

**2009-2011 OUS Agency Request Budget
Engineering & Technology Industry Council (ETIC)
Policy Package Proposal
1/22/2009**

Title: ETIC Proposal for Enhancing Engineering & Technology Education and Research

Agency Request, 2009-2011:

General Fund Request	\$ 3,000,000
Expected private support	\$ 10,732,524

Overview

This proposal focuses in three areas: recruitment, retention and clean tech. The first two areas focus on increasing the quantity and diversity of graduates, consistent with ETIC’s 2X Strategy and the Governor’s 40/40/20 Strategy. The third focuses on increasing the number of work ready graduates available to support Oregon’s sustainable industries and provide these industries with state-of-the-art research capacity. These investments in graduates and research will not only support existing sustainable industries but further enhance Oregon’s attractiveness to companies considering establishing a presence in Oregon.

The proposed budget allocations are given on page 15. The associated private support is summarized on page 18.

Recruitment

This section describes ETIC’s recruitment strategy known as the Oregon Pre-engineering & Applied Science (OPAS) Initiative. The OPAS budget is given on page 16. The forecasted student participation is given on page 17.

For ETIC to achieve its goal of doubling the number of engineering and technology degrees, Oregon needs a growing number of college freshmen motivated and prepared to pursue these degree programs. Unfortunately, interest in engineering and applied technology degree programs among college-bound high school students has been flat in engineering and has shown a significant decline in computer science over the last several years. The problem is due in part to a lack of exposure to these disciplines: Of the 170,000 Oregon high school students in over 220 high schools, fewer than 5,200 students in only 33 high schools take even a half credit in “engineering and technology” courses. Similarly, fewer than 60 Oregon students took AP computer science exams in 2007, about one-third the national average as a percentage of AP tests taken. With regard to gender and ethnicity, it is worth noting that only six of the students taking the AP computer science exams were women and, of the 57 students who reported ethnicity, all but one were white or Asian. This is consistent with other data indicating low rates of interest and participation in engineering and applied science in high school and college by women and non-Asian minorities.

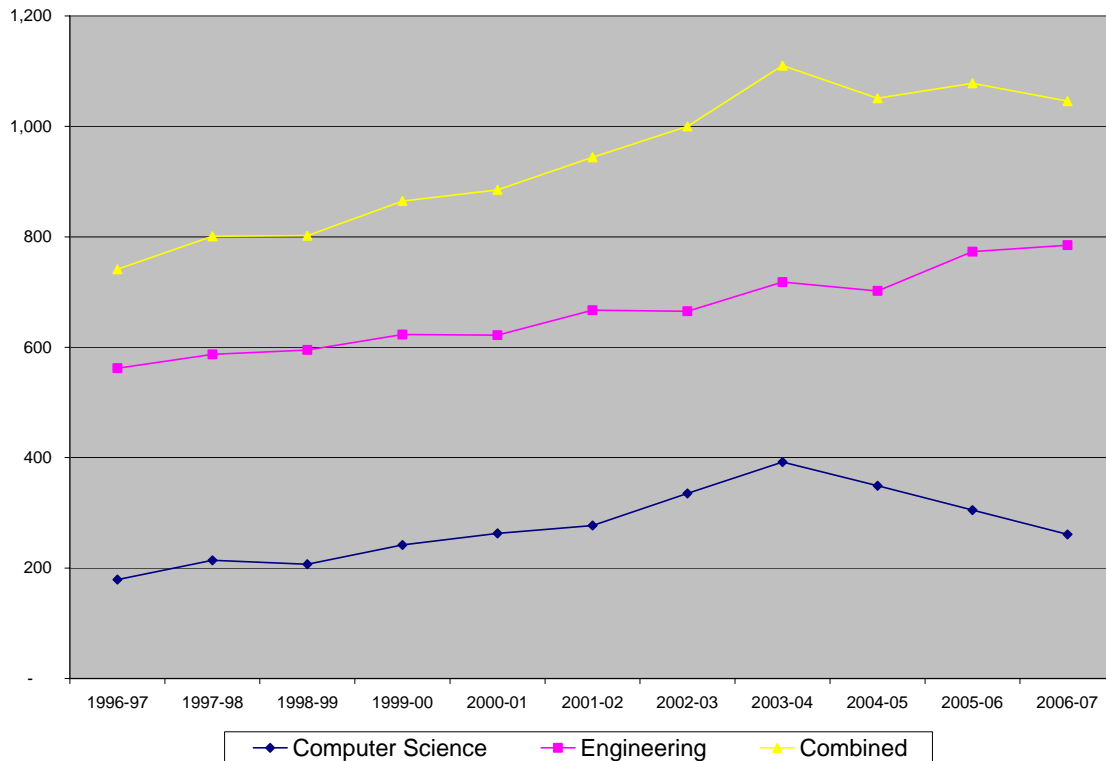


Figure 1: Engineering and computer science bachelor's degrees have grown by 41% from 1997 to 2007. But recently computer science degrees have been dropping, and growth in overall engineering and computer science degrees has stalled.

ETIC recommends a six-year initiative to expand the pool of well-prepared high school students who choose to pursue engineering and applied science majors in college.

In-Class Offerings: Engineering, computer science and applied science courses should be offered much more broadly as a part of state-wide college preparatory programs. In-class programs have a high impact on students since they provide a content rich curriculum, significant contact hours, and teaching by trained educators.

Out-of-School-Time Offerings (OST): Investment in engineering and applied science which target in-depth experiences that provide the contact hours, mentoring, and hands-on engagement required to significantly impact student interest, academic engagement and college plans.

Intensive internships for high school students and teachers. Such programs have proven beneficial for students who have demonstrated high potential and preparation when these internship experiences are at the time they are preparing to make key post-secondary education decisions like choice of college and major. One program of this type, Saturday Academy's Apprenticeships in Science and Engineering, has shown that 70% of participating students choose a college major in the field of their high school apprenticeship. Once funded, apprenticeship programs can be rapidly expanded and quickly impact the college applicant pool. Similarly, teacher internships provide high leverage because every teacher that gains a better understanding of a technical field

through an internship can impact hundreds of students by bringing new insights back to the classroom.

Team-based activities for younger students—fourth grade to ninth grades. Social context is important to students' participation and engagement in engineering and applied science programs. OST programs, such as the Oregon Robotics Tournament and Outreach Program (ORTOP), engage teams of students in demanding and socially relevant technical challenges and bring groups of students together for culminating contests and events. Such programs have proven successful in engaging students in authentic learning experiences that influence academic and career choices. Expanding such opportunities state-wide will require start-up funding and collaborations with schools to provide the necessary access to school facilities and provision of OST engineer coaching staff and engineering challenge kits. Other programs designed to reach under-represented groups include OSU's Science and Math Investigative Learning Experiences (SMILE) and PSU's Mathematics Engineering Science Achievement (MESA). We will make investments in such programs to expand the total group of students prepared for and motivated to choose engineering and applied science degree paths in college

Communication & Marketing

The primary audiences for our marketing will be will be pre-college students, families, teachers, counselors and community members. Our goal will be to enhance awareness and understanding of the opportunities represented by engineering and applied science. We will also increase the awareness of in-class and out-of-class pre-engineering and applied science opportunities in Oregon. Secondary audiences include (a) OUS campuses, community colleges and K-12 as partners in our efforts. (b) The business community, nonprofit or community organizations as partners and co-sponsors of our efforts.

The communication campaign will have three main components:

- **Web Presence.** Develop an increased and more dynamic web presence for pre-college outreach-related communications using websites and social networking technology, aimed to increase youth awareness and participation in educational and pre-career opportunities in engineering related fields.
- **Print material and distribution.** Develop and distribute printed marketing materials in companion with the web presence.
- **Speakers' Bureau.** Create a speakers' bureau and develop and expand speaking opportunities and materials. Increase arenas for adults with engineering/computer science expertise, including industry professionals, alumni, and/or college students, to present to classrooms and other K-12 student venues.
- **Advertising Campaign.** Create and implement advertising campaign to expand awareness of and participation in engineering and computer science educational paths and careers. Recruit private funds to underwrite this campaign. Engage advertising firm to design and implement campaign that compliments the design and content of web, print, and presentation efforts.

Retention

ETIC has established a new Retention Task Force, which will develop a statewide strategy that assures that best practices already in use in Oregon are deployed with

maximum impact on all campuses. In addition this task force will assure that best practices being used in other states are brought into play in Oregon. To enable the Task Force's work, the proposed investment reserves 5% that will be used during the next biennium based on a competitive Request For Proposals process that will use criteria developed by the Task Force and approved by ETIC to select the highest impact investments in retention.

In addition to the pooled investment, specific investments will be made at several campuses as described below and as summarized in the table on page 15. The resulting increases in retention are described on page 17.

Eastern Oregon University

EOU will update the existing computer labs, which at present are using machines nearing the end of their useful lives. Providing the students with up-to-date facilities will assure that the students know that they are receiving a state-of-the-art education and generate a sense of excitement in the program. Students who believe that by leaving they would be missing out on an opportunity to learn and prepare for successful careers are more likely to stay with the program.

A portion of the funds requested will be used to offer workshops to accompany CS 161 (Foundations of CS) and CS 260 (Data Structures). The workshops are peer-lead sessions for students in introductory classes, designed to enhance problem solving skills and improve confidence levels. These two courses have traditionally been "gatekeepers" that prevent many students from continuing in CSMM. Over the last ten years, EOU has developed and delivered similar workshops in support of math and chemistry courses. Analysis of data collected from these workshops has demonstrated significant improvement in student success rate and retention. Drawing from this expertise, we believe that the same approach will benefit CS students.

EOU will also enhance undergraduate research opportunities. Dr. Hettiarachchi's work in robotics has been an extremely powerful motivator for the students involved, and provides opportunities for EOU undergraduates to present at professional conferences and publish in peer reviewed journals. Expanding this program enhance retention by generating a sense of growth and excitement in the program.

These combined efforts will increase retention from freshman to sophomore years and retention of transfer students, ultimately resulting in increased graduation rates.

Oregon State University

Research into best practices in recruitment and retention was undertaken at OSU under a 5-year grant from the Hewlett Foundation (HF) that ended in July 2008. Findings of the team composed of five OSU faculty are documented in a final report and two research publications.^{1 2 3} Activities of the team included a benchmarking study and subsequent

¹ T. L. Doolen, R. K. Paasch, J. D. Porter, M. Quinn, J. R. Zaworski, "2008 Final Report to the William and Flora Hewlitt Foundation on An Integrated Learning Platform to Improve Engineering Recruitment and Retention", Oregon State University.

set of recommendations to the College of Engineering (COE) in Spring of 2006. Legacies of this funding have been leveraged with other ETIC funds to target recruitment and retention efforts across COE, particularly in undergraduate programs. The recommendations that the HF team delivered to COE in Spring 2006 were:

- The COE should create freshman interest groups that include a common residential hall experience as well as a common set of courses for small student cohorts.
- The COE should foster the creation of a large variety of small, extra-curricular programs that first- and second-year students find attractive and accessible.
- Departments/Schools in COE should develop and hold high-quality open houses and career seminars that would improve pre-engineering students' awareness of engineering disciplines outside their declared major.

In response, the following programs were instituted:

- Transitional Learning Communities, particularly in freshmen orientation courses, to improve student success and retention
- Orientation activities for incoming engineering freshmen to acquaint them with important resources within COE. This effort has led to the creation of a program called COE CONNECT, which is now run and hosted by the Undergraduate Engineering Program office within COE.
- COE Program Open Houses. This effort is now the annual Engineering Awareness Week. This week is organized by the Undergraduate Engineering Program office and supported by all programs within COE as well as by some additional programs, including Forest Engineering.

In addition, the following programmatic improvements have been made:

- Laptop requirement for all COE students: laptops are used in a variety of COE classes and have been central to enabling active learning methods to be utilized by instructors across COE. While the initial focus for OSU was freshmen and sophomore level courses, this effort has now impacted courses and students across all years.
- Integration of active learning techniques into courses across COE and College of Science.
- Development of a retention analysis and tracking tool that continues to be used by the Undergraduate Programs office to better understand retention within COE.

Examples of our success with innovative programs to produce work-ready undergraduates include:

- In 2007, IEEE recognized the TekBots team for leadership in engineering innovation. TekBots is now used by several universities across the globe because of its unique way of delivering hands-on learning to electrical and computer engineering students.

² R. Chompu-inwai and T. L. Doolen, (2008). "The Impact of Mobile Wireless Technology on Student Attitudes in Higher Education Classrooms," *International Journal of Engineering Education*, v. 24, n 1, pp 14-22.

³ T. L. Doolen and M. Long, (2007) "Identification of Retention Levers using a Survey of Engineering Freshman Attitudes at Oregon State University," *European Journal of Engineering Education*, v. 32, n. 6, pp. 721 - 734.

- Hands-on experiences are pervasive across OSU engineering including privately funded early research internships supporting research clusters, and K-12 outreach programs
- During the past 3 years, 40 OSU engineering student teams placed in the top 3 in their respective national and international competitions spanning all disciplines.
- COE has three international partners engaged in collaborative global projects. For example, in fall 2008, a team composed of OSU and German students will jointly design a Formula SAE car.
- Platforms for learning: Tekbots, Community of Code; private investment has launched a Communications Platform for Learning that extends through the curriculum with the goal of improving oral, written and new media communication skills of our graduates.
- Leadership development for undergraduate mentors in freshmen orientation classes
- Capstone design experiences, many of which feature industry projects
- Minor in Entrepreneurship (delivered by College of Business)
- And this year, the 100 member companies of the MECOP/CECOP program will hire nearly 400 interns, providing each with two six-month industry experiences.

OSU will focus on academic success for at risk students. OSU is working hard to promote the academic success of all of our students through focused access to the Academic Success Center and their academic learning service courses. OSU will pilot an early intervention process with freshmen and possibly sophomore students to connect them with “near-peer” support when they encounter academic difficulties. OSU has instituted a more formal, early intervention process to identify upper-division students with academic difficulties to help them locate and utilize the right assistance.

Portland State University

Retention-Freshmen Programs

The freshmen retention efforts of the Maseeh College of Engineering and Computer Science will build upon the retention work done at PSU by several groups studying the freshmen experience. MCECS Freshmen Program elements are derived from the First Step for Student Success report (PSU Student Affairs task force, 2008), from the APPLES Survey administered at the Maseeh College (2008), from PSU’s Freshmen Inquiry general education program, and from the engineering retention literature.

The Maseeh College will establish a faculty-led Freshmen Programs Team, assisted by a Freshmen Programs Coordinator. The Freshmen Programs Team efforts in the 2009-2011 Biennium will include the following tasks:

- Develop the Maseeh College’s undergraduate peer mentoring program for freshmen in engineering and computer science; the program will be modeled upon the success of near-peer mentoring in the Freshmen Inquiry program of PSU’s University Studies office;
- Increase faculty engagement with freshmen students through targeted Freshmen Programs mini-grants;

- Develop “How to Succeed in Engineering” orientation course, for entering Maseeh College freshmen;
- Develop ongoing freshmen seminar series, special events and career workshops; and;
- Provide focused advising for freshmen students.

Women and Minority Programs

PSU will also develop a new program supporting women and minority students traditionally underrepresented in engineering. Working closely with Oregon MESA (Mathematics Engineering and Science Achievement), the new program will be modeled upon the experience of several successful MEP (MESA Engineering Programs) currently in place at campuses around the nation.

Retention-focused MEP program elements at PSU will include the following tasks:

- Develop Academic Excellence workshops focused on group study and collaborative learning;
- Develop community building activities;
- Develop a MEP Study Center offering focused advising and counseling services and connections to appropriate campus student services;
- Support Maseeh College student organizations focused on underrepresented students, and;
- Monitor of MEP students academic progress, providing focused interventions as needed.

The MEP program advisor will also work to coordinate Maseeh College outreach efforts focused on underrepresented students, such as the Bridges program operated by the Portland State Admissions office. A part of the first biennium activities will include building a stable funding base, in collaboration with industry, education and community partners.

Both the MEP Program and Freshmen Program team activities will be evaluated annually with results reported to the Maseeh College Dean’s office and the PSU retention team.

Southern Oregon University

AT SOU retention is grounded in providing students with current knowledge and training, equipment and software at the forefront of technology as well as classes that are relevant and lead to a career that is both interesting and rewarding. Another, often overlooked, aspect of retention is a sense of community. With these things in mind, retention monies will be spent on both improving equipment in the arenas most likely to give students exposure to current thinking in our discipline and in providing for them a sense of community.

Specifically SOU will purchase equipment to enhance the network/security lab. Additional equipment and software aimed at forensic analysis, such as root kit detection, cell phone and hard drive data recovery and “cracking” software used to break encrypted

data will add much to the attractiveness and effectiveness of degrees in this highly visible field.

A sense of community can best be accomplished by providing an area for students to congregate, discuss, share and relate. Investments will be made in the network/security lab and an open space next to our lab upstairs of the main computer lab by furnishing these areas and to them a computer science identity. These improvements will also make it easier for faculty to host informative seminars on what it means to be a Computer Scientist and what types of activities students can engage in when they graduate.

All these will be strategically directed and targeted at under represented groups as much as possible. The 2005 U.S. Census Bureau shows that SOU, located in Jackson County has a relatively large number of Hispanic and American Indian/Alaska Native persons. Jackson County has a larger Hispanic population (8.1%) than the counties that surround it (average for these surrounding counties, 5.4%). Jackson and the surrounding counties have a Native American population (average, 2.1%) that is more than double the national average (1%). Our visits to high schools and community colleges as well as our involvement in the various recruitment initiatives at SOU exposes us to this group, increasing our chances at expanding enrollment and retention of under represented groups. Our physics, materials science and engineering departments are have the most diverse faculty on our campus, giving us a unique advantage of understanding the needs of minorities. A computer science effort at preserving Native American languages has given us a strong connection to this often forgotten group.

Clean Tech

Clean Tech is generally defined to be renewable energy and green building practices. Examples of renewable energy include solar, wind, wave, biofuels, and geothermal. Examples of green building practices include use of sustainable materials and high-efficiency energy systems. We propose to make significant investments during the next biennium to assure that Oregon has work-ready graduates to help serve the clean-tech industries and the university research resources that these industries need to assure growth through innovation.

Oregon Institute of Technology

Clean Tech is arguably the most important program at OIT. The university founded the Oregon Renewable Energy Center (OREC) in 2002 to focus on applied research in renewable energy, the component of Clean Tech that is most recognizable by the general public. Following that, OIT founded the first Renewable Energy Systems program in the nation three years ago at its Portland campus. The program is now Renewable Energy Engineering, is available in Klamath Falls as well, and has become the fastest growing program not only at OIT but in any OUS university. It is now the driving force for OIT's mission of producing skilled engineers and technologists.

The additional funding will be used to underwrite additional equipment and student projects for the **Renewable Energy Engineering Program**, among the most successful in the OUS system in terms of growth and student interest. Because of its appeal and importance, the School of Engineering, Technology, and Management is incorporating

renewable energy as an overall theme in existing classes, through projects and research, and in new areas such as entrepreneurship. These new activities in renewable energy require additional funds to furnish labs, acquire supplies for projects, and support student and faculty applied research through OREC.

Oregon State University

Developing Work Ready Graduates

Not only will our students be grounded in the fundamentals of engineering disciplines relevant to clean tech, but they will also learn by doing as undergraduates working on research projects, engaged in internships, and senior capstone projects. These learning opportunities are already emerging: both graduate and undergraduate students are involved in research and projects related to alternative energy applications and several of our MECOP partner companies are in the wind and solar energy sectors. Continued growth of our research in clean tech will increase such opportunities. OSU is in discussion with Renewable Northwest on further engagement in internships and capstone projects as a means to boost work force development.

In order to meet the demand for work ready graduates in Oregon's growing alternative energy sector, during 2009-11, OSU will develop a new undergraduate degree program in Energy Engineering Management (EEM). The EEM degree builds on existing strengths in our Industrial Engineering and Construction Engineering Management programs, and additionally gives our students skills to engage in all aspects of energy engineering including understanding sources and requirements, methods of production, efficiency, and project management. This program will develop professionals with knowledge and skills needed to engage in multiple facets of clean tech development and implementation. In addition, there was a recently submitted proposal to Department of Energy on which the faculty involved in the ONAMI research cluster were a key partner—other collaborators include Pacific NW National Labs, Los Alamos National Labs and three major automotive companies. If funded, these faculty will propose an Integrative Graduate Education and Research Traineeship program to the National Science Foundation. Such a program would increase OSU's visibility in education in the areas of hydrogen and alternative energy in general.

Growing Research and Economic Impact

OSU Engineering will build on existing R&D strengths to further develop clean tech impact. Those strengths are demonstrated in research grant and contract wins during the first quarter of FY 09:

- a. Electrical power generation.
 - i. An OSU led partnership with UW and NREL was just awarded one of two DoE National Marine Energy Centers with funding of over \$13.5M for five years (with 80% funding to OSU). The interdisciplinary and multi institutional center is being directed by the College of Engineering and includes development of direct drive technology developed at OSU. Columbia Power Technologies was formed to implement this technology.
 - ii. OSU's strength in power electronics (having the largest capacity academic power lab in the US) recently attracted a \$0.36M grant from BPA to improve wind energy integration and control through more

- effective coordination of energy storage technologies using advanced power electronic converters.
- iii. OSU is an international leader in ultra safe design of nuclear power generators. That expertise is evident in the Westinghouse AP1000 design that was recently sold to China for multiple sites, and Chinese engineers are currently working at OSU to understand the fundamentals of the design.
 - iv. Additionally, OSU recently spun out NuScale Power, a company that is commercializing a totally passive small scale design (35MW) that will deliver distributed power.
 - v. Moreover, OSU just received a \$6.6M contract from the Nuclear Regulatory Commission (NRC) to develop a scale model of the high temperature gas reactor, the US Department of Energy's next generation design. Though this area of R&D is not within the definition of clean tech, it is an example of OSU's impact on helping the nation develop non-carbon based sources of electrical power.
- b. Biofuels and micro-reactors.
- i. OSU has developed micro-reactor technology suitable for bio diesel production as part of the ONAMI collaboration. MTEK Corp was formed from these research results. Trillium Fiber Fuels is exploring biofuel production from cellulose with COE faculty.
 - ii. Other applications of micro-reactor technology are being investigated including desalination, as clean water is becoming one of the world's most precious resources.
 - iii. OSU is initiating a collaborative research program with Vulcan Power and PGE to develop algae to biofuel production.
 - iv. OSU has Sea Grant support to develop cellulosic ethanol products from soft woods.
 - v. Faculty in OSU and several other universities have submitted a proposal to US Department of Energy for a Federal Energy Research Center of Oregon. The Center will focus on the biological production of hydrogen using genetically modified algae.
- c. Energy Storage.
- i. The Microproducts Breakthrough Institute Collaboration with PNNL has proposed funding for a novel method of hydrogen storage.
- d. Solar Energy.
- i. OSU has developed transparent electronics technology that has been licensed for solar photovoltaic applications.
 - ii. An ONAMI collaboration including science and engineering faculty at OSU and UO is preparing a proposal to the US DoE that will establish the Federal Energy Research Center of Oregon. This center will focus on new materials for solar electricity generation and storage.
- e. Green Buildings & Smart Infrastructure.
- i. The National Science Foundation just awarded \$10M to fund the Institute for Computational Sustainability led by Cornell with OSU as a partner (up to \$4M of funding will flow to OSU). The Institute will apply optimization theory to natural resource allocation and management.
 - ii. OSU and UO also recently won a \$1.5M multi-year National Science Foundation grant for a green chemistry center that will create new

materials using processes that are less intrusive to the environment. The new electronic materials will have many applications in energy and information technology.

- iii. In addition, OSU has an emerging program in green building and smart infrastructure technology that is commencing in FY 08 with the additional of two new faculty members and a program director. Our opportunity is to couple this with existing strengths in sustainable alternatives to traditional construction materials, intelligent information systems and autonomous systems/controls to develop and apply new technology to building system design and operations.

Clean Tech & Energy Area	Amount of Q1 FY 09 Grants & Contracts with OSU Engineering Principle Investigator or Co Investigator	Company Formed During 2004-2008
Nuclear	\$6.6M + \$0.7M in other funds	NuScale Power
Wave & Wind Energy	\$6.4M + \$7M in other funds	Columbia Power Technologies
Bio-Fuels & Micro Reactors	\$0.3M	MTech Energy Solutions
Solar	\$1.5M	License to Extreme Energetics
Green Building, Green Materials & Sustainability	\$11.5M	
Energy Harvesting		Wi Chi
Total Grants and Contracts	\$26.5M & \$34.2M with other funds	

OSU will focus faculty hiring during the biennium on wave/wind energy and material for solar energy production or energy storage. The table below shows how OSU will align faculty additions in its research clusters to these clean tech opportunities.

Research Cluster	Clean Tech			
	Wave, Wind	Solar	Bio Fuel	Green/ Smart Building
Energy Systems	1			
ONAMI		1		
Infrastructure & Transportation				
Bio & Environmental Systems				
Intelligent Information Systems				
Mixed Signal Integration Systems				
End User SW/Computer Graphics				
Autonomous Systems				
Emerging Areas				
Total New Faculty	2			

Portland State University

There is insufficient funding to invest in new faculty. Traditionally we have increased research funding by hiring more research oriented faculty. But we also need to increase the research productivity of existing faculty. In this effort, we plan to invest in research support, generally graduate student funding, in key faculty members who we feel have the most promise in providing PSU a return on this investment. In addition, the primary focus of this research support will be in Clean-Tech (sustainability, green buildings, renewable energy, and energy efficiency).

This funding will be allocated to supporting five Graduate Research Assistants for one year each. The allocation will be determined by the Dean's office based on mini-grant proposals submitted by interested faculty. Based on a faculty member's vision of their research and their productivity, we hope to identify those faculty where an investment like this an investment would provide needed critical mass.

We feel that this should be a long term program and that for a modest amount of funding on an on-going basis, over time it will significantly enhance the research capabilities of the college. As with the retention program, we will be closely evaluating the selection process and the effectiveness of the program, as well as continuing to improve the program. Minimally we feel that we need 4-6 years to fully develop and assess the results of this program. Consequently, pending positive results, future requests will have continuation funding for this effort.

The choice of Clean-Tech for focused investment fits naturally the increasing emphasis at the state and university level. At the university level, PSU already has the beginnings of a multi-disciplinary program in Clean-Tech (sustainability / renewable energy / energy efficiency). This focus was acknowledged by the recent \$25M gift from the Miller Foundation to the university for developing new and enhancing existing programs in sustainability.

Clean-Tech is a critically important area where engineering can make important contributions to systems and technologies that are required to engender a sustainable society. Important technologies include energy creation and collection, such as wind power and photovoltaics, and energy efficiency and management, such as power management, transportation systems, green manufacturing, manufacturing of green technologies, process control, and public safety.

In addition to energy, we also have research areas in environmental/water resources, and structural, geotechnical, and transportation engineering. Portland is viewed as a national leader in transportation and environmentally sensitive construction and is situated in a region where hydroelectric power, water quality, and geologic concerns are of everyday importance.

OTREC, the Oregon Transportation Research and Education Consortium, is based at PSU and is dedicated to stimulating and conducting collaborative multi-disciplinary research on multi-modal surface transportation issues, educating a diverse array of current practitioners and future leaders in the transportation field, and encouraging

implementation of relevant research results. OTREC's director Prof. Rob Bertini is an ETIC hire.

The Energy Systems Information Lab (ESIL) in the college enables dynamic simulation of markets in the electric energy, natural gas, hydro networks, and other energy commodities. The lab also has the capability to analyze traditional power system questions of power flow capabilities, interchange capabilities, control simulation, and power system security. The lab is also used for sustainable energy projects and renewable energy analysis and has begun collaborating with local start-ups in wind power generation.

University of Oregon

MSI has been working with OECDD and Team Oregon for the past two years to recruit solar energy companies to Oregon, supporting these efforts by develop an internship track targeted at this important and growing Oregon cluster and connecting the University of Oregon's leading solar researchers with recruiting efforts. Chris Larson, the Director of the Graduate Internship program, has been leading the University of Oregon efforts, working with Team Oregon participants including Tim McCabe - Director, Oregon Economic & Community Development Dept., Bruce Laird - Oregon Economic & Community Development Dept., Nancy Hamilton - Governors Office, Rob Dixon - City of Hillsboro, Tom Hughes - Mayor of Hillsboro, Michael Grainey - Oregon Department of Energy, Charlie Allcock - Portland General Electric, Jeff Wheeler - Portland General Electric, Roger Lee - Economic Development for Central Oregon, Deanna Palm - Greater Hillsboro Area Chamber of Commerce, Colin Sears - Portland Development Commission, and Howard Larson - Colliers International. Chris Larson has traveled to conferences in Munich Germany, Valencia Spain and San Diego as partners with OECDD in efforts to establish Oregon as one of the world leaders in photovoltaics and solar energy technology.

Conversations with leaders in solar companies that will have significant Oregon operations, including Gordon Brinser, Bob Beisner Ralf Luedemann, and Boris Klebensberger of SolarWorld, Juanita Kurtin and Andrew Wilson of Spectra Watt, Bob Ford and Doug Moore of Solaicx, John Schumacher of Peak Sun, Vanessa Watkin of XsunX Inc and Andreas Stonas of Voxel have established the need to

- Create educational programs to deliver talent to the Solar Energy cluster,
- Expand CAMCOR to include a photo-module characterization center, and
- Expand photovoltaic research programs in Oregon's Universities

to enhance Oregon's attractiveness to Solar companies and to help Oregon Solar companies compete in the global economy.

The requested support will enable MSI to create a solar energy track to the Graduate Internship program in partnership with Oregon's Solar industry focused on providing the skills and insights necessary for the graduates to excel. The master's graduates will be expected to meet the demands of Oregon companies for process, failure analysis and development engineers from home grown Oregon talent. OSU projects this program will have more than 8 graduating masters students per year by the end of the biennium. The requested funding will also increase the number of Ph.D. students pursuing research projects in the solar and other clean energy areas.

Additional Information: See www.oregonetic.org/nb.htm

Expected Outcomes:

- Increases in the number of young people motivated to choose and prepared to succeed in engineering and technology college programs.
- Increased retention of students in college programs, whether they start as freshmen or transfer in as juniors.
- Significant increases in the number of graduates who are ready to make key contributions to sustainable industries.
- Increases in the depth and breadth of clean-tech research enhancing the competitiveness of existing sustainable industries and making Oregon even more attractive to clean-tech companies interested in setting up development and deployment businesses in Oregon.
- A 70% increase in the number of work-ready graduates available to Oregon economic clusters by 2020 vs. ETIC's baseline year of 1999.
- Nearly a three-fold increase in the amount of federally funded research serving as a source of innovation for Oregon's clusters by 2020 ETIC's baseline year of 1999.
- Increasing the quality and diversity (ethnic, geographic, gender) of students graduating from these programs.
- Increasing the global competitiveness of Oregon's programs and thus Oregon's economic clusters.

Performance Indicators:

- Engineering and Computer Science Degrees (#20)
- Externally Funded Engineering & Technology Research (internal ETIC indicator)

Allocation of funds to campuses and major focus areas

	Recruitment	Retention	Clean Tech	Total
EOU	0	15,000	0	15,000
OHSU	0	0	0	0
OIT	0	0	151,200	151,200
OSU	0	227,060	1,122,940	1,350,000
PSU	0	446,710	153,290	600,000
SOU	0	6,000	0	6,000
UO	0	0	482,400	482,400
WOU	0	0	0	0
OPAS/ Retention TF*	245,400	150,000	0	395,400
Total	245,400	844,770	1,909,830	3,000,000

* ETIC’s Oregon Pre-engineering & Applied Science (OPAS) Initiative has developed a “pipeline strategy” to increase the number of young people who people motivated to choose and prepared to succeed in engineering and technology college programs. The ETIC Retention Task Force is charged with developing a best-practices strategy and a set of criteria for an RFP in 2009. Campuses will submit proposals consistent with the strategy and criteria and compete for the available pooled funds.

Total New Faculty During Biennium	
Total FTEs	2.00
New Positions	2.00

Recruitment (OPAS Initiative)

<u>In School Pre-engineering and Computer Science</u>	
Pre-engineering: rigorous pre-professional curriculum	
▪ Leadership, administration, marketing and reporting	\$ 6,319
▪ Pre-engineering high school clusters	\$ 32,913
▪ Pre-engineering middle school clusters	\$ 7,899
▪ Highly qualified pre-engineering teacher expansion	\$ 10,532
▪ Under-represented students initiatives and support	\$ 6,319
▪ Communication and community engagement	\$ 1,317
▪ Evaluation	\$ 3,160
▪ Subtotal	\$ 68,459
Computer Science: capacity and infrastructure expansion	
▪ Leadership, administration, marketing and reporting	\$ 2,633
▪ Geographic expansion (25 schools)	\$ 19,748
▪ Regional centers of teaching excellence (4-6)	\$ 6,583
▪ Under-represented student initiatives and support	\$ 2,106
▪ Programming contest expansion	\$ 1,053
▪ Marketing and communications	\$ 790
▪ Evaluation	\$ 2,633
▪ Subtotal	\$ 35,546
In School Program Total	\$ 104,005
<u>Out of School Time Programs for Project Based Learning</u>	
▪ Programs for grades 4 through 8	
▪ Leadership, administration, and reporting	\$ 5,266
▪ Investments in programs focusing on engineering & technology	\$ 64,246
▪ Evaluation	\$ 4,213
▪ Subtotal	\$ 73,725
▪ Programs for grades 9 through 12	
▪ Leadership, administration, marketing and reporting	\$ 6,319
▪ Stipends to teacher/coaches	\$ 13,165
▪ Materials and registration for teams	\$ 7,899
▪ Training of teachers/coaches -- for all pre-engineering coaches	\$ 2,633
▪ Grants specific to particular "leagues" for training and related	\$ 5,266
▪ Evaluation	\$ 2,106
▪ Subtotal	\$ 37,389
▪ Internships	
▪ Leadership, administration, and reporting	\$ 527
▪ Internships for high school students with OUS faculty & industry	\$ 11,059
▪ Internships for teachers with faculty & industry	\$ 2,370
▪ Evaluation	\$ 527
▪ Subtotal	\$ 14,482
Out-of-School-Time Program Total	\$ 125,596
<u>Communications and Marketing: Students, Parents, Teachers, Counselors</u>	
▪ Leadership, administration, and reporting	\$ 1,053
▪ Web presence	\$ 2,370
▪ Print materials & distribution	\$ 2,896
▪ Speakers Bureau	\$ 2,633
▪ Other	\$ 1,580
Communication & Marketing Program Total	\$ 10,532
<u>Planning & Oversight</u>	\$ 5,266
<u>Total</u>	\$ 245,400

Forecast of Student Participation

January 2009	Projected			
	AY10	AY11	AY13	AY15
Number of students				
Pre-high school Outside School Time	134	201	268	335
High School Outside of School Time	20	30	58	85
High School In Class	172	517	1,205	1,722
High School Internships	5	5	7	8
Total	332	753	1,538	2,150
Student contact hours				
Pre-high school Outside School Time	7,617	11,425	15,234	19,042
High School Outside of School Time	1,682	2,522	4,834	7,094
High School In Class	10,332	30,997	72,326	103,323
High School Internships	1,722	1,722	2,153	2,583
Total	21,353	46,666	94,547	132,042
Average contact hours per student				
Pre-high school Outside School Time	57	57	57	57
High School Outside of School Time	83	83	83	83
High School In Class	60	60	60	60
High School Internships	320	320	320	320
Total	64	62	61	61

Retention Metrics									
	Freshman Retention			Transfer Retention			6-year Grad Rate		
	AY07	AY11	AY13	AY07	AY11	AY13	AY07	AY11	AY13
EOU	22%	25%	33%	68%	72%	75%	15%	22%	27%
OIT	75%	76%	77%	81%	89%	91%	37%	39%	43%
OSU	69%	72%	75%	68%	70%	72%	45%	45%	45%
PSU	66%	68%	70%	87%	89%	89%	22%	23%	23%

Total Degrees		
Academic Year Ending June	EBL	Policy Option Package
1999 Actual	1,157	1,157
2007 Actual	1,498	1,498
2013 Forecast	1,716	1,782
2020 Forecast	1,852	1,957

Externally Funded Research -- \$ million		
Academic Year Ending June	EBL	Policy Option Package
1999 Actual	\$31.2	\$31.2
2007 Actual	\$53.8	\$53.8
2013 Forecast	\$72.6	\$78.6
2020 Forecast	\$84.9	\$86.7

Budget Summary:

\$ million	EOU	OIT	OSU	PSU	SOU	UO	OPAS/ Retention	Total
State Funds	0.015	0.151	1.350	0.600	0.006	0.482	0.395	\$ 3.000
Forecasted Private Support	-	0.150	5.000	0.583	-	5.000	-	\$10.733