044

Washington State University
MAJOR CHANGE FORM - - REQUIREMENTS
(Submit original signed form and TEN copies to the Registrar's Office, zip 1035.)
See https://www.ronet.wsu.edu/ROPubs/Apps/HomePage.ASP *for this form.*

*Submit an additional copy to the Faculty Senate Office, French Administration 338, zip 1038.

Department Name Electrical Engineering and Computer Science

1. CHECK PROPOSED CHANGES.

- *☐ Change department/program name *from*_____ *to*_____
- *☐ New degree or program *in*_____
- *☐ Change name of degree *from*_____ *to*_____
- *☐ Drop degree or program *in*_____
- *☑ Extend existing degree or program *to* Global Professional Science Master's in Electrical Power Engineering campus
- ☐ New Major *in*_____
- ☐ Change name of Major *from*_____ *to*_____
- ☐ Revise Major requirements *in*_____
- ☐ Drop Major *in*_____
- ☐ Revise certification requirements for the Major *in*_____
- ☐ New Option *in*_____
- ☐ Revise requirements for the Option *in*_____
- ☐ Drop Option *in*_____
- ☐ New Minor *in*_____
- ☐ Revise Minor requirements *in*_____
- ☐ Drop Minor *in*_____
- ☐ New Undergraduate Certificate *in*_____
- ☐ Revise Undergraduate Certificate requirements *in*_____
- ☐ Drop Undergraduate Certificate *in*_____
- ☐ Other _____

Effective term/year ~~Spring 2014~~ Fall 2014

Robert G. Olsen	335-0348	bgolsen@wsu.edu
Contact Person	**Contact Phone No.**	**Contact email**

2. GIVE REASONS FOR EACH REQUEST MARKED ABOVE. *(Attach additional paper if necessary; see reverse side.)* The electric utility industry is requesting a asters level program in electric power engineering such as this in order to further educate its many newly hired engineers without requiring them to attend class in Pullman. See attached proposal for more information

4. SIGN AND DATE APPROVALS.

Sakire Arslan Ay, Assistant Director — Dean Signature/date 9/17/13 — General Education Com/date

OCT 10 2013 — Catalog Subcom/date — Academic Affairs Com/date — Graduate Studies Com/date — Senate/Date

VGS

PROPOSAL TO EXTEND A WSU PULLMAN DEGREE PROGRAM
VIA DISTANCE DEGREE PROGRAMS (WSU Online)

Send this completed proposal, including the attached tables, electronically to the OFFICE OF THE PROVOST (donnac@wsu.edu).

Degree Title: Professional Science Master's in Electrical Power Engineering

Department(s) or Program(s): The School of Electrical Engineering and Computer Science

College(s): College of Engineering & Architecture

Contact Name: Robert Olsen, PhD
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bgolsen@wsu.edu

1. DESCRIPTION AND RATIONALE – *briefly explain:*

(a) Delivery Model:

All the courses for the degree will be delivered online, asynchronously, through WSU's Learning Management System to post-bachelor's level students throughout the world.

(b) Rationale for Extending the Degree:

The U.S. Department of Labor (DOL) estimated the employment of electrical engineers as 154,000 in May 2010. The DOL predicts that employment for this occupation will gain 10,700 jobs by 2020, an increase of 7%. Engineering services firms will see the highest growth because it is less expensive for companies to contract these firms instead of having engineers on staff.

Electrical Engineering spans numerous sub-disciplines and segments of industry and research such as power, controls, microelectronics, sustainable energy, automotive, consumer electronics, wireless communications, and aerospace. Trends related to power electrical engineering as identified by a market analysis report compiled by

the University Professional & Continuing Education Association (UPCEA) Center for Research and Consulting are highlighted below.

- **Aging and Inadequate Infrastructure** – Both the aging and inadequate power grids of impoverished, Third World and rapidly expanding areas of the world and the increasingly sophisticated networks required by "smart cities" of the industrialized world are subject to the threat of component failure. In many areas of the United States, the power infrastructure is aging and insufficient for meeting the population's growing need for electricity. Electrical engineers will be at the forefront of developing the monitoring and preventive maintenance systems needed to address these problems. Safety issues have always been important for electrical engineers, but as technology develops it will become even more important to ensure safety automatically or signal an impending problem before it happens.

- **Integrating Communications with the Power Grid** – Going along with the need to anticipate and detect failures in existing power grids due to increasing urbanization and higher electricity consumption is the demand for new and better solutions to making the power grid more efficient using modern communications. American cities and suburbs need better, more efficient means of delivering electricity to homes and businesses and lighting public areas, commercial spaces and roadways. The persistent, essential nature of this need, alongside the vital importance of improving energy and cost efficiencies in the process, will open up numerous opportunities for electrical engineers in the public and private sectors.

Typically, a bachelor's degree is required for entry-level positions as an electrical or electronics engineer. A master's degree will make it easier for a professional to acquire a job or a promotion. The interdisciplinary curriculum is current and relevant and includes graduate engineering course work, professional course work, and an internship in a research, business, agricultural, or academic setting. The program must consist of a minimum of 30 credits. A thesis is not required.

Below are some of the benefits offering the degree through WSU Online will provide.

i. Industry, government, and nonprofit agencies involved in the STEM disciplines require STEM trained professionals with applied skills to help fuel innovation and ensure global competitiveness. WSU will prepare graduates for careers in the growing field of Electrical Power Engineering (EPE) by offering an online

Professional Science Master's degree in EPE. The Professional Science Master's (PSM) is a relatively new type of Master's degree designed to provide students with graduate training in the sciences, math or engineering, along with training in relevant business and management skills. Currently, almost 300 PSM degree programs are offered at over 100 universities across the nation and internationally. PSMs help spur innovation and economic competitiveness, as the curriculum and learning goals are developed with extensive input from prospective employers.

ii. The power engineering program (PEP) and its related research center (ESI Center) are fortunate to have very close and supportive relationships with the power industry, including the state's public utilities. There are approximately 20 paying annual corporate members investing in PEP and the ESI center. The membership programs are successful because of WSU's reputation in power engineering and its ability to deliver the services valued by the corporate members. Distance education is a priority area with every member utility and company, and is a constant theme at the annual industry advisory board meetings. WSU has traditionally provided these utilities with new employees at the Bachelor's level. Because of increasing demands for additional education, members of our utility advisory board have requested that we begin a Master's program that can be easily accessed by their employees. We are overdue in creating an online master's degree in power engineering, especially given the longevity and standing of the power engineering program.

iii. The establishment of this degree will not only help fulfill a critical industry need in the state in the area of workforce training and education, it will considerably enhance the value of the program and the center to entities outside of Washington state, thereby bringing in even greater financial support and prestige, which in turn will benefit the PEP and ESI center future research expenditures and subsequently the university's bottom line.

iv. The land grant mission of the University is to extend access to education. Delivering the degree online, asynchronously, will provide access to qualified place-bound individuals state wide, nationally and internationally.
Specifically, this degree will provide non-traditional students (primarily working professionals in engineering-related industries) access to a top-notch online graduate degree.

(c) *Collaborative relationship, if any, with other educational partners:* (N/A)

2. NEEDS ASSESSMENT – *identify and support estimates of student demand for the program and describe employment opportunities for graduates of the program.*

WSU has one of the very few electric power engineering programs in the country and it is highly ranked. At the same time, the electric power industry is both growing in size and in the need to modernize its electric power system. The industry must, 1) continue to grow to support the growing economy, 2) incorporate new modes of generation and 3) incorporate new communication systems to make the system more efficient. The result of this is a need for utility employees to get advanced education. This degree will fill this need for non-traditional working students, who desire to earn a Master's degree without the disruption relocating to Pullman would entail.

3. CURRICULUM – *explain and provide rationale for any differences in the program between Pullman and distance programs in:*

(a) *how GERs/UCORE and departmental requirements are satisfied:*

There are no UCORE requirements for a Master's degree.
Given that this is a new degree, it does not violate any departmental requirements for existing degrees.

(b) *the content of required courses*

The technical content of the coursework in the area of electric power engineering required for the Professional Master's degree is nearly identical to that required for the Masters of Science in Electrical Engineering (MSEE) offered on the Pullman campus. These include courses such as power electronics, power system performance, power system protection, power system analysis, power transmission/distribution, power system stability and control, power system operations, high voltage engineering, power system economics and markets and digital systems for the smart grid. The fundamental differences between this degree and the MSEE degree are that 1) the thesis or project required by the MSEE degree is replaced by a workplace internship and 2) the "breadth" requirement in electrical engineering which is part of the MSEE degree is replaced with professional courses in management and communication.

4. RESOURCE ASSESSMENT – *identify basic resources needed to deliver this program online.*

(a) **Faculty** – In order to extend this program to online delivery, what is your faculty hiring plan - both transitionally and long-term - for tenure-track, clinical, adjunct faculty and TAs?

We presently have a sufficient number of faculty to support a quality WSU Online program. As the program grows, income may be used to buy faculty out of undergraduate courses that are part of their regular load and to hire up to three adjuncts by year four to teach these undergraduate courses. Experienced TAs may also be hired to assist faculty with administrative work and to field questions from students enrolled in online courses. . The opportunity to teach Electric Power Engineering WSU Online courses will be available to EECS tenure-track faculty in accordance with the teaching obligations of the Department. WSU Online teaching opportunities for undergraduate courses offered as part of the program may also be offered to advanced graduate students with previous experience in teaching these or similar courses.

At present, all courses required for the major exist in the WSU catalog and have been developed or are in the process of being developed for WSU Online delivery. More courses will be developed as the demand for the major grows.

(b) **Curriculum** – What resources will be available to develop and maintain the necessary online courses?

WSU Online provides support to faculty in the development and delivery of online courses:

- An eLearning Consultant, with expertise and experience in instructional design of online courses, will work one-on-one with faculty members developing online courses to ensure that best practices and pedagogical recommendations for successful online learning are understood.
- The WSU Online media team will work with faculty to create appropriate media and interactive activities to promote active learning and enhance engagement.
- The same eLearning Consultant will continue to support the faculty member during course delivery as issues unique to the online learning environment arise.
- WSU Online provides face-to-face and distance orientation and trainings as well as online tutorials to support online instructors.
- A WSU Online specialist will manage proctored exams for the course, if needed.

- The WSU Online tech support team will provide 24/7 technical support.
- WSU Online provides ongoing maintenance or updating of courses each semester of offering.

WSU Online also assists students, who need to:

- Acquire required resources, such as texts and media.
- Arrange for proctored exams.
- Troubleshoot technical issues (24/7 technical support).

A faculty member appointed by the ESI center will serve as student advisor and assist students with their study plans.

Structure of the PSM in Electrical Power Engineering

Graduate Courses in STEM area (~60%): 18 credits			
Courses available (select 6)	**Course Offered**	**Status**	**Instructor**
EE 491: Performance of Power Systems (3 credits)	Every fall	Online version under development. First semester of offering will be Fall 2014.	Venkatasubramanian
EE 492: Renewable Energy Sources (3 credits)	Every fall	Online version under development. First semester of offering will be Fall 2014.	Liu
EE 525: Power System Applications of Power Electronics (3 credits)	Every fall	Online version under development. First semester of offering will be Fall 2014.	Mehrazi-Sani
EE 511: Protection of Power Systems II (3 credits)	Every spring	Online version under development. First semester of offering will be Spring 2014.	Srivastava
EE 521: Analysis of Power Systems (3 credits)	Every spring	Online version under development. First semester of offering will be Spring 2014.	Venkatasubramanian

EE 523: Power Systems Stability and Control (3 credits)	Every spring	Online version under development. First semester of offering will be Spring 2014.	Bose
EE 536: Power System Economics and Electricity Markets (3 credits)	Every fall	Online version under development. First semester of offering will be Fall 2014.	Srivastava
Professional Core Areas (~30%): 9 credits			
Courses available (select 3)	**Course Offered**	**Status**	**Instructor**
1. Quantitative Methods			
EM 526: Constraints Management (3 credits)	Every spring	Available online	Holt
EM 545: Technical Decision Analysis (3 credits)	Every fall	Available online	Rumsey
EM 595: Advanced Topics in Engineering Management (V 1-3)	Every other spring	Available online	Gray
2. Ethics			
Phil 520: Seminar in Ethical Theory (3 credits)	Every other spring	Available online	Stichter
3. Management			
EM 501: Management of Organizations (3 credits)	Every spring	Available online	Gray
EM 564: Project Management (3 credits)	Every fall	Available online	Sudikatus
EM 575: Performance Management in Technical Organizations (3 credits)	Every fall	Available online	Rumsey

4. Communication			
Engl 595: Topics in English: Communicating in Science, Technology, Engineering, and Mathematics (3 credits)	Each summer	Available online	Kristin Arola
5. Business Focus			
EM 508: Legal Concepts for Engineering and Technical Managers (3 credits)	Each fall	Available online	Crick
EM 505: Finance for Technical Systems (3 credits)	Every spring	Available online	Rumsey
6. **Internship (~10%): (8 weeks full time) 3 credits**			
EE 702: Master's Special Problems, Directed Study, and/or Examination (V 1-18)	Each fall	Online version under development. First semester of offering will be Spring 2015)	
Total: 30 credit hours			

c) **Library**

1. In specific terms, describe the adequacy of existing capacity.

The existing library collections, equipment, and personnel are adequate to support the PSM in Electrical Power Engineering degree via the WSU Online Program. Most journals that support research for the degree are available full-text electronically so can be accessed by WSU students from anywhere. Digitized copies of articles in WSU print journals can be requested electronically with 24-48 hour delivery. Digitized copies of articles in WSU print journals can be requested electronically with 24-48 hour delivery. Digitized copies of articles in journals not owned by WSU can also be requested electronically and delivered within a few days with no direct cost to the student. Indexes and databases that support research for the degree are also available electronically. Print books

in the WSU Libraries collections, as well as those owned by the 40 academic libraries in the Orbis Cascade Alliance, can also be requested electronically and will be mailed to the student. Electronic books are an important part of the library's collection and this format will continue to increase. Non-electrical engineering indexes, databases, and journals are also available electronically.

2. What is the need for new library collections?
No additional serials, monographs, or media will be needed to support the degree.

3. What new library personnel will be needed?
Specialized expertise to support the degree is already available in the library. No additional library staff or faculty is anticipated.

4. What additional library services will be needed?
No additional library services will be needed. Service needs of WSU Online students in the PSM in Electrical Power Engineering can be provided by existing personnel and computer resources.

5. For programs offered away from the Pullman campus: To what extent will collections and services be provided from Pullman and to what extent by other campus or local libraries?
Collections and services will be provided from the Pullman campus. See #1. above, for more detail. There will be very minimal need for students to use other campus or local libraries.

6. Are there any other library resource considerations.
No.

(d) **Student Services** – Sufficient student services are available at a distance to serve new WSU Online students.

The same student services infrastructure established for current WSU Online students will support students in the PSM in Electrical Power Engineering program. WSU Online is nationally known for its excellent services to distance students; staff members are invited to give presentations at national conferences and webinars, have developed a module on student services for a national organization, and receive visitors from universities in the US and other countries interested in replicating the WSU model.

WSU Online student services professionals assist individuals from their first inquiry to the university through graduation and beyond, when graduates move into the work force or to graduate school. Services include assistance with admissions, financial aid, registration, obtaining course materials, technical support, submitting assignments and take home exams, and proctored exams. WSU Online has a student government in which students are invited to participate, and a three-quarter time career counselor who works closely with students from admission through graduation, and beyond. WSU Online also has a liaison with the WSU Access Center.

5. ASSESSMENT PLAN – *Identify program learning outcomes, means of assessing outcomes and process for using results to improve the program. (If the same as the on-campus program ones, insert those here.)*

Program Title: Professional Science Master's Program, Electrical Power Engineering

Scope of Assessment (MS/PhD): Professional Science Masters (PSM)

Historical Overview:

The electrical engineering program at Washington State University (WSU) has existed since the early part of the twentieth century. From the beginning, electrical power systems has been an important part of that program. During the early 1970's, many electrical engineering departments reduced or eliminated the power option from their undergraduate programs. For this reason, WSU in cooperation with the regional electric power industry established the Power Professorship Program 1972 with the main objective of maintaining and improving the power engineering component of the department's offerings. This work has continued and expanded to this day resulting in vibrant undergraduate, graduate and research programs in electric power engineering. The proposed Professional Science Master's program represents the next phase of the partnership between the WSU power engineering program and the industry that supports it.

Program Mission Statement:

The mission of the Professional Science Master's program in electrical power engineering is to provide fundamental education in basic and applied electrical power engineering and other (non-science) supporting areas of study for engineers employed in

the electric power industry. This education will support the efficient transition of students into the workplace and give them the skills needed for advancement in the industry.

Program Objectives:

- Develop an effective program for students that allows them to acquire the education necessary to identify and solve problems relevant to the electric power industry.
- Provide students with the professional skills needed to compete effectively and advance in the electric power industry.
- Provide students with guided experience under the supervision of experienced professionals in the electric power industry.

Student Learning Outcomes (SLOs):

Students will be able to:

1. Show an understanding of the design of the electric power generation and transmission system to include the ability to:
    a. analytically describe generators of electric power
    b. apply theoretical principles to the design of transmission lines
    c. analyze the performance of transmission lines
2. Show an understanding of the analysis and operation of the electric power transmission system to include the ability to:
    a. analyze the performance of power systems under normal operation
    b. describe the principles of operating power systems
    c. analyze the performance of power systems under abnormal operation
3. Show an deeper understanding of one or more areas of electric power engineering. These options include:
    a. power electronics
    b. renewable energy
    c. power system protection
    d. high voltage engineering

e. power system operations
f. power system stability and control
g. power system communication

4. Show an understanding of the intersection between the technical and business aspects of electric power engineering to include the ability to:
   a. describe economic constraints on electric power system operation
   b. describe the operation of electric power markets
5. Describe and apply basic principles of the electric power system business. These will include:
   a. legal issues
   b. finance issues
   c. project management issues
   d. human resource issues
6. Be able to apply coursework to practical situations in the electric power industry.
7. Communicate effectively in both written and oral form. Students will be able to:
   a. demonstrate awareness of context, audience, purpose, and the assigned task(s)
   b. use appropriate and relevant content to develop and present ideas
   c. demonstrate consistent use of credible, relevant sources to support ideas
   d. demonstrate delivery techniques (posture, gesture, eye contact, and vocal expressiveness) make the presentation interesting, and speaker appears comfortable

Assessments

The assessment of the student learning outcomes will be accomplished as illustrated in the following table[1]

SLO #	Data Source	Assessment Method	Collected	Expectation
1	EE 526	exam problems tailored to learning	annually	75% or better average on specific final exam problems; 80% of students will receive a grade of 3.0 or better; course

[1] A copy of the internship assessment form is included in the appendix

		outcomes; grades; course evaluations		evaluation average greater than 4/5
2	EE 521	exam problems tailored to learning outcomes; grades; course evaluations	annually	75% or better average on specific final exam problems; 80% of students will receive a grade of 3.0 or better; course evaluation average greater than 4/5
3	Tech. Electives	Exams/ course evaluations	annually	80% of students will receive a grade of 3.0 or better; course evaluation average greater than 4/5
4	EE 536	exam problems tailored to learning outcomes; grades; course evaluations	annually	75% or better average on specific final exam problems; 80% of students will receive a grade of 3.0 or better; course evaluation average greater than 4/5
5	Prof. Electives	Exams/ course evaluations	annually	80% of students will receive a grade of 3.0 or better; course evaluation average greater than 4/5
6	Appl. of Coursework	Internship assessment	annually	80% of students will receive satisfactory evaluations by internship mentors
7	Engl 595/ internship	Writing Portfolio/Internship assessment	annually	Passing grade in writing portfolio; satisfactory internship mentor assessments of oral communications
6-7	Students/ Alumni	Exit Interview/ Alumni Survey	annually	80% of alumni are satisfied with the program

Data Analysis

The program director is responsible for collecting the following information annually

1. Course evaluations
2. Course grade distributions
3. Averages on specific exam questions tailored to student learning outcomes
4. Writing portfolio results
5. Internship assessments
6. Exit Interview/Alumni Survey

The PSM program director will provide an initial evaluation of the data outlined above to determine whether the expected results have been realized. He/she will then organize an annual meeting of electric power engineering faculty who will discuss the data listed above. The outcome of this meeting will be a report (written by the program director) listing the results of the faculty assessment. Specific improvements will be suggested by this group and these and the actions taken will be recorded in an archival document. In the following year, the effect of these changes will be noted.

This report will be reviewed annually by the power engineering industrial advisory committee for further recommendations about improvements to the program.

6. DIVERSITY – *Identify strategies for promoting diversity in the WSU Online program.*

WSU is committed to the promotion of diversity within the student population. Online education is often viewed as a means of delivering education to underrepresented populations. The online environment lends itself to mitigating racial, gender, age and cultural stereotypes in community building.

The PSM in Electrical Power Engineering major offered through the WSU Online is anticipated to draw a much different demographic than the MS in Electrical Engineering degree in Pullman. In Pullman, we have a strong showing of both Caucasian and Asian students. Close to all of our students are in the traditional college-age years of 18-22. The online program will offer a different kind of education, allowing working professionals to advance their education while still employed in biology-related industries. This means that we will attract older students, and possibly students of other ethnicities to add to the overall diversity of the program.

7. FUNDING – *Describe the funding model for this distance program and justify the budget requirements.*

The College of Engineering and Architecture will invest sufficient start-up funds in Year 1 to initiate the program; thereafter the College expects to gradually recover its investment from revenues generated in subsequent years, as the program grows.

The details of the funding plan are included in the attached spreadsheet

Table 1 below lists the faculty who teach courses on campus. This faculty group will also teach the online courses. The table indicates the percentage of their time that will be allocated to the online students in the program.

Name	Rank	Status	% Effort in Pgm.*
Robert Olsen, Effort over year	Professor	Perm, Part Time	10%
Anjan Bose	Regents Professor	Perm, Full Time	10%
Chen-Ching Liu	Professor	Perm, Full Time	10%
Ali Mehrizi-Sani	Assist Professor	Perm, Full Time	10%
Vaithianath Venkatasubrmamanian	Professor	Perm, Full Time	10%
Anurag Srivastava	Assist Professor	Perm, Full Time	10%
Pat Pedrow	Assoc Professor	Perm, Full Time	10%
Year 4, Unidentified	Adjunct Faculty	Temp, Part Time	30%
Total Faculty FTE*Effort averaged over 9 months			100%

Table 2 – Enrollments

It is expected that the program will grow from 10 newly enrolled students in Year 1 to 30 newly enrolled students in Year 4. Also, this program is not offered on campus.

Students	Year 1	Year 2	Year 3	Year N*
Headcount	12	20	32	48
AAFTE	9.00	15.00	24.00	36.00

** Year of full enrollment*
*** FTE calculation assumes a student average credit load of 6 credits in fall/spring and 3 credits in summer.*
**** ANNUAL AVERAGE FTE. For graduates, divide total annual credits by 2 to get annual average credits, then by 20 to get AAFTE.*

Table 3 – Administrative and support staff with the percentage effort in the program.

Name	Title	Responsibilities	% Effort in Pgm.
Robert Olsen	Professor	Oversight	20%
Unidentified	Principal Assistant	Student Support - Year 4	10%
Total Staff FTE			30%

Table 4 – Cost per AAFTE, reduced by Year 4 due to economies of scale. **Rationale: It will take more resources per AAFTE to get the program started, but once started there are economies of scale that reduce the cost per AAFTE.*

Table 4 Summary of Program Costs						
This template will calculate the direct, indirect and total cost as well as the cost per student FTE.						
Enter the name of the Degree program here	Date	Internal Reallocation	New State Funds	Summer Funding	Year 1 Total	Year 5 Total
Administrative Salaries, including benefits		33,403	-	11,134	44,537	44,537
Faculty Salaries, including benefits		55,962	-	-	55,962	305,930
TA/RA Salaries including benefits		14,525	-	4,842	19,367	116,201
Clerical Salaries, including benefits			-	-	-	
DDP Services except advising, $90/cr		16,200	-	-	16,200	64,800
Contract Services		-	-	-	-	-
Goods and Services			-		-	
Travel			-			
Equipment			-	-	-	
Other costs		-	-	-	-	-
Library		-	-	-	-	-
Direct Cost		**120,090**	**-**	**15,976**	**136,066**	**531,468**
Indirect Cost		**56,513**	**-**	**7,518**	**64,031**	**250,103**
Total Cost		**176,603**	**-**	**23,494**	**200,098**	**781,571**
AAFTE					9.00	36.00
Cost Per AAFTE					**22,233**	**21,710**

Tables 5a & 5b - Salary Cost Detail for Year 1 and Year 4

Table 5A Salary Cost Detail - Year 1					
Name	**Monthly salary**	**# of months**	**Annual Salary**	**Buyout Pgm %**	**Annual Pgm salary**
Administration:					
R Olsen, est @ professor level	13,911	12	166,932	0.20	33,386
Subtotal Administration	13,911		166,932	0.20	33,386
Faculty:					
Robert Olsen	13,911	4.5	62,600	0.20	12,520
Vaithianath Venkatasubrmamanian	14,473	4.5	65,130	0.20	13,026
Anurag Srivastava	10,000	4.5	45,000	0.20	9,000
Pat Pedrow	9,594	4.5	43,173	0.20	8,635
Subtotal Faculty	47,978		215,903	0.80	43,181
TA/RA's:					
One TA	2,859	12	34,308	0.50	17,154
Subtotal TA/RA	2,859		34,308	0.50	17,154
Clerical staff:					
Unidentified	5,417	12	65,000	0.05	3,250
Subtotal Clerical	5,000	12	60,000	0.05	3,250
Total	69,748		477,143	1.55	96,971

Table 5B Salary Cost Detail - Year 4 - Full Enrollment					
Name	**Monthly salary**	**# of months**	**Annual Salary**	**Buyout Pgm %**	**Annual Pgm salary**
Administration:					
R Olsen, est @ professor level	13,911	12	166,932	0.20	33,386
Subtotal Administration	13,911		166,932	0.20	33,386
Faculty:					
Anjan Bose	27,492	4.5	123,715	0.20	24,743
Chen-Ching Liu	25,926	4.5	116,667	0.20	23,333
Ali Mehrizi-Sani	11,111	4.5	50,000	0.20	10,000
Robert Olsen	13,911	4.5	62,600	0.20	12,520
Vaithianath Venkatasubrmamanian	14,473	4.5	65,130	0.20	13,026
Anurag Srivastava	10,000	4.5	45,000	0.20	9,000
Pat Pedrow	9,594	4.5	43,173	0.20	8,635
3 Adjuncts ea teach 1 class/sem each at $6000/month, each 30%	18,000	12	216,000	0.30	64,800
Devel of 7 courses, fixed amount					70,000
Subtotal Faculty	130,508		722,284	2	236,057
TA/RA's:					
Six TAs	17,154	12	205,848	0.50	102,924
Subtotal TA/RA	17,154		205,848		102,924
Clerical staff:					
Unidentified	5,417	12	65,000	0.10	6,500
Subtotal Clerical	5,417		65,000		6,500
Total	166,989		1,160,064	1.90	378,867

Appendix A

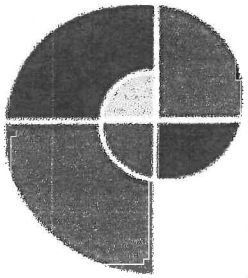
Market Analysis:

Master's Programs in Civil Engineering, Mechanical Engineering, Electrical Engineering, and Construction Management

Washington State University

DRAFT Report

Submission by:



University Professional &
Continuing Education Association
Center for Research and Consulting

October 2012

I. Key Findings

Summary of Secondary and Competitive Research

- According to the Bureau of Labor Statistics, the **employment of civil engineers, mechanical engineers, electrical engineers, and construction managers is expected to grow** from 2010 to 2020, but at widely varied rates among the different fields. The percentage of growth is predicted to be 19% for civil engineers, 9% for mechanical engineers, 6% for electrical engineers, and 17% construction managers. Increases are largely due to the growing diversity of positions in which these professionals can work. Total employment in these fields is expected to grow by roughly 14% nationally.

- With demand and job security for engineers and construction managers showing improvement, **modest salary increases are also expected**, despite difficult economic conditions. Civil engineers are looking at a 1.6% salary increase; mechanical engineers can expect a 1.4% increase, 1.6% salary increase for electrical engineers, and 0.5% salary increase for construction managers.

- **The regions with the highest concentration jobs of for civil engineers, mechanical engineers, electrical engineers, and construction managers are spread throughout the country.** California has the highest number of civil engineers, Michigan the most mechanical engineers, Virginia the most electrical engineers, and Texas is the state with the most construction managers.

- The education required for entry-level engineering and construction management jobs is a bachelor's degree. **Higher-level management and advanced positions generally require a master's degree or a Ph.D.**

- Among the most prominent and common trends affecting the engineering profession are: the **impact of the economy** on tightening project budgets and the search for more energy- and cost-efficient materials and designs; **growth of emerging international markets** creating more demand for American engineers, but also creating greater competition for jobs; and **the environmentally-conscious "green" movement** impacting the approach to building design and construction as well as the expansion of pertinent codes and regulations.

- A total of 38 potential competitors were chosen for comparison, **all of which have online programs.** These programs are spread throughout the country.
    - The average number of credits for these programs is 30.
    - The average in-state program cost for each program is $655 per credit hour for civil engineering, $838 per credit hour for mechanical engineering, $734 per credit hour for electrical engineering and $696 per credit hour for construction management.
    - The average out-of-state program cost for each program is $869 per credit hour for civil engineering, $1,046 per credit hour for mechanical engineering, $969 per credit hour for electrical engineering and $1,094 per credit hour for construction management.
- **None of the 38 schools chosen for comparison offer programs in all four subject areas.** Some of the schools offer programs in two or three of the areas. Construction management, which is expected to see the highest growth in employment, has *the least number of online programs offered.* Electrical engineering has the most with 18.

II. Recommendations

- **Explore opportunities to share internal resources between programs and also to connect them in some fashion in marketing efforts to emphasize stature in the field of engineering.** The absence of any single institution offering degrees in all four areas listed may provide a unique opportunity for Washington State University. The majority of programs evaluated have areas of intersection and overlap; an integrated approach with the four online programs sharing some branding efforts and marketing resources could create unique advantages and present the institution with the opportunity for economies of scale. The WSU brand name is sufficiently strong to confer credibility on these programs. Packaging them together as part of a comprehensive, technologically innovative engineering curriculum could give the institution's offerings their own unique identity and differentiate them from the competition.

- **Integrate access to "cutting edge" technology into the program's value proposition.** High-end software applications and other new technology play crucial roles in the modern engineering profession. Strive to provide access to as many of these industry standard platforms as possible. Few programs evaluated highlight the level of technology used to actually deliver their degrees, which presents another opportunity. Washington State should develop and implement the highest level of technology and program delivery and place a strong emphasis on these aspects of its program.

- **Incorporate the stable value of an advanced engineering degree into the marketing message.** Engineering is already one of the most promising and secure fields to enter. Salaries are on the rise and so are employment opportunities. Allowing working adults to complete a graduate degree entirely online should be a successful endeavor. Highlighting the growth in the industry, and in salary, should be a key aspect of marketing this program. A wise investment with flexible, convenient delivery should make for an attractive product aimed at working professionals.

- **Cultivate international partnerships.** The American economy will only become more globalized, especially for those in the types of jobs filled by engineering graduates, in industries such as construction, energy, product design and defense. Establishing ties to one or two reputable partner institutions in other countries (perhaps with an option for an exchange or study abroad program) will increase the program's value and appeal. There may also be opportunities to connect with American companies with overseas divisions or internationally-based firms working in the U.S.

- **Emphasize the availability of an online construction management degree.** BLS statistics expect this field to experience robust (19%) growth over the next decade, which outpaces the national average for expected job growth during that period and represents the largest projected expansion among the four engineering fields reviewed here. A competitive review also found fewer programs for construction management than for the other three fields. This represents an opportunity to differentiate WSU's offering. Consider designing a focused marketing campaign specifically devoted to highlighting the availability of an online construction management degree from a highly respected institution.

III. Occupational Analysis

Electrical and Electronics Engineers

Electrical engineers and electronics engineers have similar jobs in that they both use engineering, design software, and equipment to complete engineering projects. Both positions will also work with other engineers to discuss existing products and brainstorm about improvements and new products.

Electrical Engineers – design, develop, assess, and manage the manufacturing of electrical equipment which may include: electrical systems of automobiles and aircraft, electric motors, radar and navigation systems, communications systems, and power generation equipment. Electrical engineers develop new uses of electric power to produce new and improved products. They also provide calculations to compute manufacturing, installation, construction specifications and standards. These engineers also work with the manufacturing, installing and testing of products according to specifications and codes; this ultimately ensures that projects are satisfactorily completed on-time, on-budget. They may be called upon to address complaints and solve problems in working with the public and customers.

Electronics Engineers – design and develop electronics equipment including portable music players, global positioning systems, and broadcast and communications systems for industrial, medical, military, or scientific applications. They may also work in areas related to computer hardware. Electronics engineers may analyze electrical systems requirements, capacity, cost and customer needs to ultimately develop a systems plan. They will also create the maintenance and testing procedures for electronic equipment. These engineers may also be involved in evaluating and inspecting electronic systems and equipment to ensure they meet safety standards and regulations. If these are not met, they will recommend the necessary repairs or design modifications. Electronics engineers may also plan and develop modifications to existing electronic properties in systems and equipment to ultimately improve technical performance.

The following salary figures are from the U.S. Bureau of Labor Statistics Occupational Outlook Handbook and Occupational Employment Statistics. Table 1 shows the median salary for electrical engineers increased by 1.6% from May 2010 to May 2011. It also shows the median salary for electronics engineers increased by almost 1.5% between May 2010 and May 2011.

Table 5: Median Salary from May 2010 to May 2011: Electrical and Electronics Engineers

	May 2010	May 2011
	Median salary	Median salary
Electrical and Electronics Engineers	$ 87,180	
Electical Engineers	$ 84,540	$ 85,920
Electronics Engineers, Except Computer	$ 90,170	$ 91,500

Data source: U.S. Department of Labor, Bureau of Labor Statistics

Table 6 shows that the employment of electrical engineers is expected to grow by 7% from 2010 to 2020, a 5% increase in a decade.

Table 6: Occupational Employment Projections: Electrical and Electronics Engineers

	May 2010	2020	Change, 2010-20	
	Employment	Projected employment	Number	Percent
Electrical and Electronics Engineers	294,000	311,600	17,600	6
Electical Engineers	154,000	164,700	10,700	7
Electronics Engineers, Except Computer	140,000	146,900	6,800	5

Data source: U.S. Department of Labor, Bureau of Labor Statistics

The U.S. Department of Labor (DOL) estimated the employment of electrical engineers as 154,000 in May 2010. The DOL predicts that employment for this occupation will gain 10,700 jobs by 2020, an increase of 7% which is lower than the 14% for all occupations.

The U.S. Department of Labor (DOL) estimated the employment of electronics engineers at 140,000 in 2010. The DOL predicts that employment for this occupation will have a 5% increase by 2020, an increase of 6,800 jobs. This percentage of increase is lower than the 14% increase for all occupations.

The small increase for both positions is mainly due to their versatility in developing and applying new technologies. The manufacturing industry will experience low or negative growth, which will also cause growth to be low for electrical and electronics engineers. Engineering services firms will see the highest growth because it is less expensive for companies to contract these firms instead of having engineers on staff. There will also be growth for engineers in computer systems design and wireless communication, as well as technology innovation in research and development.

The state employing the most electrical and electronics engineers is California with 20,620 and 30,840 jobs respectively.

The Los Angeles-Long Beach-Glendale, CA Metropolitan Division is the metropolitan area employing the most electrical engineers, with 5,330 jobs. The San Jose-Sunnyvale-Santa Clara, CA metropolitan area employs the most electronics engineers with 8,940 jobs.

The Northeastern Virginia nonmetropolitan area employs the most electrical engineers out of all nonmetropolitan areas with 480 jobs. The St. Mary's County, MD nonmetropolitan area employs the most electronics engineers with 1,470 jobs.

The District of Columbia has the highest annual mean wage for electrical engineers at $104,610as well as the highest annual mean wage for electronics engineers at $110,140.

The metropolitan area with the highest annual mean wage for electrical engineers is Wilmington, North Carolina at $119,170. The San Jose-Sunnyvale-Santa Clara, CA metropolitan area has the highest annual mean wage for electronics engineers at $121, 290.

The Other North Carolina nonmetropolitan area has the highest annual mean wage for electrical engineers at $125,660. The nonmetropolitan area with the highest annual mean wage for electronics engineers is Northeastern Virginia, at $112,110.

Typically, a bachelor's degree is required for entry-level positions as an electrical or electronics engineer. A Professional Engineer License will make it easier for a professional to acquire a job or a promotion. Employers also value practical experience, such as a cooperative engineering program offered by some educational institutions. There are also five-year programs for students to obtain a bachelor's and master's degree. A graduate degree will allow professionals to obtain a job as an instructor or in a research and development position.

Trends in Electrical Engineering

Electrical Engineering spans numerous sub-disciplines and segments of industry and research such as power, controls, microelectronics, sustainable energy, automotive, consumer electronics, wireless communications, and aerospace. Though there are various trends in each of these, a sampling of some of the more general trends are highlighted here.

- **Faulty Wiring and Safety** – Both the aging and inadequate power grids of impoverished, Third World and rapidly expanding areas of the world and the increasingly sophisticated networks required by "smart cities" of the industrialized world are subject to the threat of faulty or failed wiring. In many areas of the United States, the power infrastructure is aging and insufficient for meeting the population's growing need for electricity. Electrical engineers will be at the forefront of developing the monitoring and preventive maintenance systems needed to address these problems. Safety issues have always been important for electrical engineers, but as technology develops it will become even more important to ensure safety automatically or signal an impending problem before it happens.

- **Lighting and Power Engineering** – Going along with the need to anticipate and detect failures in existing power grids due to increasing urbanization and higher electricity consumption is the demand for new and better solutions to replace the aging and inadequate existing networks. American cities and suburbs need better, more efficient means of delivering electricity to homes and businesses and lighting public areas, commercial spaces and roadways. The

persistent, essential nature of this need, alongside the vital importance of improving energy and cost efficiencies in the process, will open up numerous opportunities for electrical engineers in the public and private sectors.

- **"Going Green"** - As environmental awareness continues to rise, more and more focus is being placed on producing eco-friendly products, as well as applying green principles to the ways in which they are manufactured. New and emerging technologies along with existing green efforts span many sectors of industry and areas of electrical engineering. In addition to ongoing quests in applying the use of renewable sources of energy (wind, solar, etc) and the advancement of alternative fuel automobiles, there are many efforts focusing on developing more energy efficient products. One example is the effort to reduce the power consumption of evolving broadband wireless networks. Also, greater advancements are being made in battery technologies.

- **Regulations** – The impact of "green" initiatives on the profession is not felt only in the laboratory. Yet another emerging trend affecting electrical engineering is the rash of new and ever-changing national and international regulations and standards, many of them aimed at controlling environmental impact and increasing energy/cost efficiency. This will require electrical engineers to keep pace with new developments and understand how to develop compliant models.

- **Innovative Equipment** - Innovations and growth in pneumatic and hydraulic equipment will also play a part in the future of electrical engineering. These systems are air and hydraulic driven which makes them safer to operate. The advent of safer, new technologies using hydraulics and other complimentary technologies is likely to open up new job opportunities for electrical engineers.

- **Personal Electronics** – People around the world are using and depending more and more on personal electronic devices (music players, smart phones, tablets, etc.) and finding new uses and needs for technology in their daily lives. The demand for these devices to become ever more sophisticated and powerful (and smaller) will continue. This will foster new innovations and technology advancements in many areas of electrical engineering. This includes more advanced microelectronics (smaller, faster, more power efficient, etc.), as well as new innovations and improvements in wireless communications, signal processing, network infrastructures, battery technology and more. Mobile cloud computing (combines mobile computing and cloud computing) is also an emerging technology that will likely play a part in driving further advancements in various areas of electrical engineering.

- **Size and Efficiency** – Miniaturization is a trend that has been prominent in nearly every aspect of modern lives. The drive to reduce the size of everything from consumer goods to industrial machinery, for reduced costs and greater

efficiency, has become an increasingly important part of the design and manufacturing process. Electrical engineers will be tasked with designing equipment and parts that are smaller, lighter and faster while maintaining or improving performance.

IV. Competitive Analysis

Secondary research has produced a representative list of potential competitors to the Washington State University online program. Table 9 shows the institution, degree and online availability.

Table 9: Competitors

	Civil Engineering	Mechanical Engineering	Electrical Engineering	Construction Management
Arizona State University	NO	NO	YES	NO
Auburn University	YES	YES	NO	NO
California State University, Fullerton	NO	NO	YES	NO
Capitol College	NO	NO	YES	NO
Colorado State University	YES	YES	YES	NO
DeVry University	NO	NO	YES	NO
Drexel University	NO	NO	YES	YES
East Carolina University	NO	NO	NO	YES
Florida International University	NO	NO	NO	YES
Georgia Institute of Technology	NO	YES	YES	NO
Iowa State University	NO	YES	YES	NO
Johns Hopkins University	NO	NO	YES	NO
Kettering University	NO	NO	YES	NO
Lehigh University	NO	YES	NO	NO
Michigan Technological University	NO	YES	NO	NO
Milwaukee School of Engineering	NO	NO	NO	YES
Mississippi State University	YES	YES	YES	NO
Missouri University of Science and Technology	YES	YES	NO	NO
North Carolina State University	YES	YES	YES	NO
New Jersey Insitute of Technology	YES	NO	NO	NO
Norwich University	YES	NO	NO	NO
Oklahoma State University	NO	NO	YES	NO
Polytechnical Institute of NYU	NO	NO	YES	NO
Southern Methodist University	YES	YES	YES	NO
Stanford University	YES	YES	YES	NO
University of Alabama	YES	YES	YES	NO
University of Buffalo	NO	NO	YES	NO
University of Colorado, Boulder	NO	NO	YES	NO
University of Delaware	NO	YES	YES	NO
University of Florida	NO	NO	NO	YES
University of Idaho	YES	YES	YES	NO
University of Illinois at Urbana-Champaign	NO	YES	NO	NO
University of Louisville	YES	NO	NO	NO
University of Maryland Baltimore County	YES	NO	NO	NO
University of Southern California	NO	NO	NO	YES
Western Carolina University	NO	NO	NO	YES
Western New England University	NO	NO	YES	NO
Widener University				

Table 9 also shows that few institutions offer an online master's degree in Construction Management in comparison to the other three areas. Many of the institutions listed offer their programs as a Master of Engineering or a Master of Science, and offer degrees in more than one focus area listed above. Furthermore, the majority have brick and mortar classroom program offerings as well, or at the very least allow online students to have access to their facilities.

The following tables show the competitors for each discipline and the description for each program will be found in the appendices at the end.

APPENDIX

INTERN ASSESSMENT FORM (MENTOR ASSESSMENT)

Intern's Name: _____

Name of Company: _____

Mentor: _____ Date: _____

Intern's Position or Assignment: _____

_____

_____

_____

PART I Please complete this evaluation at the end of the intern's work period. The main goal of this assessment is to determine whether through participation in the Professional Science Masters program the intern 1) has received an education appropriate to the needs of your organization and 2) has been able to apply principles taught in the program to problems faced during the internship.

You are encouraged to discuss the completed form with the intern to aid in their professional development. The evaluation is a mechanism that the Professional Science Masters Faculty has employed to inform its continuous improvement program, therefore it is not confidential. Please use the scale below to evaluate your intern's performance in the following areas:

1	2	3	4	5	6
Needs more training or education	Performing below expectations	Acceptable performance	Above average performance	Superior performance	Not observed

Job Assignment Performance

Sufficient knowledge to perform tasks	1	2	3	4	5	6
Verbal communication skills	1	2	3	4	5	6
Written communication skills	1	2	3	4	5	6
Analytical skills – analyses problems and takes appropriate action	1	2	3	4	5	6

Uses technical skills required for the position	1	2	3	4	5	6
Meets deadlines	1	2	3	4	5	6
Takes initiative to get a job done, including overcoming obstacles	1	2	3	4	5	6
Sets priorities	1	2	3	4	5	6

How would you assess the intern's overall performance?

☐ outstanding ☐ above average ☐ satisfactory ☐ below average ☐ unsatisfactory

INTERN ASSESSMENT FORM (MENTOR ASSESSMENT)

PART II

This section gives you the opportunity, as an experienced professional, to make recommendations that would help in the professional development of the intern as well as give the Professional Science Masters Faculty some insight into the areas that may need more attention. Based on your observation of skills exhibited by the intern during this iternship

What do you consider the major strengths of the education received by the intern through the Professional Science Masters program?

_____
_____
_____
_____
_____
_____
_____

What do you consider to be areas of the program that could be strengthened?

_____
_____
_____
_____
_____
_____

What would you recommend to make this student better prepared for the workplace? (e.g. courses, activities, skills acquisition)?

_____
_____
_____
_____
_____
_____

Other comments, commendations, or recommendations:

Thank you for your time in completing this evaluation!

Please place form in a sealed envelope and address to: Ms. Jody Opheim, Energy Systems Innovation Center, Washington State University, Pullman, WA, 99164-2752, or Email a pdf to : opheim@wsu.edu. Questions, call 509-335- 6456

#044

Lambeth, Suzanne Terese

From: Sherman, Jane
Sent: Friday, September 20, 2013 11:15 AM
To: Lambeth, Suzanne Terese
Subject: FW: Proposal for Professional Science Master's in Electrical Power Engineering

Good Morning, Suzanne –

The Provost has approved moving the PSM in Electrical Power Engineering on to the Faculty Senate process, and I believe that Bob Olsen has provided you with the appropriate documents.

Thank you for your help.

-- Jane

Jane C Sherman
Vice Provost for Academic Policy and Evaluation
Washington State University
410 11th Avenue SE, Suite 102
Olympia WA 98501
360.534.2322

From: Bernardo, Daniel John
Sent: Wednesday, September 18, 2013 8:38 PM
To: Sherman, Jane
Subject: RE: Proposal for Professional Science Master's in Electrical Power Engineering

Ok. Pls move it forward to Faculty Senate.
Thanks,
Dan

From: Sherman, Jane
Sent: Tuesday, September 17, 2013 3:38 PM
To: Bernardo, Daniel John
Subject: Proposal for Professional Science Master's in Electrical Power Engineering

Dan –

This proposal has been reviewed by the Graduate School, the Budget Office, and the Libraries. It has the support of the College of Engineering and the Global Campus. It makes a good case for employer need, student demand, and program quality.

There are no outstanding issues, so I would like to move it on to the Faculty Senate if it has your support.

Thanks.

-- Jane

Jane C Sherman
Vice Provost for Academic Policy and Evaluation
Washington State University
410 11th Avenue SE, Suite 102