rebecca.webb@osucascades.edu
> osucascades.edu
>
> ---
>
> **From:** James McNames [mailto:mcnames@pdx.edu]
> **Sent:** Tuesday, October 10, 2017 7:40 AM
> **To:** Webb, Rebecca <rebecca.webb@osucascades.edu>
> **Cc:** Sung Yi <syi@pdx.edu>
> **Subject:** Re: OSU-Cascades Engineering Science
>
> I too would like to have a look at the proposed curriculum.
>
> James
>
> > On Oct 6, 2017, at 2:49 PM, Sung Yi <syi@pdx.edu> wrote:
> >
> > Dear Dr. Rebecca,
> >
> > It is good to know that OSU-Cascades is proposing a 4-year B.S.

degree program in engineering science.

I will be happy to review the program. However, we have been busy for preparing the ABET visit next week. So it will take some time to provide my opinion.

Thank you.

Sung Yi
Professor and Chair
Mechanical and Materials Engineering Department
Portland State University
Post Box 751
Portland, Oregon 97207-0751
Fax: (503) 725-8255
Phone: (503) 725-5470
Email: syi@pdx.edu
Website: http://web.cecs.pdx.edu/~sungyi/

From: Webb, Rebecca [mailto:rebecca.webb@osucascades.edu]
Sent: Friday, October 06, 2017 1:43 PM
To: syi@pdx.edu; mcnames@pdx.edu
Subject: OSU-Cascades Engineering Science

Drs. Yi and McNames:

My name is Rebecca Webb and I am the Program Lead for the Energy Systems Engineering program at OSU-Cascades. I'm sure you are very busy now that the term has started, but I have a quick question for you. OSU-Cascades is proposing a new 4-year B.S. degree program in Engineering Science. We are hopeful that it complements rather than competes with the other engineering programs in the state and fills an unmet need. I'd like to hear your opinion. Would you have time to take a quick look at our proposed curriculum and provide your thoughts?

Thanks,
Rebecca

<image001.jpg> Rebecca Webb, PhD
Program Lead | Instructor | Energy Systems Engineering
541.322.3167 | osucascades.edu

<image001.gif>
James McNames, Ph.D.

Professor and Chair

Electrical and Computer Engineering Department
Maseeh College of Engineering and Computer Science
Portland State University

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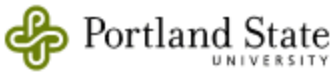

James McNames, Ph.D.
Professor and Chair

Electrical and Computer Engineering Department
Maseeh College of Engineering and Computer Science
Portland State University

From: Sung Yi
To: James McNames; Webb, Rebecca
Cc: James Hook; ren su; Bob Bass; Donald Duncan; Branimir Pejcinovic
Subject: RE: OSU-Cascades Engineering Science
Date: Monday, October 16, 2017 7:00:01 PM

Rebecca,

I agreed with Prof. McNames. I do not feel much overlap. However, if you still want me to review your program, then I will be happy to do so.

Sung Yi
Professor and Chair
Mechanical and Materials Engineering Department
Portland State University
Post Box 751
Portland, Oregon 97207-0751
Fax: (503) 725-8255
Phone: (503) 725-5470
Email: syi@pdx.edu
Website: http://web.cecs.pdx.edu/~sungyi/

From: James McNames [mailto:mcnames@pdx.edu]
Sent: Monday, October 16, 2017 4:48 PM
To: Webb, Rebecca
Cc: Sung Yi; James Hook; ren su; Bob Bass; Donald Duncan; Branimir Pejcinovic
Subject: Re: OSU-Cascades Engineering Science

Rebecca,

I looked over the program in Engineering Science. It does not appear to compete with either of the programs offered by my department in Electrical Engineering or Computer Engineering. I don't have enough information to make any judgement about whether it would serve an unmet need or not. Please let me know if you need any other information from us. Good luck with your new program.

Regards,
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> Hi, James:
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> Rebecca Webb, PhD | Program Lead & Instructor
> Energy Systems Engineering

541.322.3167 | rebecca.webb@osucascades.edu
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> **Subject:** OSU-Cascades Engineering Science
>
> Drs. Yi and McNames:
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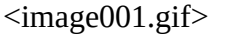
> My name is Rebecca Webb and I am the Program Lead for the Energy

Systems Engineering program at OSU-Cascades. I'm sure you are very busy now that the term has started, but I have a quick question for you. OSU-Cascades is proposing a new 4-year B.S. degree program in Engineering Science. We are hopeful that it complements rather than competes with the other engineering programs in the state and fills an unmet need. I'd like to hear your opinion. Would you have time to take a quick look at our proposed curriculum and provide your thoughts?

Thanks,
Rebecca


Rebecca Webb, PhD
Program Lead | Instructor | Energy Systems Engineering
541.322.3167 | osucascades.edu


James McNames, Ph.D.
Professor and Chair

Electrical and Computer Engineering Department
Maseeh College of Engineering and Computer Science
Portland State University

<ENGR_SCI_Curriculum.pdf><ENGR_SCI_ExecutiveSummary.pdf>

Portland State UNIVERSITY
James McNames, Ph.D.
Professor and Chair

Electrical and Computer Engineering Department
Maseeh College of Engineering and Computer Science
Portland State University

Element 1
Hydrogen Generators

Element 1 Corp

63050 Plateau Drive | Bend, Oregon USA 97701
+1.541.306.3976 | e1na.com

March 5, 2018

Higher Education Coordinating Commission
255 Capitol Street NE, Third Floor
Salem, OR 97310

Re: Proposed Engineering Science Program, Oregon State University

Dear Commission Members:

I strongly support the proposed Bachelor of Science in Engineering Science degree program at Oregon State University – Cascades (OSU Cascades). I serve in the capacity of CEO and CTO at Element 1 Corp. in Bend (development and licensing of hydrogen technology in support of clean energy commercialization). Although we are based in Central Oregon, we conduct business globally. Presently, we have a technical team of 8 well-educated and experienced individuals, including one graduate of the Energy Systems Engineering program at OSU Cascades.

I have reviewed the proposed Engineering Science curriculum, and believe this program would well prepare students for work as engineers. When filling an open position at my company, we definitely prefer to hire from Oregon Universities, and would certainly look to graduates of the Engineering Science program because we are very satisfied with the quality education provided by OSU Cascades.

Sincerely,

Dave Edlund
Founder & CEO
www.e1na.com

March 21, 2018

Higher Education Coordinating Commission
255 Capitol Street NE, Third Floor
Salem, OR 97310

Re: Proposed Engineering Science Program
Oregon State University

Dear Commission Members:

I strongly support the proposed Bachelor of Science in Engineering Science degree program at Oregon State University – Cascades. I am a Civil Engineering Project Manager located in Central Oregon. My employers is a private consulting firm that locally employs seven engineers and two EITs with backgrounds in civil and environmental engineering. Additionally, I am the President of the Central Oregon Chapter of Professional Engineers of Oregon. Our organization, part of the National Society of Professional Engineers, represents licensed engineers, advocating for the preservation and strengthening of the professional and ethical standards of the profession.

I have reviewed the proposed engineering science curriculum. I believe this program would provide a strong foundation within several engineering disciplines. The Professional Engineers of Oregon always support the advancement and education of people in the field of engineering. I am pleased to see this program's intent is to provide a broadly-applicable engineering education. Appropriately, the approval of Accreditation Board for Engineering and Technology, Inc. (ABET) and National Council of Examiners for Engineering and Surveying (NCEES) is being sought for the program by OSU-Cascades.

Sincerely,

Tom Headley, PE, CWRE, LEED AP
Civil Engineering Project Manager
Bend, OR

3426 SW Evergreen Avenue
Redmond, OR 97756
March 26, 2018

Higher Education Coordinating Commission
255 Capitol Street NE, Third Floor
Salem, OR 97310

Re: Proposed Engineering Science Program
Oregon State University

Dear Commission Members:

I strongly support the proposed Bachelor of Science in Engineering Science degree program at Oregon State University – Cascades. I am a Senior Electrical Engineer at Dana Engineering, Inc. Dana Engineering is located in Richland, Washington, and employs multiple disciplines in Civil, Structural, Mechanical and Electrical Engineering.

I have reviewed the proposed engineering science curriculum. I believe this program would well prepare students for work as engineers because I took similar courses in my Electrical & Electronic Engineering classes at Cal Poly, Pomona. When filling an open position at my company, I would definitely encourage hiring a graduate of the Engineering Science program because it appears that they have a more rounded education than a strictly discipline focused program.

I have included a copy of my resume to show how I experienced many different types of projects in my engineering career.

Sincerely,

William G. Guy, P.E.

ACCESSIBILITY
New Program Proposal
(Degree or Certificate)
Guidelines for Addressing Accessibility

Sections 503 and 504 of the Rehabilitation Act of 1973, and the Americans with Disabilities Act of 1990 (ADA), as amended by the ADA Amendments Act of 2008 prohibits discrimination on the basis of disability. The Rehabilitation Act and the ADA require that no qualified person shall, solely by reason of disability, be denied access to, participation in, or the benefits of, any program or activity operated by the University. Each qualified person shall receive the reasonable accommodations needed to ensure equal access to employment, educational opportunities, programs, and activities in the most integrated setting feasible.

For questions and assistance with addressing access, please contact:
the Office of Disability and Access Services (737-4098), or
the Office of Affirmative Action and Equal Opportunity (737-3556).

Title of Proposal: OSU-Cascades Bachelor of Science in Engineering Science

Date: 01/2019

School/Department/Program: n/a

College: College of Engineering

- ☐ Accessibility (http://oregonstate.edu/accessibility/policies)
- ☐ Faculty Guidelines (http://ds.oregonstate.edu/facultyguidelines)
- ☐ Information Technology Guidelines (http://oregonstate.edu/accessibility/ITpolicy)

By signing this form, we affirm that at we have reviewed the listed documents and will apply a good faith effort to ensure accessibility in curricular design, delivery, and supporting information.

Julie Gess-Newsome
Sign (Dean of Academic Affairs, OSU-C)

Julie Gess-Newsome
Print (Dean of Academic Affairs, OSU-C)

1/14/19
Date

Source: Office of Academic Programs, Assessment, and Accreditation (glb/ch; 4-26-16)

Library Support for the Proposed Engineering Science Program on Cascades Campus

This report is an analysis of the capacity of the OSU Cascades local library collection and services, in combination with access to the resources of the whole of OSU Libraries and Press (OSULP) and Summit, to support the proposed Engineering Science degree on the Cascades campus.

Print Monographs and E-Books

Due to the size restrictions of the OSU Cascades Library, support for this program will depend on the OSU Valley Library in Corvallis and OSULP e-book collections. The print collection at the Valley Library is available to OSU Cascades students by request and can be received within 3 working days. While the print collection is only half the size of the Pennsylvania State University, the peer institution identified by the proposal, the availability of the Orbis Cascade Alliance collections brings the print collection up to a satisfactory level.

OSU is served well by the OSULP investment in the Orbis/Cascades Alliance, whose combined collection is substantial. Students and faculty can order from the collections of all the libraries in the Orbis Cascade Alliance through the Summit catalog. University of Oregon, Portland State University, University of Washington and Washington State University are some of the larger research libraries represented in the Summit catalog. Books requested through Summit are delivered to OSULP within three to five working days.

The growing availability of e-books makes it possible to expedite access to more information from various locations. This immediate access serves the OSU Cascades students and faculty well. Students at the OSU Cascades campus will have access to the e-books purchased centrally, which includes over 7,824 titles in relevant engineering subjects, in a collection of almost 400,000 titles. These include IEEE/Wiley e-books, the ASME Digital Collection, Springer engineering e-books, and the Morgan & Claypool Synthesis Collection.

The ASM Handbook is important to the proposed program, but is currently only available as a print title in the Valley Library. This title is not conducive to borrowing, so the online version of this handbook will be necessary for the proposed program. The online version costs $1,850 per year. The current subscription for the print volumes ($575/year) can be applied to the online subscription, so OSU Cascades will be responsible for the additional cost ($1,275/year) to make the handbooks available to Cascades students.

Serials/Journals

The OSULP maintain a strong journals collection in Engineering. Relevant journals in the Web of Science categories of Multidisciplinary Engineering, Electronic and Electrical Engineering, Mechanical Engineering, Industrial Engineering, and Energy Systems were compared to OSULP subscriptions (See Table 1). Both the full list of journals and the highest impact journals (1st Quartile) were evaluated. Of the high-impact titles, OSULP has access to 94% of the titles. All of these subscriptions are for electronic access to the articles, so OSU Cascades students have immediate access to the content. There is concern that with regular price increases to our licenses

and a flat budget that access may be eroded over time. The OSULP already have sacrificed timely access to some titles in favor of an embargo period to cut costs.

Table 1. Engineering Science Journals

Subject Category	OSU Holdings	Total # of Journals	% of All Journals	High Impact Factor OSU Holdings	All High Impact Factor Journals	% of High Impact Factor Journals
Engineering, Multidisciplinary	54	85	64%	20	21	94%
Engineering, Electrical & Electronic	211	262	81%	65	66	99%
Engineering, Industrial	36	44	82%	11	11	100%
Engineering, Mechanical	81	130	62%	28	33	85%
Energy Systems	67	90	74%	22	23	98%
Total	**427**	**585**	**73%**	**138**	**146**	**94%**

Indexes and Databases

The core indexes to the relevant information for this program are shown in Table 2. The OSULP maintain access to these databases as they are core to a number of OSU's primary research and teaching areas.

Table 2: Indexes and Databases for Engineering Science

Databases	Publisher	Index Coverage	Full Text Coverage
Compendex	Elsevier	1969-Present	Index Only
Web of Science	Clarivate Analytics	1965-Present	Index Only
IEEE Xplore	IEEE	1951-Present	Includes journals, conference papers, books, and standards
ASME Digital Collection	ASME	1960-Present	Includes journals, conference papers, and books
ASTM Compass	ASTM	Present	Includes journals, research reports, and standards
SAE Digital Library	SAE	1998-present	Technical papers
Morgan & Claypool Synthesis Digital Library	Morgan & Claypool	2005-present	Short, authoritative e-books

Safari Books Online	Various	N/A	Technology e-books; titles can be requested by contacting the Engineering Librarian

Key library services & librarian expertise
Expertise at OSU-Cascades is covered by Sami Kerzei, who provides instruction as requested either in-class or via the web, responds to reference inquiries, and develops materials to assist faculty members and students in their research.

The liaison for the College of Engineering is Lindsay Marlow. Liaisons serve as the major contact for faculty, staff and students, monitor trends in curriculum and research, attend relevant college, departmental and program events to gain insight, and identify how OSULP expertise and resources can be most effectively used. They promote OSULP expertise and collaborate with the Expert Leads to integrate and leverage that expertise throughout the OSU Community. .

Providing access to items not owned by OSULP is the domain of the Interlibrary Loan and Summit staff both at OSULP and at lending libraries. Print articles located in the OSU Libraries' collections may be requested via the Scan and Deliver service, which provides PDFs of the requested articles.

Summary
Overall, OSU Libraries collections are adequate to support the proposed Engineering Science degree at Cascades campus. The addition of a subscription to ASM Handbooks Online is required to support the program. The cost of this would be shared with the Valley Library; Cascades share would be $1,275/year, with an estimated 5%/year inflation.

Respectfully submitted,

Laurel Kristick
Collection Assessment and Science Librarian
October 2, 2017

CHRISTOPHER L. HAGEN, PHD, PE

1500 SW CHANDLER AVENUE, BEND, OREGON 97702 TELEPHONE: 541-322-2061 EMAIL: CHRIS.HAGEN@OREGONSTATE.EDU

RESEARCH: Energy systems, advanced internal combustion engines, unconventional fuels, control systems, optical sensors, applied thermodynamics, and fluid mechanics.

EDUCATION:

PhD, Mechanical Engineering — **University of Wisconsin-Madison, 2006**
Minor: Control Systems — Madison, WI
Thesis topic: *Optical Measurements in Kinetically Controlled Combustion*

MS, Mechanical Engineering — **Colorado State University, 2002**
Emphasis: Energy Conversion — Fort Collins, CO

BS, Mechanical Engineering — **Valparaiso University, 1997**
Minor: Manufacturing Management — Valparaiso, IN

EXPERIENCE:

Associate Professor — **September 2017 – present**
Assistant Professor — **July 2012 – August 2017**
Oregon State University-Cascades — ***Bend, OR***

Founder and director of the OSU Energy Systems Laboratory. Lead a team of ~10 undergraduate, graduate, postdoctoral, and technician researchers investigating clean, novel energy conversion technologies while instructing energy systems engineering (ESE) students in the thermal-fluid sciences.

Assistant Research Professor — **March 2010 – July 2012**
Colorado State University — ***Fort Collins, CO***

Conducted experiments and educational activities with regard to advanced power generation systems. Pursuits included assessing the operability of unconventional fuels such as hydrotreated biofuels and biomass-derived low energy density gaseous fuels in combustion engines, field-testing feedback control systems for stationary engine emissions control, and developing optical sensors for both fuel quality monitoring and quantification of trace combustion emissions in the troposphere.

Lead Fuels Research Engineer — **December 2006 – March 2010**
Chevron Energy Technology Company — ***Richmond, CA***

Developed and implemented fuel research programs to evaluate unconventional fuel performance in high-efficiency gasoline and diesel engines. Technical and project manager of global programs with universities, national laboratories, contract laboratories, and industry partners.

Designed and constructed a >$2 million, 1000 SF single-cylinder-engine research facility with advanced emission characterization equipment capable of investigating the combustion performance of both bio- and petroleum-derived fuels.

Graduate Research Assistant — **August 2003 – December 2006**
University of Wisconsin Engine Research Center — ***Madison, WI***

Developed novel laser-based sensors for collecting chemical kinetic information in harsh environments; specifically, absorption-based microsecond-resolution temperature and species concentrations measurements in n-heptane and isooctane-fueled homogenous charge compression ignition (HCCI) engines.

Application Engineer — **February 2001 – August 2003**
Woodward Industrial Controls Inc. — ***Fort Collins, CO***

Responsible for fuel delivery system development and analysis. Activities included: fuel system design, fuel flow analysis, component selection, and flow calculations.

Oversaw control system development of 400kW miniturbine generator set located at Walter Aircraft Engines, Prague, Czech Republic.

Onsite control system engineer for 30 MW natural gas-fired turbine generator sets, Pratt & Whitney Power Systems, East Hartford, CT.

Engineer **December 1998 – December 2000**
Enginuity International Inc. ***Fort Collins, CO***
Primary test engineer for final engine set-up of large bore (> 35 cm) natural gas compression engine emissions reduction retrofit projects. Commissioned control systems with lean oxides of nitrogen (NO_x) reduction algorithms, high-pressure fuel injection systems, precombustion chambers, high-energy multistrike ignition systems, and upgraded turbochargers.

Graduate Research Assistant **May 1997 – December 1998**
Colorado State University Engines and Energy Conversion Lab. ***Fort Collins, CO***
Project manager on the Global Engines Laboratory online test cell, a web-based educational tool that allows the user to remotely run physical engine experiments. Project scope was three engine stands fueled with gasoline, diesel, and natural gas, respectively.

Co-op Engineer **May 1994 – August 1996**
Cincinnati Milacron Inc. ***Cincinnati, OH***
Assisted senior engineers with fabrication of a high-speed gantry mill for fuselage machining.

TEACHING AND ADVISING:

Courses Taught

ME 311 Introduction to Thermal and Fluid Sciences, 2015, 2014, 2013, 2012
ME 312 Thermodynamics, 2017, 2016, 2014, 2013
ME 331 Introductory Fluid Mechanics, 2012
ME 505 Combustion, Reading and Conference, 2014
ESE 499 Intermediate Thermodynamics, 2017
ME 540 Intermediate Thermodynamics, 2017, 2015
MECH 337 (CSU) Thermodynamics, 2012
MECH 417 (CSU) Control Systems, 2010
Guest Lecturer; MECH 661 (CSU) Int. Comb. Eng., ME 770 (U. of WI) Adv. Exp. Instr.

Research Faculty

Dr. Yibin Deng (12-month visiting prof., Wuhan U. of Tech., Wuhan, Hubei, China) 2016
Dr. Kyle Niemeyer, 2015

Post-Doctoral Researchers

Dr. David Wagner, 2016 – present
Dr. Shyam Menon, 2014 – 2016 (Asst. Prof. Louisiana State University)
Dr. Kyle Niemeyer, 2014 (Asst. Prof. Oregon State University)

Advisor, Graduate Students

PhDME Shane Daly
PhDME Zachary Taie
MSME Zoe Lavrich
MSME Khang Tran
MSME Sean Brown, 2017 (SpaceX)
MSME Shane Daly, 2105
MSME Robert Elgin III, 2014 (Intel)
MSME Matthew Boley (CSU, 2012)
PhDME Devin Yates (UC Berkeley Chevron Intern Supervisee, 2008)

Member, Graduate Committee

MSEE Kyle Hoover
MSME Matthew Hyder, 2017
MSME Aaron Fillo, 2017
MSME Kyle Zada, 2017
MSEE, David Barry, 2017 (graduate council representative)

MSEE Alex Louie, 2016 (graduate council representative)

PhDME Thomas Mosier, 2015
PhDME Ida Truedsson (Faculty Opponent, Lund University, Sweden, 2014)
MSME student Roshan Kochuparampil (CSU, 2013)

Advisor, Undergraduate Honors

BSME Sean Brown, 2015
BSME Torres Neuhoff (CSU, 2012)

Advisor, Undergraduate Assistants

BSESE Jon Young
BSESE Gertrude Villaverde
BSESE Lawandy Agsutinus, 2017
BSESE Claire Cushing, 2017
BSESE Zoe Lavrich, 2016
BSESE Raymond Kuhn, 2016
BSESE Ryan Heltemes, 2016
BSESE Walter Beckwith, 2015
BSESE James Malone, 2015
BSESE Nicholas Olson, 2015
BSESE Zachary Taie, 2014
BSESE Josh Tibbitts, 2014
BSESE Dustin Stewart, 2013
BSESE Megan Glenn, 2013

Advisor, Visiting Scholar

BS Physics, Margaret Lane

Advisor, Senior Design Practicum

Academic Year (AY) AY 20157, 2014, AY 2013, AY 2011 (CSU), AY 2010 (CSU)

JOURNAL PUBLICATIONS

1. Ganti, H., Menon, S.K., Niemeyer, K.,E., **Hagen, C.L.**, Effects of Oil and Water Contamination on the Operation of a Natural Gas Internal Combustion Engine, *Journal of Natural Gas Science and Engineering*, Volume 41, May 2017, Pages 30-39, ISSN 1875-5100, http://doi.org/10.1016/j.jngse.2017.02.038.
2. Deng, Y., Menon, S.K., Lavrich, Z., Wang, H., **Hagen, C.L.**, Design, Simulation, and Testing of a Novel Micro-Channel Heat Exchanger for Natural Gas Cooling in Automotive Applications, *Applied Thermal Engineering,* Volume 110, January 2017, Pages 327–334, *doi: 10.1016/j.applthermaleng.2016.08.193*.
3. Daly, S., Niemeyer, K.E., Cannella, W.J., **Hagen, C.L.**, Predicting Fuel Research Octane Number using Fourier-Transform Infrared Absorption Spectroscopy of Neat Hydrocarbons, accepted for publication by *Fuel*. Volume 183, 1 November 2016, Pages 359–365, *doi:10.1016/j.fuel.2016.06.097*
4. Daly, S.R., Olson, N. **Hagen, C.L.**, Fourier-Transform Infrared Absorption Spectroscopy in Binary Hydrocarbon-Alcohol Single Droplet Evaporation, *Journal of Spectroscopy*, vol. 2016, Article ID 3619634, 7 pages, 2016. doi:10.1155/2016/3619634.
5. Elgin, R.C., **Hagen, C.L.**, A Semi-Empirical CNG Tank Filling Model Created for a Novel Self-Refueling Vehicle System, *Proceedings of the Institution of Mechanical Engineers, Part D: Journal of Automobile Engineering*, published online, January 2016, doi: 10.1177/0954407015623409.
6. Malakoutirad, M., Bradley, T.H., **Hagen, C.L.**, Design Considerations for an Engine-Integral Reciprocating Natural Gas Compressor, *Applied Energy*, Volume 156, 2015, pp. 129-137, ISSN 0306-2619.
7. Elgin, R.C., **Hagen, C.L.**, Development and Operation of a Self-Refueling Compressed Natural Gas Vehicle, *Applied Energy*, Volume 155, 2015, pp. 242-252, ISSN 0306-2619.
8. Niemeyer, K.E., Daly, S.R., Cannella, W.J., **Hagen, C.L.**, Investigation of the LTC Fuel Performance Index for Oxygenated Reference Fuel Blends, *Fuel*, Volume 155, 2015, pp. 14-24.

9. Niemeyer, K.E., Daly, S R., Cannella, W.J., **Hagen, C.L.** A Novel Fuel Performance Index for LTC Engines Based on Operating Envelopes in Light-Duty Driving Cycle Simulations, *ASME Journal of Engineering for Gas Turbines and Power,* 2015, Volume 137, Issue 10 p.101601.
10. **Hagen, C.L.**, Lee, B.C., Franka, I.S., Rath, J.L., VandenBoer, T.C., Roberts, J.M., Brown, S.S., and Yalin, A.P., Cavity Ring-Down Spectroscopy Sensor for Detection of Hydrogen Chloride, *Atmospheric Measurement Techniques*, Volume 7, 2014, pp. 345–357.
11. Kranendonk, L.A., Caswell, A.W., **Hagen, C.L.**, Neuroth, C.T., Shouse, D.T., Gord, J.R., Sanders, S.T., Temperature Measurements in a Gas-Turbine-Combustor Sector Rig Using Swept-Wavelength Absorption Spectroscopy, *Journal of Propulsion and Power* 2009, Volume 25, Issue 4, pp. 859-863.
12. **Hagen, C.L.**, Sanders, S.T., Investigation of Multi-Species (H_2O_2 and H_2O) Sensing and Thermometry in an HCCI Engine by Wavelength-Agile Absorption Spectroscopy, *Measurement Science & Technology* 2007, Volume 18, Issue 7, 1992-1998.
13. **Hagen, C.L.**, Sanders, S.T., Toward Hyperspectral Sensing in Practical Devices: Measurements of Fuel, H_2O and Gas Temperature in a Metal Homogeneous Charge Compression Ignition Engine, *Journal of Near Infrared Spectroscopy,* Volume 15, Issue 4, 2007, pp. 217-225.
14. **Hagen, C.L.**, Schmidt, J.R., Sanders, S.T., Spectroscopic Sensing via Dual-Clad Optical Fiber, *IEEE Sensors Journal,* Volume 6, Issue 5, 2006, pp. 1227-1231.
15. **Hagen, C.L.**, Walewski, J.W., Sanders, S.T., Generation of a Continuum Extending to the Midinfrared by Pumping ZBLAN Fiber with an Ultrafast 1550-nm Source, *IEEE Photonics Technology Letters,* Volume28, Issues 1-4, 2006, pp. 91-93.
16. Walewski, J.W., Filipa, J.A., **Hagen, C.L.**, Sanders, S.T., Standard Single-Mode Fibers as Convenient Means for the Generation of Ultrafast High-Pulse-Energy Super-Continua, *Applied Physics B-Lasers and Optics* Volume 83, Issue 1, 2006, pp. 75-79.

PEER-REVIEWED CONFERENCE PROCEEDINGS

1. Menon, S.K., Ganti, H., **Hagen, C.L.**, Development and Testing of a Bimodal Internal Combustion Engine for a Self-Refueling Vehicle Application, *SAE 2016 World Congress,* Detroit, Michigan, USA, 2016; Volume 2016-01-1014. doi:10.4271/2016-01-1014
2. Menon, S.K., Weyer, K., Pedersen, D., **Hagen, C.L.**, Self-Regulating System for Natural Gas Cooling in a Bimodal Internal Combustion Engine, *Proceedings of the ASME Internal Combustion Engine Division Fall Technical Conference*, Houston, Texas, USA, 2015, Paper No. ICEF2015-1126, pp. V002T07A010. doi:10.1115/ICEF2015-1126.
3. Menon, S.K., Ganti, H., Wang, H., **Hagen, C.L.**, Development and Analysis of Micro-Channel Heat Exchangers for Natural Gas Cooling, *The 13th International Conference on Nanochannels, Microchannels, and Minichannels*, San Francisco, California, USA, 2015.
4. Elgin, R.C., Daly, S., **Hagen, C.L.**, Experimental Validation Towards a Self-Refueling CNG Vehicle to Provide Home Refueling, *SAE 2014 World Congress,* Detroit, Michigan, USA, 2014; Volume 2014-01-1343.
5. Echter, N.P., Weyer, K.M., Turner, C.W., Babbitt, G.R., **Hagen, C.L.,** Design and Analysis of a Self-Refueling CNG Vehicle to Provide Home Refueling, *SAE 2014 World Congress,* Detroit, Michigan, USA, 2014; Volume 2014-01-1341.
6. Boley, M., **Hagen, C.L.**, Simulation of Turbocharged Marine Diesel Engine for Electrical Power System Trainer, *ASME Internal Combustion Engine Division Spring Technical Conference*, ASME: Torino, Piemonte, Italy, May 2012.
7. Rath, J., Franka, I., Lee, B., **Hagen, C.L.**, Yalin, A., Cappelli, M., Electric Field Measurements in Gases Using Cavity Enhanced Polarimetry, *AIAA Aerospace Sciences Meeting*, AIAA: Nashville, TN, January 2012.
8. Zuehl, J.R., Ghandhi, J.B., **Hagen, C.L.**, Cannella, W.J., Fuel Effects on HCCI Combustion Using Negative Valve Overlap, *SAE 2010 World Congress*, Detroit, Michigan, USA, 2010; Volume 2010-01-0161.

9. **Hagen, C.L.**, Sanders, S.T., Application of a Novel White Laser Sensor to an HCCI Engine, *SAE 2006 World Congress*, Detroit, Michigan, USA, 2006, Volume 2006-01-1200.

CONFERENCE PROCEEDINGS, SELECTED PUBLICATIONS, & POSTERS

1. Lavrich, Z, Wagner, D.R., Taie, T., Halliday, D., **Hagen, C. L.**, Dehydrogenation Catalysis in Rotating Fluidized Beds, , American Chemical Society, Northwest Regional Meeting (NORM), June 2017, Corvallis, Oregon, USA, presentation.
2. Wagner, D.R., Lavrich, Z., Taie, Z., Halliday, D., **Hagen, C.L.**, "Partial Oxidation of Hydrocarbons in Novel Fluidized Bed Reactors," [Poster] The Combustion Institute, 10th U.S. National Meeting, 23-26 April 2017, College Park, Maryland, USA, poster.
3. Lavich, Z., Taie, Z., Menon, S.K., Beckwith, W., Daly, S.R., Halliday, D., **Hagen, C.L.**, Internal Combustion Engines as Fluidized Bed Reactors, *69th Annual Meeting of the APS Division of Fluid Dynamics,* Volume 61, Number 20, November 2016, Portland, Oregon, USA, presentation.
4. Taie, Z., Beckwith, W., **Hagen, C.L.**, First and Second Law Thermodynamic Analysis of a Natural Gas Fueled Residential Standby Generator, *Western States Section of the Combustion Institute, SpringTechnical Meeting*, Seattle, Washington, USA, 2016.
5. Menon, S.K., Taie, Z., **Hagen, C.L.**, Internal Combustion Engines as Chemical Reactors: Issues and Challenges, *Western States Section of the Combustion Institute, SpringTechnical Meeting*, Seattle, Washington, USA, 2016.
6. Brown, S.P., Menon, S.K., **Hagen, C.L.**, Investigation of Scaling Laws for Combustion Engine Performance, *Western States Section of the Combustion Institute, Fall Technical Meeting*, Provo, Utah, USA, 2015.
7. Menon, S.K., Ganti, H., Niemeyer, K.E., **Hagen, C.L.**, Effect of Natural Gas Conditions on Combustion Characteristics and Overall Performance of a Novel Bimodal Internal Combustion Engine, *9th U. S. National Combustion Meeting*, Cincinnati, Ohio, USA, 2015.
8. Brown, S.P., **Hagen, C.L.**, Testing and Analysis of 2-Stroke UAV Engines, *AIAA Region VI Student Conference*, Reno, Nevada, USA, 2015.
9. Taie, Z., Beckwith, W., **Hagen, C.L.**, Home Generator Benchmarking Program: Residential Natural Gas Fired Electrical Generator and MicroCHP, *ARPA-E Energy Summit*, Washington, District of Columbia, USA, 2015, poster.
10. Niemeyer, K., Daly, S., Cannella, W.J., **Hagen, C.L.**, A New Fuel Index for LTC Engines Based on Operating Envelopes in Light-Duty Driving Cycle Simulations, W1P084, *35th Symposium on Combustion*, San Francisco, California, USA, 2014, poster.
11. Taie, Z., **Hagen, C.L.**, Preventing Fuel Tank Oxygen Ingress for a Bimodal CNG Internal Combustion Engine, W1P134, *35th Symposium on Combustion*, San Francisco, California, USA, 2014, poster.
12. Olson, N., **Hagen, C.L.**, Quantified Measurement of Droplet Evaporation Rates of a Two Component Mixture, W3P021, *35th Symposium on Combustion*, San Francisco, California, USA, 2014, poster.
13. Niemeyer, K.E., Cannella, W.J., **Hagen, C.L.**, A New Fuel Index for LTC Engines Based on Operating Envelopes in Light-Duty Driving Cycle Simulations: Primary Reference Fuels, In *Western States Section of the Combustion Institute, Spring Technical Meeting*, Paper 14S-20, Pasadena, California, USA, 2014.
14. Elgin, R.C., Turner, C.W., **Hagen, C.L.**, Combustion Chamber Design Considerations for a Compression Ignition Engine to Spark Ignited Natural Gas Engine Conversion, *Western States Section of the Combustion Institute, Fall Technical Meeting*, Fort Collins, Colorado, USA, 2013.
15. **Hagen, C.L.**, NGV Self-Contained Home Filling Station, *ARPA-E MOVE Kickoff Meeting,* Washington, District of Columbia, December 2012.
16. Cannella, W.J. and **Hagen**, **C.L.**, Fuels and Advanced Combustion Technology Research Activities, Chevron *Global Downstream Technology Forum*, Lafayette, California, USA, 2008, poster.

17. **Hagen, C.L.**, Fundamentals of Transient Thermal-Light Absorption Spectroscopy and Application to Optical Sensing in HCCI Engines, University of Wisconsin-Madison, PhD Thesis, 2006.
18. **Hagen, C. L.**, Sanders, S.T., Multispecies Sensing with a Single Laser Source in HCCI Combustion, *31st Symposium on Combustion*, Heidelberg, Germany, 2006, poster.
19. Kranendonk, L.A. , Caswell, A.W., **Hagen, C.L.**, Gord, J.R., Fujimoto, J.G., Sanders, S.T., Broadband, High-Resolution Absorption Spectroscopy in Piston and Gas Turbine Engines, Shock Tubes, and Rocket Plumes, *31st Symposium on Combustion*, Heidelberg, Germany, 2006, poster.
20. Cherian, S., **Hagen, C.L.**, Kirkpatrick, A., Willson, B., The Global Engine Laboratory - Data Acquisition and Control Over the Internet, Proceedings, *9th Technology Based Engineering Education Consortium (TBEEC)*. Nashville, Tennessee, 1997.

MANUSCRIPTS IN REVIEW OR IN PREPARATION

1. Lavrich, Z., Taie, Z., Devin, H., **Hagen, C.L.**, Internal Combustion Engine as a Fluidized Bed Reactor, *2017 ASME ICEF. accepted*
2. Brown, S., Cushing, C., Menon, S., **Hagen, C.L.**, Development of a Small Engine Test Stand, *2017 ASME ICEF. Accepted*
3. Brown, S.P., Herron, T, Hagen, C.L., Generator Performance for UAV Hybrid Powertrains, IEEE Journal of Transactions on Mechatronics. *Submitted*

SERVICE TO THE PROFESSION

- NSF Review Panelist, 2017
- Session Organizer: 2017 Society of Automotive Engineers (SAE) World Congress, Detroit, Michigan, USA, April 4-6, Combustion in Gaseous-Fueled Engines
- Reviewer, Cyclotron Road applications
- Reviewer, NASA ASTAR Graduate Fellowships, 2016
- Reviewer, *Energy and Fuels*, 2016
- Session Organizer: 2016 SAE World Congress, Detroit, Michigan, USA, April 12 – 14, Combustion in Gaseous-Fueled Engines
- Reviewer, 2015, *Journal of Applied Thermal Engineering*
- Reviewer, 2015, *Journal of Natural Gas Science & Engineering*
- Executive Committee member, At-Large, Western States Section of Combustion Institute
- U.S. Department of Energy Merit Review Panel, Washington, D.C., USA, April, 2015.
- Session Organizer: 2015 SAE World Congress, Detroit, Michigan, USA, April 21 – 23, Combustion in Gaseous-Fueled Engines
- Reviewer, 2014, ASME Internal Combustion Engine Division Fall Technical Conference
- Session Organizer: 2014 SAE World Congress, Detroit, Michigan, USA, April 8 – 10, Compressed Natural Gas (CNG)/Dual-fuel CNG Engines
- Session Organizer: 2013 SAE World Congress, Detroit, Michigan, USA, April 16 – 18, Natural Gas Engines and Vehicles
- Reviewer, 2013, SAE International Powertrains, Fuels and Lubricants Meeting
- Reviewer, 2013, *International Journal of Energy*
- Reviewer (invited), 2013, Advanced Research Project Agency-Energy, Full Spectrum Optimized Conversion and Utilization of Sunlight (FOCUS) Full Applications
- Session Organizer: 2012 SAE International Powertrains, Fuels and Lubricants Meeting, Malmo, Sweden, September 18 – 20, Alternative and Advanced Fuels
- Session Organizer: 2012 SAE World Congress, Detroit, Michigan, USA, April 24 – 26, Fuel & Additive Effects on SI Engine Performance
- Session Organizer: 2010 SAE International Powertrains, Fuels and Lubricants Meeting, San Diego, California, USA, October 25-27, Alternative Fuels

- Session Organizer: 2009 SAE International Powertrains, Fuels and Lubricants Meeting, San Antonio, Texas, USA, November 2-4, Alternative Fuels
- Session Organizer: 2009 SAE International Powertrains, Fuels and Lubricants Meeting, Florence, Italy, June 15 – 17, Homogenous Charge Compression Ignition (HCCI), Variable Valve Actuation
- Reviewer: 2008 SAE International Powertrains, Fuels and Lubricants Meeting, Session: Alternative Fuels, Homogeneous Charge Compression Ignition Engines
- Reviewer: 2006 SAE World Congress, Session: Combustion and Flow Diagnostics
- Reviewer: 2006 SAE Small Engine Technology Conference
- Reviewer: Optics Communications Journal
- Reviewer: Measurement Science and Technology Journal

INVITED PRESENTATIONS

- Air Force research Laboratory, *Reciprocating Engines: UAV Hybrid-Electric Powertrain Development and Modular Chemical Reactor*, Dayton, Ohio, USA, July 7, 2017
- Frontiers in Science, Sisters Science Club, *Biofuels or Fossil Fuels*, Sisters, Oregon, USA, April 26, 2017
- Pacific Crest Middle School, *Engineering?*, Bend, Oregon, USA, April 21, 2017
- Association for Unmanned Vehicle Systems International Workshop Panelist/Presenter, *Unmanned Aircraft System Propulsion: Optimization, Technical Challenges and Future Directions*, Washington, District of Columbia, USA, October 14, 2015.
- Oak Ridge National Laboratory, *Paths toward Natural Gas for Transportation and Residential Power Generation*, Knoxville, Tennessee, USA, August 12, 2015.
- Oregon Public Radio Panelist, *Think Out Loud: The Impact of the OSU-Cascades Campus, Bend, Oregon*, USA, July 10, 2015.
- Lund University, Sweden, *Natural Gas for Transportation: Creating a Self-Refueling Vehicle*, Lund, Sweden, April 24, 2014.
- Professional Engineers of Oregon, Annual Meeting, *Energy Conversion Research with an Eye towards Internal Combustion Engines and Natural Gas*, Wilsonville, Oregon, USA, May 9, 2014.
- Oregon State University, Science Pub: *Natural Gas for Transportation*, Corvallis, Oregon, USA, April 14, 2014.
- University of Alaska-Fairbanks, Alaska Center for Energy and Power (ACEP), *Energy Conversion with an Eye towards Internal Combustion Engines and Natural Gas*, Fairbanks, Alaska, USA, December 2, 2013.
- Portland State University, Mechanical and Materials Engineering Department, *Energy Conversion with an Eye towards Internal Combustion Engines and Natural Gas*, Portland, Oregon, USA, November 8, 2013.
- Professional Engineers of Oregon, Central Chapter Meeting, *Natural Gas Vehicle Research at OSU-Cascades*, Bend, Oregon, USA, April 22, 2013.
- Oregon State University, Science Pub: *Energy Research, What About Natural Gas for Transportation?*, Bend, Oregon, USA, February 19, 2013
- MATHCOUNTS Middle School Students, *Engineering?*, Redmond, OR February 23, 2013.
- Rotary Club, Mt. Bachelor Chapter, *Energy Research, What About Natural Gas for Transportation?*, Bend, Oregon, USA, December 14, 2012.
- Bend Research Incorporated, *Energy Research Areas: Getting More Out of What We Have*, Bend, Oregon, USA, September 13, 2012.

SERVICE TO THE UNIVERSITY

- OSU-Cascades Associate Academic Dean search committee, 2017
- Energy Systems Engineering faculty search committee, 2017
- OSU School of Mechanical, Industrial, and Manufacturing Engineering (MIME) awards committee, 2017, 2016
- MIME Design faculty search committee, 2017
- OSU-Cascades Academic Dean search committee, 2016
- Energy Systems Engineering instructor search committee, 2015

- Graduate Council Representative, 2015, 2014, 2013
- Energy Systems Engineering Undergraduate Program Committee, 2016, 2015, 2014, 2013, 2012
- MIME School Head Search Committee, 2013
- MIME Thermal Fluid Science Faculty Search Committee, 2014, 2013
- Technical Advisor for OSU Advantage Accelerator Intern Program (student Sean Brown)

PROPOSALS AWARDED AS PRINCIPAL INVESTIGATOR

- 2017 Advanced Internal Combustion Engine Fuel Modeling and Testing Phase III, Energy Industry Sponsor, $100,000.
- 2017 Sandia National Laboratory Combustion Research Facility, $51,000.
- 2016 Energy System Engineering Graduate Student Fellowship, $51,000.
- 2016 Advanced Research Project Agency for Energy (ARPA-E) Innovative Development in Energy-Related Applied Science (IDEAS), Sponsor: U.S. Department of Energy, Award Number DE-AR0000681, $3,200,000 (Hagen share $600,000)
- 2015 M.J. Murdock Charitable Trust Commercialization Initiation Award, $60,000.
- 2015 Gap Grant, Sponsor: OSU Venture Development Fund, $60,000.
- 2015 NASA Graduate Aeronautics Scholarship, Advanced STEM Training and Research (ASTAR) Fellowship Program (student Sean Brown), $100,000.
- 2015 Advanced Internal Combustion Engine Fuel Modeling and Testing Phase II, Energy Industry Sponsor, $142,177.
- 2015 Oregon Metals Initiative & Hatch Product Development, $10,438.
- 2014 Gap Grant, Sponsor: Oregon Nanoscience and Microtechnologies Institute (ONAMI), $250,000.
- 2014 Gap Grant, Sponsor: Oregon Built Environment & Sustainable Technologies (BEST), $150,000.
- 2014 Advanced Research Project Agency for Energy (ARPA-E) Innovative Development in Energy-Related Applied Science (IDEAS), Sponsor: U.S. Department of Energy, Award Number DE-AR0000485, $500,000.
- 2013 Advanced Research Project Agency for Energy (ARPA-E) Methane Opportunities for Vehicular Energy (MOVE), Sponsor: U.S. Department of Energy, Award Number DE-AR0000259, budget increase, $299,900.
- 2013 Advanced Internal Combustion Engine Fuel Modeling and Testing, Energy Industry Sponsor, $202,710.
- 2013 Gap Grant, Sponsor: OSU Venture Development Fund, $25,000.
- 2013 Gap Grant, Sponsor: OSU Venture Development Fund, $12,000.
- 2012 Advanced Research Project Agency for Energy (ARPA-E) Methane Opportunities for Vehicular Energy (MOVE), Sponsor: U.S. Department of Energy, Award Number DE-AR0000259, $699,392.
- 2011 University Design Challenge, Sponsor: Air Force Office of Scientific Research, $60,000.
- 2010 Physics-Based Dynamic Model of Marine Based Power Generation Equipment, Sponsor: Woodward Inc., $71,000.
- 2009 Strategic Research proposal, topic confidential, Sponsor: Chevron Energy Technology Corporation, $170,000 per annum.
- 2009 Strategic Research proposal, topic confidential, Sponsor: Chevron Energy Technology Corporation, $80,000 per annum.
- 2004 Graduate Student author of "Dual-clad fiber optics for single-port absorption spectroscopy sensor," Sponsor: The Optoelectronics Industry Development Association through the Photonics Technology Access Program (PTAP), $33,000.

PATENTS

U.S. Patent No. 9,316,178, Hagen, C.L., G. Babbitt, C. Turner, N. Echter, K. Weyer-Geigel. "Internal Combustion Engine for Natural Gas Compressor Operation." April 19, 2016

U.S. Patent No. 9,528,465 Hagen, C.L., G. Babbitt, C., "Internal Combustion Engine for Natural Gas Compressor Operation." December 27, 2016,

PROFESSIONAL AWARDS, MEMBERSHIPS AND CERTIFICATIONS

SAE Ralph R. Teetor Faculty Award, 2017
OSU Faculty Innovator Award, 2016
OSU Excellence in Postdoctoral Mentoring Award, 2016
Popular Science Magazine's "12 New Faces of Energy," June, 2015
OSU-Cascades Scholarship & Creative Activity Award, 2015
Member, Society of Automotive Engineers (SAE)
Member, The Combustion Institute
Member, American Society of Mechanical Engineering (ASME)
Member, Institute for Electrical and Electronics Engineers (IEEE)
Professional Engineer, State of Colorado
Scholarship, Association of Energy Engineers (AEE), 1998

ENTREPRENEURSHIP

Founder and former CTO, Onboard Dynamics Incorporated, Bend, Oregon, Oct. 2013 – March 2015
CTO, Crystal Creek Energy, LLC, Fort Collins, Colorado, 2011-2012

Bahman Abbasi

Email: AbbasiB@oregonstate.edu
Phone: 541-706-2093
Website: http://mime.oregonstate.edu/people/abbasi

Biographical Summary

Dr. Bahman Abbasi joined Oregon State University in 2017 as an Assistant Professor of Mechanical, Industrial, and Manufacturing Engineering (Energy Systems Engineering). Before joining OSU he worked as a Lead Technologist at Booz Allen Hamilton and a Technical Advisor to US Department of Energy with wide-ranging experience in power generation systems, solar-thermal energy, high-temperature materials, light metals production and recycling, water-energy nexus, among other energy technologies. Prior to that he worked in various industries; including, natural gas pipes manufacturing, automotive, as well as a Lead Engineer at General Electric. He received his Ph.D. in Mechanical Engineering from the University of Maryland in 2010 with focus on phase-change phenomena and heat transfer, and has authored 20 technical publications including five issued patents.

Education

- **Ph.D. in Mechanical Engineering**, University of Maryland, College Park, MD (2008-2010)
  - Focus area: Multiphase flows, phase change phenomena
  - Dissertation title: "Pressure-based prediction of spray cooling heat transfer and critical heat flux"
  - Investigated the effect of spray characteristics on spray cooling heat transfer and developed a comprehensive pressure-based correlation to predict the single- and two-phase heat transfer coefficient and critical heat flux.

- **M.S. in Mechanical Engineering**, Southern Illinois University, Edwardsville, IL (2006-2007)
  - Focus area: Fluid mechanics, free surface flows
  - Thesis title: "Experimental and computational study of droplet and bubble formation"
  - Conducted high-speed photography and 3D numerical analysis to study droplet and bubble formation, growth, and detachment as a function of fluid properties and temperature.

- **M.S. in Automotive Engineering**, 2004-2006
  - Focus area: Internal combustion engines, reacting flows
  - Thesis title: "Numerical study of a fuel droplet behavior in a combustion chamber"
  - Developed KIVA- and Fluent-based codes to study fuel droplet deformation, evaporation, and combustion in a compression ignition engine.

- **B.S. in Mechanical Engineering**, 2000-2004
  - Focus area: Mechanical design, solid mechanics

Research Interests

- Energy-efficient and cost-effective water desalination/purification/reclamation systems for decentralized production using local surface or underground resources.
- Devise solutions to address reverse osmosis (RO) desalination systems' major hindrances (namely, tremendous capital and operating costs) by scaling down systems while maintaining efficiency.
- Fabricate alternative and more effective membranes and novel control systems as well as design hybrid and entirely new processes; integrate these with renewable energy sources.
- Conduct interdisciplinary research into ultra-high temperature materials and coatings (> 1500 ^{o}C) in oxidizing environments for various applications such as, hydrogen generation, solar fuels production, and thermal energy storage.
- Develop novel fabrication technologies for specialty materials and applications.

Previous Professional Experience

- **Lead Technologist**, Booz Allen Hamilton, Washington, DC (2013-2017)
  - Serve as Science, Engineering and Technology Advisor for the United States Department of Energy, Advanced Research Projects Agency – Energy (ARPA-E).
  - Contribute to identifying energy-related areas for conducting research and technology development projects and develop Funding Opportunity Announcements in those areas.
  - Benchmark technical state of the art and designated areas with transformational impact on domestic and global energy outlook.
  - Design technical and economic metrics to assure success in research project management of assigned program areas. Examples include light metals production (ARPA-E METALS program) and dispatchable solar electricity generation (ARPA-E FOCUS program).
  - Review numerous research proposals on a wide variety of topics to evaluate scientific and engineering soundness, economic viability, scale-up potential, and impact on US and global energy production and consumption.
  - Advise and support U.S. government officials in selecting, negotiating, and actively overseeing and managing dozens of multimillion dollar technology development projects in a variety of energy production, storage, and consumption subjects. Examples areas include:
    - Thermal storage technologies using molten salts, molten metals, or solid particles.
    - Solar fuel production in different cycles using ceria or perovskites as reactive material.
    - Combined solar electricity and storage systems in various configurations of dish, CPV, heat storage, and thermo-acoustic engines for power generation.
    - Super-critical CO_2 power cycle including rotor design and cold storage.
    - Light metals extraction from ore using various leaching, carbothermic, and electrochemical processes.
    - Light metals recycling with electromagnetic, XRF, or electrochemical methods.
    - Day- and night-time radiative cooling using photonic structures.

- **Lead Advanced Systems Engineer**, General Electric Appliances, Louisville, KY (2011-2013)
  - Designed, developed, and evaluated a model-based hybrid PID/optimal control system for household refrigerators to enhance thermal and humidity control as well as energy efficiency. Field testing completed over two years of operation without failure.

- Developed and experimentally verified a novel method for computer simulation of two-phase flows in capillary tubes in the absence of precise geometric information.
- Participated in the development of a prototype food identification system for household refrigerators using various image processing techniques.
- Led the design, development, and fabrication of a state of the art research laboratory, equipped with various thermal-fluid measurement instruments as well as an advanced LabVIEW data acquisition system.
- Obtained five U.S. patents and published a number of technical papers on various control strategies for household refrigerators and object identification methods.

Publications

Journal Articles and Patents

- Bahman Abbasi, Keith Wait, "Enthalpy based control for a refrigeration appliance," Patent number: US20140230464, 2014.
- Bahman Abbasi, Keith Wait, "Refrigerator control system and method," Patent number: US20140165632, 2014.
- Keith Wait, Brent Junge, Bahman Abbasi, "Control system for a dual evaporator refrigeration system," Patent number: US20140260409, 2014.
- Michael Kempiak, Erik Hitzelberger, Bahman Abbasi, "Method for viewing contents of a refrigerator appliance," Patent number: US20140168396, 2014.
- Keith Wait, Brent Junge, Bahman Abbasi, "Dual evaporator refrigerator appliance and method of operating the same," Patent number: WO2014163831 A1, 2013.
- Bahman Abbasi, "Prediction of Capillary Tube Adiabatic Flow Properties in the Absence of Precise Geometric Information," Journal of Fluids Engineering, vol. 135, pp. 091102, 2013.
- Bahman Abbasi, Jungho Kim, "Prediction of Two-Phase Heat Transfer and Critical Heat Flux for PF-5060 Sprays," Journal of Heat Transfer, vol. 133, pp. 101504, 2011.
- Bahman Abbasi, Jungho Kim, "Development of a General Dynamic Pressure-Based Single-Phase Spray Cooling Heat Transfer Correlation," Journal of Heat Transfer, vol. 133, pp. 052201-1 – 052201-10, 2011.
- Bahman Abbasi, Jungho Kim, Andre Marshall, "Dynamic Pressure-Based Prediction of Spray Cooling Heat Transfer Coefficient," International Journal of Multiphase Flow, vol. 36, pp. 491-502, 2010 (26 citations).
- Majid Molki, Bahman Abbasi, "Effect of Temperature on the Vorticity Field of an Evolving Water Droplet," International Journal of Heat and Mass Transfer, vol. 53, pp. 18-28, 2010.

Conference Papers

- Keith Wait, Bahman Abbasi, Michael Kempiak, "Fast, High-Fidelity Simulation of Dynamic Thermo-Fluid States in Refrigeration Systems," ASME Dynamic Systems and Control Conference, 2013.
- Bahman Abbasi, "Circumventing Imprecise Geometric Information and Development of a Unified Modeling Technique for Various Flow Regimes in Capillary Tubes," American Physical Society, 65th Annual Fall Division of Fluid Dynamics Meeting, November 18-20 2012, San Diego, California.

- Bahman Abbasi, Keith Wait, Michael Kempiak, "A Sealed System and Compressor Model for Optimal Control of Household Refrigerators," International Mechanical Engineering Conference and Exposition, November 9-15 2012, Houston,.
- Bahman Abbasi, Michael Kempiak, Brent Junge, "Development of a Hybrid Empirical-Analytical Method to Predict Adiabatic Flow Properties in Capillary Tubes," ASME 2012 Fluid Engineering Summer Meeting, July 8-12 2012, Rio Grande, Puerto Rico.
- Bahman Abbasi, Jungho Kim, "Pressure-Based Prediction of Single Phase Spray Cooling Heat Transfer Coefficient for Low Prandtl Number Fluids," 14th International Heat Transfer Conference, August 8-13 2010, Washington, DC.
- Bahman Abbasi, Jungho Kim, "Effect of Spray Characteristics on Spray Cooling Heat Transfer and Critical Heat Flux," International Conference on Multiphase Flow, May 30-June 4 2010, Tampa, Florida.
- Majid Molki, Bahman Abbasi, "Experimental and Numerical Investigation of Droplet Growth and Detachment near the Inception Point," International Mechanical Engineering Conference and Exposition, November 11-15 2007, Seattle, Washington.
- Majid Molki, Bahman Abbasi, "Thermal Wake of a Single Rising Air Bubble in a Large Body of Stagnant Liquid," International Mechanical Engineering Conference and Exposition, November 11-15 2007, Seattle, Washington.
- Bahman Abbasi, Reza Ebrahimi, "Numerical Modeling and Investigation of Candle Flame under Different Ambient pressures," The First Combustion Conference in Iran, 2006.

Other Qualifications and Experiences

Industrial Experience

- Worked as a Mechanical Engineer in automotive and manufacturing industries (2002-2006).
- Collaborated with Garneu Industries Ltd. (a Canadian firm) to install and commission a three-layer coating plant for natural gas transmission pipes.
- Conducted detailed studies on the technological requirements and business and environmental impacts of using CNG as transportation fuel in the Middle East.
- Designed parts and components for a variety of application; including, various support structures in manufacturing plants (trusses, catwalks, etc), polyethylene extruder parts, and conveyor belts (for cement production industry).

Professional Memberships

- American Society of Mechanical Engineers
- The Minerals, Metals, and Materials Society

Training and Certificates

- Booz Allen Hamilton: Several training programs in engineering management and consulting.
- General Electric: Six Sigma and multiple other technical and non-technical training programs.
- MathWorks: Matlab, Simulink, Simscape.
- National Instruments: LabVIEW core courses 1, 2, and 3.

Kyle Webb – Curriculum Vita
Instructor, Energy Systems Engineering
Oregon State University - Cascades
Tykeson Hall 318
1500 SW Chandler Ave
Bend, OR 97702
(541) 322-3134

A. EDUCATION AND EMPLOYMENT INFORMATION

Education:

2013	University of Colorado Ph.D. Electrical Engineering
2005	Oregon State University M.S. Electrical Engineering
1998	Dartmouth College – Thayer School of Engineering B.E. Electrical Engineering
1997	Dartmouth College A.B. Engineering

Employment:

2015 to present	Instructor, Energy Systems Engineering OSU-Cascades Bend, OR
2012-2015	Instructor, Department of Mechanical and Aerospace Engineering University of Colorado Colorado Springs Colorado Springs, CO
2009-2012	Lecturer, Department of Mechanical and Aerospace Engineering University of Colorado Colorado Springs Colorado Springs, CO
1999-2009	R&D Engineer Agilent Technologies Colorado Springs, CO
1998-1999	R&D Engineer Hewlett-Packard Company Colorado Springs, CO

B. TEACHING, ADVISING, AND OTHER ASSIGNMENTS

1. Instructional Summary

Term	Institution	Course	Course Title	Enrollment
S17	OSU-C	ENGR 202	Electrical Fundamentals II	17
S17	OSU-C	ENGR 202	Electrical Fundamentals II – Laboratory	17
S17	OSU-C	ENGR 112	Introduction to Engineering Computing	8
W17	OSU-C	ESE 498	Capstone Design	28
W17	OSU-C	ESE471	Energy Storage Systems	21
W17	OSU-C	ENGR 201	Electrical Fundamentals I	7
W17	OSU-C	ENGR 201	Electrical Fundamentals I – Laboratory	7
F16	OSU-C	ESE 497	Capstone Design	28
F16	OSU-C	ESE 470	Energy Distribution Systems	25
S16	OSU-C	ESE 499	Feedback Control Systems	20
W16	OSU-C	ESE 471	Energy Storage Systems	26
W16	OSU-C	ESE 498	Capstone Design	24
F15	OSU-C	ESE 497	Capstone Design	24
F15	OSU-C	ESE 470	Energy Distribution Systems	26
F15	OSU-C	MIME 101	Introduction to MIME	14
S15	UCCS	MAE 3055	MechEtronics II	48
S15	UCCS	MAE 3055	MechEtronics II – Laboratory	48
S15	UCCS	MAE 4020/5020	Numerical Methods with MATLAB	17
S15	UCCS	MAE 4421	Control of Aerospace and Mechanical Systems	35
F14	UCCS	CS 1090	Introduction to Programming Using MATLAB	35
F14	UCCS	MAE 3055	MechEtronics II	48
F14	UCCS	MAE 3055	MechEtronics II – Laboratory	48
F14	UCCS	MAE 3401	Modeling and Simulation of Dynamic Systems (Honors)	12
S14	UCCS	MAE 2055	MechEtronics I – Laboratory	48
S14	UCCS	MAE 3055	MechEtronics II	45
S14	UCCS	MAE 3055	MechEtronics II – Laboratory	45
S14	UCCS	MAE 3401	Modeling and Simulation of Dynamic Systems	40
S14	UCCS	MAE 4020/5020	Numerical Methods with MATLAB	23
F13	UCCS	MAE 2055	MechEtronics I	48
F13	UCCS	MAE 2055	MechEtronics I – Laboratory	48
F13	UCCS	MAE 3055	MechEtronics II	25
F13	UCCS	MAE 3055	MechEtronics II – Laboratory	25
S13	UCCS	MAE 2055	MechEtronics I	24
S13	UCCS	MAE 3055	MechEtronics II	7
S13	UCCS	MAE 3020	Numerical Methods with MATLAB	10
F12	UCCS	MAE 2055	MechEtronics I	24
F12	UCCS	MAE 3055	MechEtronics II	9
S12	UCCS	MAE 2055	MechEtronics I	23
S12	UCCS	ECE 3240	Electronics Laboratory II	20
F11	UCCS	MAE 3055	MechEtronics II	13
F11	UCCS	ECE 3230	Electronics Laboratory I	24
S11	UCCS	MAE 2055	MechEtronics I	25
F10	UCCS	MAE 2055	MechEtronics I	36
S10	UCCS	MAE 2055	MechEtronics I	24
F09	UCCS	MAE 1502	Principles of Engineering	21
F09	UCCS	MAE 1502	Principles of Engineering	20

2. Student Evaluations of Teaching (OSU-C courses only):

Term	Course	Q1		Q2		N
		Course Median	Dept. Median	Course Median	Dept. Median	
S17	ENGR 202	5.0	4.8	5.9	4.9	10/17
W17	ESE 498	5.3	4.8	5.6	4.9	19/28
W17	ESE 471	5.0	4.8	5.2	4.9	14/21
W17	ENGR 201	5.8	4.2	6.0	4.3	3/7
F16	ESE 497	4.9	4.6	5.2	4.8	24/28
F16	ESE 470	5.1	4.6	5.7	4.8	21/25
S16	ESE 499	5.0	4.7	5.6	4.9	15/20
W16	ESE 471	5.0	4.6	5.3	4.8	15/27
W16	ESE 498	5.1	4.6	5.6	4.8	13/24
F15	MIME 101	5.5	4.5	5.5	4.7	7/14
F15	ESE 470	4.5	4.5	4.8	4.7	18/26
F15	ESE 497	-	-	-	-	0/24

C. SCHOLARSHIP AND CREATIVE ACTIVITY

1. Publications:

Thomas R. Amundson, Kyle M. Webb, Rebecca N. Webb, Numerical power output predictions for low-bandgap thermophotovoltaic cells coupled with a latent-heat energy storage system, Journal of Energy Storage, Volume 6, May 2016, Pages 204-212, ISSN 2352-152X.

Kyle M. Webb, T.S. Kalkur, Compensation of self-heating-induced timing errors in bipolar comparators, Microelectronics Journal, Volume 47, January 2016, Pages 31-39, ISSN 0026-2692.

Webb, K.M.; Kalkur, T.S., "A Circuit-Based Approach for the Compensation of Self-Heating-Induced Timing Errors in Bipolar Comparators," *Bipolar/BiCMOS Circuits and Technology Meeting (BCTM), 2012 IEEE*, pp.1-4, Sept. 30 2012-Oct. 3 2012.

Webb, K.; Song H., “Compensation Scheme of a 50Ω Bond Wire Interconnect Using Time-Domain Reflectometry,” Journal of Microelectronics and Electronic Packaging, Vol. 8, No. 3, 2011.

D. SERVICE

1. University Service

OSU-Cascades

Winter 2017	PROT Committee – Matt Orr
Winter 2017	Search Committee – ESE Assistant/Associate Professor
2016 -	Experiential Learning/Undergraduate Research Committee
2016 -	Honors College/Baccalaureate Core Committee
Spring 2016	Search Committee – Mathematics Instructor
Winter 2016	PROT Committee – Susan McMahon
2015 - 2017	Long-Range Development Planning Committee
2015 - 2017	LRDP Committee – Sustainability Advisory Group
Fall 2015	PROT Committee – Todd Montgomery

UCCS

2014-2015	UCCS Green Action Fund – Faculty Advisor
2014-2015	UCCS Sustainability Committee
Fall 2014	MAE Instructor Search Committee
Fall 2013	MAE Instructor Search Committee – Chair
2012-2014	MAE Course Scheduling Coordinator
2012-2014	SAE Baja Club - Advisor
2012-2014	MAE Laboratory Committee - Chair

E. AWARDS

2014	UCCS Outstanding Instructor Award
2014	College of Engineering and Applied Science Teacher of the Year
2012	College of Engineering and Applied Science Lecturer of the Year

Rebecca Webb – Curriculum Vita
Instructor, Energy Systems Engineering
Oregon State University - Cascades
Tykeson Hall 316
1500 SW Chandler Ave
Bend, OR 97702
(541) 322-3167

A. EDUCATION AND EMPLOYMENT INFORMATION

Education:

2005	Oregon State University Ph.D. Mechanical Engineering
2000	Pennsylvania State University M.S. Mechanical Engineering
1998	University of Rhode Island B.S. Mechanical Engineering

Employment:

2016 to present	Program Lead and Instructor, Energy Systems Engineering OSU-Cascades Bend, OR
2014-2016	Associate Professor, Department of Mechanical &Aerospace Engineering University of Colorado Colorado Springs Colorado Springs, CO
2007-2014	Assistant Professor, Department of Mechanical & Aerospace Engineering University of Colorado Colorado Springs Colorado Springs, CO
2006-2007	Senior Engineer Directed Energy Solutions Colorado Springs, CO
2000-2002	R&D Engineer Agilent Technologies Colorado Springs, CO

B. TEACHING, ADVISING, AND OTHER ASSIGNMENTS

1. Instructional Summary

Term	Institution	Course	Course Title	Enrollment
F17	OSU-C	ENGR 211	Statics	4
F17	OSU-C	ME 311	Intro to Thermal-Fluid Sciences	26
F17	OSU-C	ENGR 407	MECOP Seminar	6
F17	OSU-C	ESE 497	Capstone Design	28
S17	OSU-C	ESE 360	Energy Consumption Analysis	33
W17	OSU-C	ME 332	Heat Transfer	23
W17	OSU-C	ESE 498	Capstone Design	28
F16	OSU-C	ENGR 211	Statics	3
F16	OSU-C	ME 311	Intro to Thermal-Fluid Sciences	35
F16	OSU-C	ESE 497	Capstone Design	28
S16	OSU-C	PH 211	Physics I	7
W16	OSU-C	ESE 360	Energy Consumption Analysis	36
W16	OSU-C	ME 332	Heat Transfer	32
S15	UCCS	MAE 3130	Fluid Mechanics	10
S15	UCCS	MAE 4511	Engineering Design II	13
F14	UCCS	MAE 3310	Heat Transfer	41
F14	UCCS	MAE 4510	Engineering Design I	13
S14	UCCS	MAE 3130	Fluid Mechanics	12
S14	UCCS	MAE 3310	Heat Transfer	20
F13	UCCS	MAE 4130	Intermediate Fluid Mechanics	14
F13	UCCS	MAE 9510	Radiative Heat Transfer	10
S13	UCCS	MAE 5130	Incompressible flow	14
F12	UCCS	MAE 5131	Computational Fluid Dynamics	16
F12	UCCS	MAE 3310	Heat and Mass Transfer	36
S12	UCCS	MAE 3130	Fluid Mechanics	13
S12	UCCS	MAE2301	Engineering Thermodynamics I	35
F11	UCCS	MAE 3310	Heat and Mass Transfer	15
F11	UCCS	MAE 4130	Intermediate Fluid Mechanics	17
S11	UCCS	MAE 5131	Computational Fluid Dynamics	39
S11	UCCS	MAE 3310	Heat and Mass Transfer	28
F10	UCCS	MAE 3130	Fluid Mechanics	20
F10	UCCS	MAE 4130	Intermediate Fluid Mechanics	19
SU10	UCCS	MAE 5131	Computational Fluid Dynamics	16
S10	UCCS	MAE 3310	Heat and Mass Transfer	17
S10	UCCS	MAE 5130	Incompressible Flow	9
F09	UCCS	MAE 4130	Intermediate Fluid Mechanics	16
F09	UCCS	MAE 3130	Fluid Mechanics	26
S09	UCCS	MAE 3310	Heat and Mass Transfer	21
F08	UCCS	MAE 4130	Intermediate Fluid Mechanics	19
F08	UCCS	MAE 3010	Mechanical Engineering Laboratory	36
S08	UCCS	MAE 3310	Heat and Mass Transfer	37
F07	UCCS	MAE 3010	Mechanical Engineering Laboratory	39
F07	UCCS	MAE 1502	Principles of Engineering	23

2. Student Evaluations of Teaching (OSU-C courses only):

Term	Course	Q1		Q2		N
		Course Median	Dept. Median	Course Median	Dept. Median	
S17	ESE 360	4.2	4.8	5.0	5.0	26/33
W17	ME 332	5.6	4.8	5.8	4.9	18/23
W17	ESE 498	5.3	4.8	5.6	4.9	19/28
F16	ENGR 211	*				
F16	ME 311	5.3	4.6	5.5	4.8	25/35
F16	ESE 497	5.0	4.6	5.1	4.8	23/28
S16	PH 211	5.3	4.6	5.7	4.9	5/7
W16	ESE 360	4.5	4.6	5.2	4.8	29/36
W16	ME 332	5.7	4.6	6.0	4.8	20/32

C. SCHOLARSHIP AND CREATIVE ACTIVITY

1. Publications:

Amundson, T.R., Webb, K.M., Webb, R.N., Numerical power output predictions for low-bandgap thermophotovoltaic cells coupled with a latent-heat energy storage system, Journal of Energy Storage, Volume 6, May 2016, Pages 204-212, ISSN 2352-152X.

Amundson, T.R. and Webb, R.N., 2015, "Numerical Radiation Exchange in a Rectangular Microchannel Using the Monte Carlo Method," Proceedings of the ASME Power and Energy Conference in San Diego, CA.

Reid, M.R., Saleem, F.M., Scharfe, D. B., and Webb, R.N., 2013, "Preheating a Cold Gas Thruster Flow through a Thermal Energy Storage Conversion System," Journal of Propulsion and Power, 29 (6), pp. 1488 – 1492.

Reid, M.R., Scharfe, D.B., and Webb, R.N., 2013, "Computational Evaluation of a Latent Heat Energy Storage System," Solar Energy, 95, pp. 99 – 105.

Horvath, J.A. and Webb, R.N., 2013, "Experimental Study of Radiation Absorption by Minichannels of Varying Geometry," Experimental Thermal and Fluid Science, 44, pp. 631 - 636.

Gould, D.W., Hoff, B.W., Young, M.P., Webb, R.N., 2013, "Numerical Analysis of a Single Minichannel Within a High-Temperature Hydrogen Heat Exchanger for Beamed Energy Propulsion Applications," Proc. ASME 2013 Summer Heat Transfer Conference in Minneapolis, MN.

Amundson, T.R., Scharfe, D.B., and Webb, R.N., 2013, "Computational Evaluation of the Effects of Voids on a Thermal Energy Storage System Using Molten Silicon As the Phase Change Material," Proc. ASME 2013 Summer Heat Transfer Conference in Minneapolis, MN.

Reid, M.R., Webb, R.N., and Lilly, T.C., 2012, "Computational Evaluation of Latent Heat Energy Storage System Using a High Temperature Phase Change Material', Proceedings of the 6th International Conference on Energy Sustainability, San Diego, CA.

Bosworth, R.W., Ventura, A.L., Webb, R.N., Young, M.P., Ketsdever, A.D, Gimelshein, N.E, and Gimelshein, S.F., 2012, "Thermal Modeling and Performance Measurements of Radiometric Arrays for Near Space Propulsion", Proceedings for the 43rd AIAA Thermophysics Conference, New Orleans, LA.

Ventura, A., Ketsdever, A., Webb, R., Alexeenko, A., Gimelshein, N., and Gimelshein, S., 2012, "Repulsion and Attraction Caused By Radiometric Forces", Proceedings of the 28th International Symposium on Rarified Gas Dynamics, Zaragoza, Spain.

Horvath, J.A. and Webb, R.N., 2011, "Experimental Study of Radiation Absorption by Microchannels of Varying Aspect Ratios," Solar Energy, 85(5), pp. 1035 - 1040.

Horvath, J.A., Boartfield, A.G., and Webb, R.N., 2011, "Enhanced Heat Collection Element Performance Through Surface Geometry", Proceedings of the 5th International Conference on Energy Sustainability, Washington, D.C.

Webb, R., 2008, "Liquid Nitrogen Flow Boiling in a Parallel Microchannel Array", Proceedings from the ECI International Conference on Heat Transfer and Fluid Flow in Microscale, Whistler, B.C.

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SERVICE

1. University Service

OSU-Cascades

2016 –	Program Lead Committee
2016 –	ABET data collection and analysis
2017 – 2018	Search committee chair – CS Assistant Professor
2017 – 2018	Search committee – Associate Dean
2017 – 2018	Search committee – Physics Instructor
2016 – 2017	Search committee chair – ESE Assistant Professor
2016 – 2017	Search committee – Physics Instructor
2016 – 2017	Search committee – Computer Science Instructor
2016 – 2017	Program Expansion Committee
2016 – 2017	Campus Culture Committee
2016 – 2017	Purchased all physics equipment and did lab set up for PHY 211, 212, 213

UCCS

2014 – 2015	Sustainability Committee
2014 – 2015	Undergraduate Research Committee
Fall 2014	MAE Primary Unit Committee, Chair
2013 – 2015	MAE Honors Program development
2012 – 2015	MAE Executive Committee
2012 – 2015	Founder and director of campus-wide Undergraduate Research Academy
2012 – 2014	MAE Workload Policy Committee
2010 – 2015	Faculty Assembly
2010 – 2015	MATLAB License Review Committee
2010 – 2011	Society of Women Engineers, Faculty Advisor
2009 – 2014	Society of Automotive Engineers Baja Team, Faculty Advisor
2008 – 2010	MAE Website Maintenance
2007 – 2015	MAE Search Committees
2007 – 2014	Faculty Assembly Women's Committee
2007 – 2012	MAE Graduate Committee, Chair
2007 – 2012	MOSAIC Mentor
2007 – 2009	MAE Lab Committee

D. AWARDS

2014	UCCS Million Dollar Club
2014	UCCS Outstanding Teacher Award
2012	College of Engineering and Applied Science Researcher of the Year
2009	College of Engineering and Applied Science Teacher of the Year

Oregon State University
Cascades

OSU-Cascades
1500 SW Chandler Ave.
Bend, Oregon 97702

OSUcascades.edu

3/9/2018

Dr. Rebecca Webb
Program Lead & Instructor, Energy Systems Engineering
1500 SW Chandler Avenue
Oregon State University - Cascades
Bend, OR 97702

Dear Becca,

Thank you for the opportunity to review the College of Engineering's proposal to provide a Bachelor of Science in Engineering Science at the Oregon State University-Cascades campus. Per my review of the documentation provided and discussed, I understand that the program has some redundancy will current program offerings but will require additional space to accommodate new faculty and instructional labs that are not currently available.

I am assuming that courses listed in the proposal can be accommodated in the currently available classrooms through growth in seat capacity utilization or increased scheduled room utilization. The application indicates the Engineering Science program will temporarily lease shop space to support any machine shop required course work until construction of the STEAM-focused Academic Building 2 is completed in 2021. Space programming for engineering labs has been identified for the new facility. I would advise a review of space needs occur for this program to ensure the new facilities will meet anticipated growth needs for the program as the OSU-Cascades campus expands.

Given that your proposal outlines an initial strategy for accommodating the program fully through on-campus facilities and off-campus leased facilities, current space needs should not be impacted by the College of Engineering's request and OSU-Cascades Planning and Design supports this proposal.

Sincerely,

Jane M. Barker

Jane M. Barker
Sr. Project Manager for Campus Expansion
Oregon State University-Cascades

This assessment plan and report template has multiple tabs. Be sure to open your window wide enough to see the tabs.

What this assessment plan and report are asking for:

>>> This report is asking for a clear, succinct accounting of full-cycle assessment activities for each degree program. This means the program needs to engage in and report the following:

>> Each degree program must have **clear, measurable student learning outcomes** that represent the knowledge, skills, and values a graduating student will possess.

> The outcomes need to be meaningful to the faculty and other professionals in the field and represent what OSU students need to succeed and be valued in the field.

> The outcomes will likely have sub-components that help further define the outcome. If you develop sub-components, those can be submitted as an attachment to the report. For this report you can just list the primary outcome.

>> Each year one or more of the program outcomes must be in some stage of the assessment cycle (data collection, review/consideration of the data, implementation of changes as a result of the data) such that **ALL outcomes have been assessed and reported in a period of 5 years**.

> A plan must be in place to measure all outcomes within 5 years. A plan is built into this annual assessment report under questions 3.c. and 5. Separate, detailed plans are encouraged.

> A cycle of fewer than 5 years is fine. If the program has fewer than 5 outcomes, it will be on a shorter cycle (e.g. 4 outcomes = 4 or fewer years).

> If the program has >10 different outcomes and needs a longer cycle, please contact the APAA to develop an alternative plan. We are glad to work with you.

> If programs are in the developmental phases for program-level assessment and/or have new learning outcomes, start with assessing FEWER outcomes and ASSESS THEM WELL! Please communicate with the APAA if this is the case or if you want some help with designing an efficient assessment plan.

>> Each outcome must have **at least one direct measure** identified and aligned to it, but more than one measure is best practice and far more reliable.

> Indirect measures can be used to support or triangulate the data from the direct measures.

> In some cases indirect measures are the primary means of data collection. This is the exception rather than the rule. If indirect measures are the sole source of data, then please provide an explanation for its selection.

>> Use the student learning data to **inform programmatic decision-making** to maximize student learning and improve the strength, effectiveness, and efficiency of the program.

> You will be asked to describe the process your unit uses/d to reflect upon the data, how results of assessment efforts relate to strategic planning, and plans for any course, curricular, or unit level changes based upon the data.

Why are we asking for this?

>>> The number one reason we are asking for this information is to ensure the **use of evidence and data to inform curricula and pedagogy**.

>> Just as in our scholarly and creative work, evidence and data are essential supplements to the professional competence and commitment that we dedicate to our students.

>> Additional reasons, which should be compelling to educators and members of the academic community, are that we owe it to the the students and we must demonstrate genuine, full cycle assessment to our accrediting body, the NWCCU. Remember, accreditation is voluntary but necessary.

How the annual report submission and the associated tracking and submission process works:

>>> By switching to an Excel spreadsheet format your program can **report multiple years of data in one document**. Just use a new tab for a new year and label the tab.

>>> Submit reports to the APAA Sharepoint website: https://sharepoint.oregonstate.edu/sites/APAA/assessment/default.aspx

>> **Instructions can be found at: http://oregonstate.edu/admin/aa/apaa/assessment-resources**

Template was updated by Tam Belknap, 3/13/2018. Developed by Stefani Dawn, PhD, Assistant Director of Assessment, 2013-15

Feel free to send question, comments, or suggestion to tamara.belknap@oregonstateuniversity.edu, 541-737-2171

ENGINEERING SCIENCE (ESC)	an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	an ability to communicate effectively with a range of audiences	an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	an ability to acquire and apply new knowledge as needed, using appropriate learning strategies
	1	2	3	4	5	6	7
Required ESC Course	**"X" = course includes Learning Outcome(s) that directly support the associated Student Outcome**						
ESC 111 - Intro to Engineering			x	x	x		
ENGR 201 - Electrical Fundamentals I							
ENGR 211 - Statics							
ENGR 212 - Dynamics							
ENGR 202 - Electrical Fundamentals II	x	x					x
ENGR 212 - Dynamics							
ENGR 248 - Engineering Graphics - 3-D Modeling							
ENGR 203 - Electrical Fundamentals III							
ECE 271 - Digital Logic Design							
ECE 272 - Digital Logic Design Laboratory							
IE 425 - Industrial Systems Optimization							
ME 311 - Introduction to Thermal-Fluid Sciences		x		x			x
ECE 322 - Electronics I							
IE 415 - Simulation and Decision Support Systems							
ESE 330 - Modeling & Analysis of Dynamic Systems							
ESC 340 - Introduction to Experimentation				x		x	x
ESC 350 - Engineering Materials							
ME 331 - Introductory Fluid Mechanics							
ESE 430 - Feedback Control Systems							
ESE 470 - Energy Distribution Systems							
IE 471 - Project Management for Engineers							
ESC 440 - Computational Methods for Engineers	x		x			x	
ENGR 390 - Engineering Economy							
ESC 497 - ESC Capstone Design	x		x		x		
ESE 498 - ESC Capstone Design		x		x		x	

Program Information

Program:	Engineering Science	**Associated Minors:**
College or Administrative Division:	College of Engineering	
Subunit(s):		

How will you communicate program level student learning outcomes to the students and the public? (include web link)

Our student outcomes and our program educational objectives will be posted on the OSU Cascades website (https://osucascades.edu/academics)

Program Learning Outcomes, Benchmarks and Measures

Outcomes: List your program level student learning (SLO) outcome(s) . (Please indicate if outcome is for specific minor only)	1. an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics	2. an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors	3. an ability to communicate effectively with a range of audiences	4. an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts	5. an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives	6. an ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions	7. an ability to acquire and apply new knowledge as needed, using appropriate learning strategies.
Year was this outcome developed or most recently changed?	2019	2019	2019	2019	2019	2019	2019
Next year will you be reporting on this outcome?	Annually	Annually	Annually	Annually	Annually	Annually	Annually
Assessment Method: List the measures/methods /instruments used to assess the outcome. How do students demonstrate their attainment of this outcome and how is their learning evaluated?	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.	Executive Summaries (D), Matrix of Overall Performance on SO's (D), Surveys of Seniors, Alums, Employers (I) - the direct assessments come directly from course learning outcomes that map to our student outcomes, and include homeworks, exam questions, quizzes, projects, lab reports, etc.
Assessment Method: Are the measures/methods/instruments direct (D) or indirect (I)?	They are both direct and indirect	They are both direct and indirect	They are both direct and indirect	They are both direct and indirect	They are both direct and indirect	They are both direct and indirect	They are both direct and indirect
Assessment Method: What benchmarks or indicators of success are you using to determine if the outcome has been satisfactorily met by the students?	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys	70% of all Executive Summaries indicate meeting student learning outcomes; 70% of students achieve 72.5% or higher on Learning Outcome Matrix; 4.0 on CLO surveys

Process

How will your unit reflect on the data you are reporting and who was involved? How are the results of your assessment efforts related to strategic planning and overall program review?	Evaluation of assessments and evaluations are performed and reviewed by ESC faculty. Head of COE Interdisciplinary Curriculum Committee reviews this assessment report and ABET self-study as it is prepared.
What data are you archiving? Where and how? How long do you expect to archive the data?	ABET self-study reports, executive summaries, matrix of overall performance, and student samples of work . All materials archived digitally in Box. Data will be kept for an ABET assessment cycle.

Program Information

Program:	This is the title of your primary degree program/certificate
College or Administrative Division:	This is the College or Administrative Division that contains the program
Subunit(s)	This is the Department and/or School
Report Submitted By:	Type the name and position/role with the unit
APAA Submission Cycle Due Date:	4/15/2018

*Please only include the outcomes that have new results or actions in this reporting year for clarity

Program Outcomes Matched with Measures and Results

Outcomes: List your program level student learning (SLO) outcome(s). *	1. Program level student learning outcome	2. Program level student learning outcome	3. Program level student learning outcome	4. Program level student learning outcome	5. Program level student learning outcome
Results: What do the data that result from you assessment methods or processes show about student learning relative to this outcome? Describe any patterns or trends that you identified as meaningful or that highlight areas of concern or success.					
Actions: Describe any course-level (content, pedagogical, structural, etc.) changes that will result /have resulted from the current year's assessment of this outcome. Include timelines.					
Actions: Describe any program/degree level (e.g. curricular, process, structural, etc.) changes related to this outcome that have resulted/will result from this year's assessment and/or from other sources (i.e. external accreditors)					
Full-Cycle impact: If this learning outcome has been assessed previously and is being reported on again this year, what impact have the changes incorporated (if any) had on student learning? If you have not yet assessed the results of the changes made based on previous results, please indicate the year you will revisit this outcome					

Process

How did your unit reflect on the data you are reporting and who was involved? Were there any challenges or concerns? How are the results of your assessment efforts related to strategic planning and overall program review?	
Are there specific data archiving notes for the outcome(s) you are reporting on in this report?	

Plans

Describe the unit's (or sub-units) assessment plans for the upcoming year.	

Copy and paste the template from the previous year. Doing "select all" does not always work with merged fields, so highlight the rows (arrow to the far left hold down mouse button), copy, click in this upper left cell and paste.

Outcomes and Quality Assessment

Section a.

This section only requires student learning outcomes and not educational outcomes. However, I feel that including the educational outcomes strengthens the proposal. I would suggest that you further emphasize the fact that the ABET outcomes are the actual student learning outcomes. Maybe add a few sentences at the beginning of the section that provides an overview of the different types of outcomes. For example:

"The Engineering Science Program will be using the ABET student learning outcomes to academically assess the program. Educational outcomes have also been developed to provide extended assessment of the program beyond students' time at OSU."

Section b.

The assessment methods are well described and align with other engineering programs assessment plans. The numbered steps that you have provided create a great view for the program's process of assessment. While I do have some suggested additions, please retain the current description as the core of your response.

I believe the response could be improved with 2 additions: identifying specific courses where assessment will take place and providing some examples of possible assessment instruments.

The identification of courses could be done in a visual format like a curriculum map (similar to Tables 1, 2, and 5). This map can be tentative, with a possibility that it might change in the future. However, at this stage in the proposal, it is expected that a program has some idea about "where" assessment will take place.

Providing descriptions of possible assessment methods will provide the reviewers with context for how students will be evaluated. Examples of possible methods would not need to be provided for every outcome, only a few are needed to demonstrate the types of assessments that you are planning on using. For example, you could add a few sentences that say, "To assess outcome (d), a rubric will be created to assess students during a specific group project in ESC 350. The results of a research paper in ESE 497 will be used to assess outcome (h)."

1) Do supplies and equipment costs match need-seem low to potential needs. Are you using course fees to offset some of these costs? Are you using existing equipment from other programs disciplines?

   We will be using equipment from the Energy Systems Engineering program for classes in the first two years of the curriculum. Minor equipment needed for upper division courses are shown in the year 1 and 2 budgets under "services and supplies." Other major equipment purchases (Instron machine and Rockwell hardness tester) are contained in a "fixed furniture and equipment" budget for our new academic building (AB2) and will be purchased at the time of the building construction. The building will be ready in Fall 2021 which is consistent with the needs of the program.

2) Would there be additional marketing/outreach costs? How would updating websites, promotional materials be covered? Or does the larger Cascades budget account for this?

   Marketing and outreach costs are part of the larger Cascades budget. The marketing budget includes line items for new programs.

3) Would .33 FTE for the Machine Shop Staff cover the needs of the 19.75 FTE of students that would need access to a Machine Shop? And how? Is the shop open for 13 hours a week, staff by student workers as well, etc. Is it already managed by costs through another program discipline?

   Three courses will utilize the machine shop for curricular activities. MIME 101 will use the shop 2-3 times throughout the Fall term. ESE 497 and ESE 498 (Capstone Design) will use the shop intermittently in the Fall and Winter terms respectively. Other uses of the shop include research support for tenured and tenure track faculty. 13 hours per week of shop support will be adequate for these initial tasks. The staff position will also have oversight of maker spaces for our Arts, Media and Technology and Outdoor Products degree programs that will fund the remaining 0.67 FTE for that staff member. The machine shop staff is not a curricular or teaching position. The staff is there for operational concerns of the equipment in the shop and to make sure supplies are ordered and on hand. The curricular needs in the machine shop are handled by course instructors.

4) Please move the student worker out of the supplies and services section and allocate them in personnel. You may have already identified the OPE with them, but that should also be identified in there.

   Done.

From:	Swift, Michele - COB
To:	Nave-Abele, Janice Lorie
Cc:	Mc Kiel, Carol J; Webb, Rebecca; Ketsdever, Andrew; Mathern, Rebecca; Clark, Candice Renee
Subject:	RE: Engineering Science Cat I
Date:	Monday, December 2, 2019 9:11:05 AM

Janice,

Can you attach this email string to CPS #102102 and let me know once you've attached it?

Thanks!
Michele

From: Ketsdever, Andrew <andrew.ketsdever@osucascades.edu>
Sent: Monday, December 2, 2019 9:00 AM
To: Mathern, Rebecca <Rebecca.Mathern@oregonstate.edu>; Clark, Candice Renee <clarkca@oregonstate.edu>
Cc: Swift, Michele - COB <michele.swift@bus.oregonstate.edu>; Mc Kiel, Carol J <carol.mckiel@oregonstate.edu>; Webb, Rebecca <rebecca.webb@osucascades.edu>
Subject: FW: Engineering Science Cat I

Good morning Rebecca, Candice,

I hope your holiday weekend was restful.

I'm forwarding the response from Dr. Rebecca Webb on the Cat I questions you forwarded for Engineering Sciences (see below and attached). I don't know if the questions/responses need to be formally documented in the CPS, but we stand ready to do that if necessary.

I appreciate the effort that goes into reviewing these. Please let me know if we can address any other concerns.

Best,
Andrew

From: Webb, Rebecca <rebecca.webb@osucascades.edu>
Sent: Wednesday, November 27, 2019 1:04 PM
To: Ketsdever, Andrew <andrew.ketsdever@osucascades.edu>
Subject: RE: Engineering Science Cat I

- 2 of the 6 courses in the new designator are capstone- it means there are only 4 content based courses in the new description. Might be fine but speaking to that would be useful (read: don't create new courses to just create new courses, but articulate why the limited new courses in the new designator are complimented with the already existing courses).

I updated the executive summary and full proposal to make sure this is clearly addressed but cannot upload the new documents in CPS (it says this proposal is no longer available for editing). They are attached to this email and summarized below:

- Added to Executive Summary: Due to the multidisciplinary nature of the proposed program, which will be housed in the College of Engineering, the curriculum can be constructed largely from existing engineering classes. The impact and uniqueness of the program is through a thoughtful integration of courses across disciplines rather than the creation of new courses. Therefore only four unique courses are required, allowing for fast implementation.
- Added to full proposal: Due to the multidisciplinary nature of the proposed program, the curriculum was purposefully constructed from existing engineering classes wherever possible. The impact and uniqueness of the program should be through exposure to courses across disciplines. Therefore the content of existing courses was carefully reviewed and those that mapped to the goals of the proposed program adopted. The result was only four unique courses will need to be created.

- There didn't seem to be outright support from PSU, just no disagreement. Is that sufficient?

  The purpose of the liaison process is to inform not garner "outright support." The Provost has asked for and received the brief program description that was presented to the Statewide Provost Council. We have not heard of any objections to this program from PSU or any other state entity.
- Advisor: student ratio is not reasonable (doesn't mean there is a solution but want to go on the record with this statement)

  Our advisor to student ratio at OSU-Cascades is 1:275. That is part of our budget model and has been decided for our campus. Energy Systems and Computer Science currently have on the order of 175 students. There is capacity for advising in our central pool and with our current engineering advisor and more advisors will be hired as the need arises.
- The two capstone courses (497 and 498) have the exact same course description. That doesn't make sense and should either be one course and repeatable for credit or should be different. The course name MIME Capstone Design might be confusing to folks who don't know what MIME means. I know there is a character limitation but perhaps it could be a bit more descriptive?

  This will not be changed to maintain consistency with all MIME Capstone Design offerings.
- It's my understanding that course descriptions should be complete sentences that describe what is covered in the courses. I don't have expertise in this area but can say that a HUGE audience of the course descriptions (after students, of course), is transcript evaluators. Evaluators use the description as the first basis (sometimes the only) to find equivalencies when someone is transferring from one school to another. So, if there isn't enough information, it's likely that someone might not get transfer credit OR that it will take a lot of extra work to get transfer credit. So, a possible lens to use is "can someone without extensive knowledge in this topic understand the basic topics that will be covered (and at what level) in this course"? Just my two cents.

  All updated in the system.

From:	Webb, Rebecca
To:	Nafshun, Richard Loren
Subject:	RE: OSU-Cascades Engineering Science Program (proposed) - requesting input from chemistry
Date:	Monday, April 29, 2019 8:58:00 AM

Hi, Rick:
Thanks for looking at this. Yes, I was modeling after CH 201, 201, 205 – with the hopes that we will soon have the capacity to offer that series as well.
Becca

From: Nafshun, Richard Loren <Richard.Nafshun@oregonstate.edu>
Sent: Friday, April 26, 2019 4:39 PM
Cc: Webb, Rebecca <rebecca.webb@osucascades.edu>
Subject: Re: OSU-Cascades Engineering Science Program (proposed) - requesting input from chemistry

Hi Becca,
Looks good. With two terms of lecture and one term of lab are you modeling this after CH 201, 202, and 205?
Best,
Rick

Dr. Richard L Nafshun
Department of Chemistry
Oregon State University
Corvallis, Oregon 97331
541.737.6742
nafshunr@chem.orst.edu

On Apr 26, 2019, at 4:25 PM, Lerner, Michael M <Michael.Lerner@oregonstate.edu> wrote:

> Hi Becca- I think you might contact Rick Nafshun, he is cc'd.
>
> ---
>
> **From:** Webb, Rebecca
> **Sent:** Friday, April 26, 2019 3:42 PM
> **To:** Lerner, Michael M
> **Subject:** OSU-Cascades Engineering Science Program (proposed) - requesting input from chemistry
>
> Hi, Michael:
> OSU-Cascades has proposed an Engineering Science degree. As part of the curriculum, we have proposed our students to take:
>
> - CH 231
> - CH 261
> - CH 232
>
> We would like liaison input on the inclusion of these courses from the chemistry

department. Would you mind directing me to the right person for this request?
Thanks,
Becca

Rebecca Webb, PhD | **Program Lead & Instructor**
Tykeson Faculty Scholar in Energy Systems Engineering
541.322.3167 | rebecca.webb@osucascades.edu

From: Webb, Rebecca
To: "Bill Bogley"
Subject: RE: OSU-Cascades Engineering Science Program (proposed) - requesting input from math
Date: Monday, April 29, 2019 9:08:00 AM

Hi, Bill:

Thanks for looking at this so quickly. Our students do need exposure to Taylor series and polynomial approximation, so our plan was to provide that material in our computational methods class.

I think that is all I need for now. Thanks again for the quick reply.

Becca

From: Bill Bogley <bogleyw@science.oregonstate.edu>
Sent: Friday, April 26, 2019 4:45 PM
To: Webb, Rebecca <rebecca.webb@osucascades.edu>
Cc: Bill Bogley <bogley@math.oregonstate.edu>
Subject: Re: OSU-Cascades Engineering Science Program (proposed) - requesting input from math

Dear Rebecca,

This is a pretty reasonable spread. Only question I might ask is whether your students will need some exposure to Taylor series or polynomial approximation of functions. That's MTH 265, of course.

Do you need more than that at this point? The other question you may need to ask is whether the MTH capacity exists at Cascades to deliver these courses for your students.

Let me know how I can help.

Bill

Bill Bogley, Professor and Head
Department of Mathematics
Oregon State University

> On Apr 26, 2019, at 3:37 PM, Webb, Rebecca <rebecca.webb@osucascades.edu> wrote:
>
> Hi, Bill:
> OSU-Cascades has proposed an Engineering Science degree. As part of the curriculum, we have proposed our students to take:
>
> - MTH 251
> - MTH 252
> - MTH 254

- MTH 256
- MTH 264

We would like liaison input on the inclusion of these courses from the mathematics department. Would you mind directing me to the right person for this request?
Thanks,
Becca

Rebecca Webb, PhD | **Program Lead & Instructor**
Tykeson Faculty Scholar in Energy Systems Engineering
541.322.3167 | rebecca.webb@osucascades.edu

From:	Webb, Rebecca
To:	Chair, Physics - COS
Subject:	RE: OSU-Cascades Engineering Science Program (proposed) - requesting input from physics
Date:	Friday, April 26, 2019 4:00:00 PM

Thank you! We have some free electives programmed in and PH315 would be a great option. We will have to see what we can do.
Have a great weekend,
Becca

From: Heidi Schellman <physchair@science.oregonstate.edu>
Sent: Friday, April 26, 2019 3:59 PM
To: Webb, Rebecca <rebecca.webb@osucascades.edu>; physics.chair@science.oregonstate.edu
Subject: Re: OSU-Cascades Engineering Science Program (proposed) - requesting input from physics

Definitely should take those courses.

We have some more advanced courses that might also be useful - and Ryan would probably love to teach. Notably PH315 Physics of Contemporary Challenges.

On 4/26/19 3:39 PM, Webb, Rebecca wrote:

> Hi, Heidi:
> OSU-Cascades has proposed an Engineering Science degree. As part of the curriculum, we have proposed our students to take:
>
> - PH 211
> - PH 212
> - PH 213
>
> We would like liaison input on the inclusion of these courses from the physics department. Would you mind directing me to the right person for this request?
> Thanks,
> Becca

Rebecca Webb, PhD | **Program Lead & Instructor**
Tykeson Faculty Scholar in Energy Systems Engineering
541.322.3167 | rebecca.webb@osucascades.edu

--
Heidi Schellman
Head, Department of Physics
Oregon State University

Webb, Rebecca

From: Geddes, Scott
Sent: Monday, April 29, 2019 1:40 PM
To: Webb, Rebecca
Subject: RE: OSU-Cascades Engineering Science Program (proposed) - requesting input from sciences
Attachments: ENGR_SCI_ExecutiveSummary COMMENTS SG.pdf

Hi Becca,

I have added some general comments on the pdf. These might actually be more questions than comments, and possibly more due to my lack of understanding about the process or the structure than anything else.

It looks like a really exciting initiative. As a scientist of sorts the thought of mixing the scientific enquiry method with the practical applications of engineering suggests graduates ideally suited for the real world applications and practical development of the commercial (bio)science field just like we have growing in Bend.

In terms of the College of Science courses you have listed, the chemistry math and physics courses are all well situated to absorb the expected increase in enrollment resulting from the Engineering Sciences program and would subsequently benefit from doing do. There are two additional Math Instructors due to begin this summer and a third Chemistry Instructor was hired this academic year. As subsequent growth continues in the chemistry classes, this would support the addition of the engineering specific chemistry sequence (CH 201,202,205) allowing the more efficient targeting of core concepts for relevant majors. Physics should be considered a scheduling priority, as there is only one instructor currently, but there is ample room in the class sections for growth. As growth does continue, exploring the opportunity to hire an additional instructor/adjunct would also result in increased flexibility for the other majors requiring physics.

I am looking forward to meeting the new Engineering Science students in a few years.

Thanks,

Scott

Scott Geddes
Oregon State University - Cascades
1500 SW Chandler Avenue; Bend, OR 97702
scott.geddes@osucascades.edu | 541-322-2037

Oregon State University Cascades

From: Webb, Rebecca
Sent: Friday, April 26, 2019 15:45

To: Geddes, Scott <Scott.Geddes@osucascades.edu>
Subject: OSU-Cascades Engineering Science Program (proposed) - requesting input from sciences

Hi, Scott:
OSU-Cascades has proposed an Engineering Science degree. As part of the curriculum, we have proposed our students to take:

- CH 231
- CH 261
- CH 232
- PH 211
- PH 212
- PH 213
- MTH 251
- MTH 252
- MTH 254
- MTH 256
- MTH 264

We would like your liaison input on the inclusion of these courses. I have attached an executive summary of the proposal to this email to provide context. If you could please provide me with feedback by 5/03, it would be most appreciated.
Thanks,
Becca

Rebecca Webb, PhD | **Program Lead & Instructor**
Tykeson Faculty Scholar in Energy Systems Engineering
541.322.3167 | rebecca.webb@osucascades.edu

OSU Internal Budget Outline Form

Estimated Costs and Sources of Funds for Proposed Program

Total new resources allocated to the Proposed Program, if any.
If no change in resources is required, the budgetary impact should be reported as zero.

PROGRAM TITLE: BSES, Bachelor of Science in Engineering Science

BUDGET PERIOD: From FY 20 to FY 23

Business Center CCBO **Date** 2/19/2018

Name and Title of Reviewer Terri Libert, Budget Development and Reporting Manager **Signature of Reviewer**

	Total			
	Fiscal Year 1	Fiscal Year 2	Fiscal Year 3	Fiscal Year 4
Personnel				
Faculty, Tenured/Tenure-track	-	-	-	-
Faculty, fixed-term	68,500	76,698	175,573	190,866
Sub-total, Faculty	68,500	76,698	175,573	190,866
Graduate Assistants	-	-	-	-
Support Staff	-	-	14,985	15,435
Fellowship/Scholarship	-	-	-	-
OPE	35,760	46,706	107,873	117,607
Personnel Subtotal	105,525	124,697	301,071	326,603
Other Expenses				
Library, Printed	-	-	-	-
Library, Electronic	-	-	-	-
Services & Supplies	10,750	8,870	15,502	11,647
Capital Equipment	-	-	-	-
Other Resources Subtotal	10,750	8,870	15,502	11,647
Physical Facilities	-	-	-	-
Construction	-	-	-	-
Major Renovation	-	-	-	-
Other Expenses	-	-	-	-
Physical Facilities Subtotal	-	-	-	-
Check math	-	-	-	-
Total Cost of Program	116,275	133,567	316,573	338,250
Resources				
Current Budget, unit	-	-	90,156	93,381
Tuition (e campus, differential)	128,052	175,857	226,417	244,869
Institutional Reallocation from other b	-	-	-	-
Special State Appropriation	-	-	-	-
Federal Funds and other Grants	-	-	-	-
Fees/Sales	-	-	-	-
Foundation Endowment	-	-	-	-
Tuition remission (GA support)	-	-	-	-
Other, describe:				
Total Resources	**128,052**	**175,857**	**316,573**	**338,250**
check math	128,052	175,857	316,573	338,250

Note: Please include budget narrative describing items listed above.

OSU Internal Budget Outline Form

Estimated Costs and Sources of Funds for Proposed Program

Total new resources allocated to the Proposed Program, if any.
If no change in resources is required, the budgetary impact should be reported as zero.

PROGRAM TITLE: BSES, Bachelor of Science in Engineering Science

BUDGET PERIOD: From FY 20 to FY 23

Business Center CCBO Date 2/19/2018

Name and Title of Reviewer Terri Libert, Budget Development and Reporting Manager

	One-Time			
	Fiscal Year 1	Fiscal Year 2	Fiscal Year 3	Fiscal Year 4
Personnel				
Faculty, Tenured/Tenure-track				
Faculty, fixed-term	68,500	76,698	175,573	190,866
Sub-total, Faculty	68,500	76,698	175,573	190,866
Graduate Assistants				
Student Workers	1,265	1,293	2,640	2,695
Support Staff	-	-	14,985	15,435
Fellowship/Scholarship				
OPE	35,760	46,706	107,873	117,607
Personnel Subtotal	105,525	124,697	301,071	326,603
Other Expenses				
Library, Printed				
Library, Electronic				
Services & Supplies	8,750	8,870	11,502	11,647
Capital Equipment				
Other Resources Subtotal	8,750	8,870	11,502	11,647
Physical Facilities				
Construction				
Major Renovation				
Other Expenses				
Physical Facilities Subtotal	-	-	-	-
Total Cost of Program	**114,275**	**133,567**	**312,573**	**338,250**
Resources				
Current Budget, unit			86,156	93,381
Tuition (e campus, differential)	128,052	175,857	226,417	244,869
Institutional Reallocation from other budgetary units				
Special State Appropriation				
Federal Funds and other Grants				
Fees/Sales				
Foundation Endowment				
Tuition remission (GA support)				
Other, describe:				
Total Resources	**128,052**	**175,857**	**312,573**	**338,250**

Note: Please include budget narrative describing items listed above.

Recurring

OSU Internal Budget Outline Form

Estimated Costs and Sources of Funds for Proposed Program

Total new resources allocated to the Proposed Program, if any.
If no change in resources is required, the budgetary impact should be reported as zero.

PROGRAM TITLE: BSES, Bachelor of Science in Engineering Science

BUDGET PERIOD: From FY 20 to FY 23

Business Center CCBO Date 2/19/2018
Name and Title of Reviewer Terri Libert, Budget Development and Reporting Manager

	Recurring			
	Fiscal Year 1	Fiscal Year 2	Fiscal Year 3	Fiscal Year 4
Personnel				
Faculty, Tenured/Tenure-track				
Faculty, fixed-term				
Sub-total, Faculty	-	-	-	-
Graduate Assistants				
Support Staff				
Fellowship/Scholarship				
OPE				
Personnel Subtotal	-	-	-	-
Other Expenses				
Library, Printed				
Library, Electronic				
Services & Supplies	2,000	-	4,000	
Capital Equipment				
Other Resources Subtotal	2,000	-	4,000	-
Physical Facilities				
Construction				
Major Renovation				
Other Expenses				
Physical Facilities Subtotal	-	-	-	-
Total Cost of Program	**2,000**	**-**	**4,000**	**-**
Resources				
Current Budget, unit			4,000	
Tuition (e campus, differential)				
Institutional Reallocation from other budgetary units				
Special State Appropriation				
Federal Funds and other Grants				
Fees/Sales				
Foundation Endowment				
Tuition remission (GA support)				
Other, describe:				
Total Resources	**-**	**-**	**4,000**	**-**

Note: Please include budget narrative describing items listed above.

One-Time

OSU BUDGET NARRATIVE – BSES, Bachelor of Science in Engineering Science

Personnel:

Faculty, Tenured/tenure-track: None planned during budget period

Faculty, Fixed-term:
Full-time Instructors:

- One instructor at $65,000 in Year 1, escalated at 3% per year
    - Additional $3,500 per year for summer pay
- One additional instructor at $65,000 in Year 3, escalated at 3% per year
    - Additional $3,500 per year for summer pay

Part-time Instructors:

- Pay rate for 9-month part-time instructors is $43,002
- Year 1 = 0.00 FTE = $0
- Year 2 = 0.14 FTE = $6,143
- Year 3 = 0.80 FTE = $34,402
- Year 4 = 1.06 FTE = $45,459

Graduate Assistants: No new graduate assistants

Support Staff: One 0.33 FTE Machine Shop Staff at $45,000 base salary in Year 3, escalated at 3% per year

OPE:
Full-time Instructors:

- Fixed OPE (health benefits) = $17,209 for year 1, escalated at 3% per year
- Variable OPE (retirement and other benefits) = 37.08%, escalated at 3% per year plus 2% for potential additional State PERS liability passed on to the institution
- Total OPE:
    - Year 1 = $35,760
    - Year 2 = $46,085
    - Year 3 = $97,783
    - Year 4 = $105,518

Part-time Instructors:

- Variable OPE (other benefits only) = 9.83% in Year 2, escalated at 3% per year
    - Year 1 = $0
    - Year 2 = $622
    - Year 3 = $3,586
    - Year 4 = $4,881

Support Staff:

- Variable OPE only = 43.4% in Year 3, escalated at 3% per year
    - Year 1 = $0
    - Year 2 = $0
    - Year 3 = $6,504
    - Year 4 = $7,208

Student Workers:

- Year 1 = $1,265
- Year 2 = $1,293
- Year 3 = $2,640
- Year 4 = $2,695

Other Expenses:

Library: No new printed or electronic materials

Services and Supplies:
Recurring:

- Department operating expense
  - Office supplies = $50 per year in Years 1-2, $150 per year in Years 3-4
  - Postage = $100 per year
  - Lab supplies = $1,200 in Year 1, $1,320 in Year 2, $1,452 in Year 3, $1,597 in Year 4
  - Lab equipment = $5,000 per year
- Professional development
  - $2,400 in Years 1-2
  - $4,800 in Years 3-4

One-Time:

- New hire set-up costs = $2,000 in Year 1 and $4,000 in Year 3

Capital Equipment: None

Facilities Renovation: None

Resources:

Current Budget: Support from OSU-Cascades E&G Funds including campus tuition, fees, and allocation of Student Success and Completion funding from State of Oregon Higher Education Coordinating Commission

- Year 1 = $0
- Year 2 = $0
- Year 3 = $90,156
- Year 4 = $93,381

Tuition: Tuition generated from students enrolled in major (net of 10% Fee Remission)

- Year 1 = 11.85 FTE for academic year = $128,052
- Year 2 = 15.80 FTE for academic year = $175,857
- Year 3 = 19.75 FTE for academic year = $226,417
- Year 4 = 20.74 FTE for academic year = $244,869

New Degree Program Proposal
Engineering Science

Status: Pending Review - Faculty Senate Exec Committee (Previous Version)

Hide All Reviews

1. Review - College Approver - Engineering

Approved by Frank Chaplen Associate Professor / Biol & Ecol Engineering, *May 19, 2019 7:58am*

2. Review - Curriculum Coordinator

Sent Back by Janice Nave-Abele Curriculum Coordinator / Acad Progms & Assessment, *May 22, 2019 9:08am*

Comments

Janice Nave-Abele (Curriculum Coordinator) May 22, 2019 9:08am
Sent back to Originator for updates.

3. Originator Response

Rebecca Webb Instructor-Engineering / Acad Prog / Student Aff, *June 20, 2019 12:46pm*

Comments

Rebecca Webb June 20, 2019 12:46pm
All of Janice's recommendations made and documents updated.

4. Review - Curriculum Coordinator

Approved by Janice Nave-Abele Curriculum Coordinator / Acad Progms & Assessment, *June 27, 2019 9:25am*

Comments

Janice Nave-Abele (Curriculum Coordinator) June 27, 2019 9:25am
Please correct/align the WIC course information in the proposal. Email regarding this sent to Originator on 5/26.

5. Review - Graduate School

Approved by Janice Nave-Abele Curriculum Coordinator / Acad Progms & Assessment, *June 27, 2019 9:50am*

Comments

Janice Nave-Abele (Graduate School) June 27, 2019 9:50am
This is an undergraduate program and does not require Graduate School approval.

6. Review - Budgets and Fiscal Planning Committee

Sent Back by Andrew Ibarra Dir-Physical Activity Program / Sch of Bio/Pop Hlth Sci, *October 4, 2019 3:34pm*

Comments

Andrew Ibarra (Budgets and Fiscal Planning Committee) October 4, 2019 3:34pm
We had several questions:
1) Do supplies and equipment costs match need-seem low to potential needs. Are you using course fees to offset some of these costs? Are you using existing equipment from other programs disciplines?
2) Would there be additional marketing/outreach costs? How would updating websites, promotional materials be covered? Or does the larger Cascades budget account for this?

3) Would .33 FTE for the Machine Shop Staff cover the needs of the 19.75 FTE of students that would need access to a Machine Shop? And how? Is the shop open for 13 hours a week, staff by student workers as well, etc. Is it already managed by costs through another program discipline?
4) Please move the student worker out of the supplies and services section and allocate them in personnel. You may have already identified the OPE with them, but that should also be identified in there.

If you have questions on our questions dont hesitate to call (76811)

7. Originator Response

Rebecca Webb Instructor-Engineering / Acad Prog / Student Aff, *October 11, 2019 1:58pm*

Comments

Rebecca Webb October 11, 2019 1:58pm
All questions answered in document called Response_10_11_2019 which was uploaded to the Other Attachments section of the proposal. Also, the budget was updated to address #4. Thank you.

8. Review - Budgets and Fiscal Planning Committee

Approved by Andrew Ibarra Dir-Physical Activity Program / Sch of Bio/Pop Hlth Sci, *October 18, 2019 11:11am*

Comments

Andrew Ibarra (Budgets and Fiscal Planning Committee) October 18, 2019 11:11am
We approve, but recommend you also clarify how you plan to cover costs of additional course development. It may be within workload or not, but clarification on that would be recommended. Also clarify costs for advising, are those central, absorbed within current operations?

9. Review - Graduate Council Chair

Approved by John Becker-Blease Associate Dean / College of Business Dept, *October 21, 2019 8:31am*

Comments

John Becker-Blease (Graduate Council Chair) October 21, 2019 8:31am
No Graduate Implications. No concerns.

10. Review - Curriculum Council Chair

Sent Back by Michele Swift Senior Instructor I / College of Business Dept, *December 2, 2019 9:18am*

Comments

Michele Swift (Curriculum Council Chair) December 2, 2019 9:18am
Please attach the updated proposal and executive summary. Reference attachment RE_Engineering Science Cat I.pdf for comments and responses.

11. Originator Response

Rebecca Webb Instructor-Engineering / Acad Prog / Student Aff, *December 2, 2019 9:37am*

Comments

Rebecca Webb December 2, 2019 9:37am
Updated executive summary and proposal attached.

12. Review - Curriculum Council Chair

Approved by Michele Swift Senior Instructor I / College of Business Dept, *December 6, 2019 4:15pm*

Comments

Michele Swift (Curriculum Council Chair) December 6, 2019 4:15pm
The CC approved the proposal but we recommend the following:
1) Take steps to lower the student-adviser ratio. While your ratio of 275:1 appears to be consistent with the national median ratio, NACADA suggests that this load should be adjusted downward, depending on

the student advised, the complexity of the curriculum and the other job responsibilities assigned to the adviser.
2) Work with MIME to differentiate the course descriptions for MIME 497 and MIME 498. Having two courses with identical course descriptions risks creating confusion for students.

13. Review - Faculty Senate Exec Committee

Pending Review

More Queued Reviews (4)

Faculty Senate; Provost /Academic Affairs; Academic Programs; Catalog Coordinator

Proposal

Proposal ID:102102
Type:New Degree Program
Submission Date:December 2, 2019 9:37am
Comments:*None*

History

Active Version - Submitted December 2, 2019 9:37am
Version 3 - Submitted October 11, 2019 1:58pm
Version 2 - Submitted June 20, 2019 12:46pm
Version 1 - Submitted April 29, 2019 11:42am

Originators

NAME	TITLE	DEPARTMENT/SCHOOL
Rebecca Webb	Instructor-Engineering	Acad Prog / Student Aff

Contacts

NAME	TITLE	DEPARTMENT/SCHOOL
Julie Gess-Newsome	Dean of Academic Affairs	Acad Prog / Student Aff

Proposal Details

College:College of Engineering
Department/School:No Department
Program Type:Undergraduate Major
New Degree Name:Engineering Science

Supporting Documents

DOCUMENTS
*** Signed Transmittal Sheet**
Transmittal_CascadesSignatures.pdf (51.38 Kb added Dec 02, 2019 9:18 am)
*** Executive Summary**
ENGR_SCI_ExecutiveSummary_Rev1.docx (18.86 Kb added Dec 02, 2019 9:35 am)
*** Proposal**
ENGR_SCI_hecc_new_academic_program_proposal_5-FINAL_Rev4.docx (131.34 Kb added Dec 02, 2019 9:35 am)

*** Letters of Support**

OIT Letter_OIT_EE.pdf (89.76 Kb added Dec 02, 2019 9:18 am)

COCC Letter_COCC.pdf (59.89 Kb added Dec 02, 2019 9:18 am)

PSU Letter_PDX_EE.pdf (83.21 Kb added Dec 02, 2019 9:18 am)

PSU Letter_PDX_Mechanical.pdf (85.45 Kb added Dec 02, 2019 9:18 am)

Element1 Support Letter 5Mar2018.pdf (580.27 Kb added Dec 02, 2019 9:18 am)

PE1 PE Letter of Support - Tom Headley 2018-03-21.pdf (11.42 Kb added Dec 02, 2019 9:18 am)

PE2 SupportLetter_Guy.pdf (9.78 Kb added Dec 02, 2019 9:18 am)

*** Accessibility Form**

Accessibility_Signed.pdf (45.50 Kb added Dec 02, 2019 9:18 am)

*** Library Evaluation**

2017 Cascades Cat I Engineering Science Library Evaluation.pdf (45.15 Kb added Dec 02, 2019 9:18 am)

*** Faculty CVs**

Chris_Hagen_October_2017_CV.pdf (205.01 Kb added Dec 02, 2019 9:18 am)

Bahman Abbasi - CV (OSU-Cascades).pdf (593.53 Kb added Dec 02, 2019 9:18 am)

kwebb_CV_2017.pdf (78.45 Kb added Dec 02, 2019 9:18 am)

RWebb_CV_2017.pdf (58.14 Kb added Dec 02, 2019 9:18 am)

Other Attachments

Engineering Science_Space Letter_2017_FINAL.pdf (921.50 Kb added Dec 02, 2019 9:18 am)
Space Evaluation

ug_assessment_apa_reporting_template.xlsx (42.96 Kb added Dec 02, 2019 9:18 am)

EngineeringScience_AssessmentPlanFeedback_Heath.pdf (49.61 Kb added Dec 02, 2019 9:18 am)

Response_10_11_2019.docx (13.96 Kb added Dec 02, 2019 9:18 am)

RE_ Engineering Science Cat I.pdf (84.73 Kb added Dec 02, 2019 9:18 am)

LIAISONS

*** Liaisons**

Richard Nafshun
Request: *None*
Response: RE_ OSU-Cascades Engineering Science Program (proposed) - requesting input from chemistry.pdf (64.16 Kb added Dec 02, 2019 9:18 am)

Bill Bogley
Request: *None*
Response: RE_ OSU-Cascades Engineering Science Program (proposed) - requesting input from math.pdf (62.74 Kb added Dec 02, 2019 9:18 am)

Heidi Schellman
Request: *None*
Response: RE_ OSU-Cascades Engineering Science Program (proposed) - requesting input from physics.pdf (61.93 Kb added Dec 02, 2019 9:18 am)

Scott Geddes
Request: *None*
Response: Geddes.pdf (132.50 Kb added Dec 02, 2019 9:18 am)

BUDGET INFORMATION

*** Budget Year 1**

Engr Sci_osu budget worksheet_101019.xlsx (25.32 Kb added Dec 02, 2019 9:18 am)

*** Budget Year 2**

Engr Sci Budget Narrative-101019.docx (18.34 Kb added Dec 02, 2019 9:18 am)

*** Budget Year 3**

Engr Sci_osu budget worksheet_101019.xlsx (25.32 Kb added Dec 02, 2019 9:18 am)

*** Budget Year 4**

Engr Sci Budget Narrative-101019.docx (18.34 Kb added Dec 02, 2019 9:18 am)