

**2009-2011 OUS Agency Request Budget  
Policy Package Proposal  
8/20/08**

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

**Agency Request 2009-2011:**

General Fund Request --     \$39,738,000

Expected private support --     \$47,074,000

***Connections to Board goals and other goals:***

1. Increase college participation and completion.
  - a. Focus on middle school high school to expand the number and diversity of our future engineering and applied science degree graduates (OPAS<sup>1</sup>).
  - b. Investments in increasing retention and graduation rates (all campuses).
  - c. GK-12 program training teachers and teaching K-8 students in inquiry based science in schools within the Umatilla-Morrow ESD. (UO)
  - d. MESA program focuses on recruitment and retention of students traditionally underrepresented in Engineering (PSU).
  - e. New programs specifically directed at first-year students with special emphasis on retaining women and underrepresented minorities. (OSU).
  - f. Pre-college programs (OIT).
  - g. Science Technology Education Partnership program increasing science and engineering majors at community colleges. (UO)
2. Alignment with OUS Research Council. ETIC and the Research Council keep each other informed about their research strategies to maximize collaboration and minimize duplication.
3. Sustainability
  - a. Energy Systems Research (OSU): develop innovative, alternative energy systems capable of providing electric power or transportation fuels using centralized or distributed energy sources.
  - b. Renewable Energy Systems (OIT): first undergraduate engineering program in the nation in renewable energy.
  - c. Wind power and photovoltaics and Energy Systems Information Lab (PSU).
  - d. Photovoltaic and Semiconductor Processing Graduate Internship Program: trains MS and Ph.D. students to excel in Oregon's high tech. economy. (UO)

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<sup>1</sup> Oregon Pre-engineering & Applied Science Initiative, a statewide initiative of ETIC. See [opas.ous.edu](http://opas.ous.edu)

- e. Water systems especially with regards to the Columbia basin (PSU).
- f. Water reuse and treatment (OSU)
- 4. Health Care
  - a. Health Informatics (OIT)
  - b. Biological and Environmental Systems (OSU)
  - c. Bioengineering and Health (PSU)
  - d. Biotechnology Graduate Internship Program: Trains MS and Ph.D. students to excel in Oregon's growing biotechnology industry cluster. (UO)
  - e. Certificate in Medical Informatics (WOU)
- 5. Transportation
  - a. Instrumentation of dynamic systems (PSU).
  - b. Infrastructure engineering, which includes industrial sectors of construction, engineering services, and the public works portion of local, state, and federal agencies (OSU).
- 6. Support of Oregon Innovation Council strategy. The investments in 2011-2013 are targeted in the areas that will bring the largest economic benefit to Oregon including:
  - a. ONAMI
  - b. Wave Energy
  - c. Food Production
  - d. Manufacturing
  - e. Bio-Based Research
  - f. Drug Discovery

These investments in research and teaching faculty and facilities complemented by pre-college outreach programs will enhance Oregon's ability to innovate in all industries by providing:

- a. Highly educated work-ready graduates that can immediately help their employers create new products and services as well as enhance existing ones.
- b. New technologies that can be put to use by both high-tech and low-tech companies.
- c. New businesses based on new ideas and the people that create them—leading to new industries that diversify Oregon's economy.

In addition, internships sponsored by ETIC-member companies give Oregon students unique skills that allow them to graduate "work ready." ETIC companies donate equipment that assures that both research and teaching benefit from latest technologies. This same equipment is available to Oregon companies to enhance their competitiveness.

The ETIC public-private partnership has created a cultural change that has

- Created new and stronger connections between industry and academia;
- Established aggressive and measurable goals that have been consistently achieved.

- Produced private support well above the state support.
- Increased annual graduation rates.
- Doubled the annual externally funded research.

**Description:**

*ETIC Vision:* Oregon’s engineering & technology education and research programs are strategic assets for Oregon’s economy and Oregon’s residents by

- providing unique programs of the highest quality that meet the needs of Oregon’s industry clusters;
- attracting resources to Oregon from throughout the world;
- doubling the number of bachelors, masters, and PhDs receiving a globally competitive engineering education; and
- performing innovative research that gives existing and new businesses a competitive advantages in the global economy.

*Strategy:* Based on the needs of existing and emerging Oregon clusters, grow our Engineering and Technology programs to produce graduates and innovations that provide competitive advantage to Oregon’s industries. Over the long term build a self-sustaining innovation engine that draws grants, donations and others sources of underwriting to Oregon. In particular, ETIC plans to more than double the number of degrees produced each year and increase the amount of externally funded research by a factor of five from 1999 – the ETIC baseline year – and 2020.

*Criteria:* Campus proposals have been reviewed by the Voting Members of ETIC based on the following criteria:

<b>2X</b>	Contribution to doubling the number of work-ready technical graduates by 2013 vs. 1999	<b>Forecasted Results</b>	Metrics forecast indicates plan will contribute to ETIC 2X goal.
		<b>Educational Capacity &amp;</b>	Plan invests in increasing capacity and productivity to
		<b>Outreach</b>	Plan for increasing number and diversity of students.
		<b>Retention</b>	Plan for increasing the proportion of students completing degree
<b>5X</b>	Contribution to 5X increase in externally funded research in Oregon by 2020 vs. 1999	<b>Forecasted Results</b>	Metrics forecast indicates plan will contribute to ETIC 5X Goal.
		<b>Research Capacity &amp;</b>	Plan invests in increasing capacity and productivity to
		<b>Collaboration</b>	Plan includes industry-academic, inter-department, inter-campus,
		<b>Public-Private Partnership</b>	Mutually beneficial relationship with Oregon industry.

<b>Global competitiveness</b>	Contribution to global competitiveness of Oregon industries	<b>National Ranking</b>	Will lead to higher national ranking
		<b>Commercialization</b>	Produces patents, licenses, spin-offs
		<b>Benefits Oregonians</b>	Provides opportunities. Helps keep and grow family-wage jobs.
		<b>Serves Oregon Clusters</b>	Source of talent & innovation for existing and new companies.
<b>Effectiveness</b>	Effectiveness of proposed investment	<b>Private Support Ratio</b>	Forecasted private support divided by requested state funds.
		<b>Expertise Leverage</b>	Plan leverages existing expertise
		<b>Track Record</b>	Track record makes plan
		<b>Internal Consistency</b>	Details of plan match stated goals and provide confidence that results can be achieved.
		<b>Return on Investment</b>	Strong results for Oregon including progress toward "2X and "5X" goals vs level of
		<b>Sustainability</b>	Increases in tuition, research revenues and other resources will cover the some or all of the

### Eastern Oregon University

Eastern will hire one additional faculty member who will be responsible for teaching introductory computer science courses, freeing up the existing faculty for course development and providing an opportunity to seek new sources of external funding. Currently, Eastern teaches most of the courses in the program catalog, but must offer many electives on an every-other-year basis and there is no time or support for grant writing or creating multi-modal course materials. The new faculty member also will be able to help meet the ambitious student recruitment, retention and degree production goals of the program, by devoting a portion of his/her time in community outreach and counseling of existing students and coordinating the efforts of other faculty members towards the same end.

At present the program is located in two separate buildings on the La Grande campus. A portion of the investment will underwrite facilities improvements that will allow all of the faculty and lab facilities to share a single space.

### Oregon Institute of Technology

Investments in **Education** will be made in four parts that broaden OIT programs into areas important to the Oregon economy and that have potential for attracting students to engineering and information technology:

- Renewable Energy Systems – a successful program with promise for expansion and near-term self-sufficiency.
- Information Technology – two areas for strategic growth: Embedded Systems Engineering Technology and Information Technology/Health Informatics.
- OIT Online Graduate Program in Manufacturing Engineering – designed to meet specific demand by adapting a successful model.
- Special Opportunities – two small but important thrusts that have potential to bring new students into engineering: Biomedical Engineering and Manufacturing Engineering Technology Robotics Laboratory.

**Applied Research** is the driving engine for OIT's mission of producing skilled engineers and technologists. The ETIC investment for the next biennium will build on its experience in this area, particularly in renewable energy, with a strategy to (1) integrate applied research across the curricula of OIT with a special focus on engineering and applied science, and (2) increase private support for applied research as a way to leverage state funds.

**Student Recruiting** is essential to graduating more engineers and applied scientists from Oregon's universities. Additional funding will allow OIT to hire a recruiting specialist within the School of Engineering, Technology, and Management to focus on the particular issues relating to these students, bringing OIT to a new level of capacity, and helping to meet ETIC's goals of doubling engineering graduates.

OIT's **Pre-College Program** builds on long-time experience with elementary, middle, and high school students and teachers in a two-part strategy that will increase opportunities for women and underserved minority populations to become engineering and applied science graduates.

## **Oregon State University**

Oregon's industries need local access to top engineering talent: this means the best work ready engineers, world-class research collaborators, and academic programs attractive to top people. OSU and other ETIC collaborators have made progress on addressing this need: at OSU this progress includes higher quality graduates, growth to 25<sup>th</sup> nationally in BS degrees, doubling research, and significant increase in spin outs. Yet Oregon industry needs remain unmet. OSU will help by delivering the economic impact of America's top 25 engineering colleges as measured in BS through PhD degrees, research results, and spin outs. Then Oregon will have a prosperous future thanks to top engineering talent that will enable Oregon to be globally competitive and remain a high quality place to live. Doubling the number of engineering faculty by 2013 will position OSU to achieve these goals and our proposal for 2009-11 is the next step toward this objective.

Oregon will reap tremendous benefits from OSU's efforts to strengthen its college of engineering.

- First more of Oregon's best and brightest will be retained because the opportunity for engineering education right here in Oregon will rival the best programs across the nation. Young Oregonians are already seeing this opportunity and the college has doubled the number of highly recruited students retained in Oregon. Our efforts on recruitment and retention will drive the number to double again and increase the diversity of those engineering graduates.
- Second, our partnerships with more than 100 Oregon companies will help place these graduates in Oregon jobs, allow them to have immediate impact on products and services, and provide the leadership talent those companies will need in the future.
- Third, recruitment and retention of top faculty will lead to innovation in degree programs that create the best engineers and great opportunities for our graduates. New faculty will enable increased research collaboration with Oregon industry and deliver solutions to needs for innovative products, processes, or services.
- And fourth, our efforts to drive research results to impact will help create jobs: since 2004, OSU Engineering research has delivered technologies that have formed the basis of 11 new companies. By investing in OSU, Oregon will see substantial return on investment through job creation.

During 2009-11, increased efforts on recruitment and retention of students, including a special focus on diversity is a priority at all levels of funding. Additionally, OSU will recruit new faculty to reduce student/faculty ratios, increase opportunities for undergraduate and graduate students, and build upon its strengths in collaborative research in order to increase impact on Oregon's current and future industry as follows:

The Policy Option Package will enable OSU to continue momentum but will extend the timing to reach the critical mass needed for greatest impact on Oregon's future. Faculty recruiting will focus on building our programs in Energy Systems, ONAMI, Infrastructure and Transportation, Bio & Environmental Systems/the Bio Economy & Sustainability Signature Research Center, and Intelligent Information Systems.

The foundation of our success for Oregon is a public-private partnership. Private funds help us recruit and retain top students and faculty through scholarships, fellowships, and faculty chairs, help transform the infrastructure of OSU Engineering with projects such as the Kelley Engineering Center, and provide seed funding for educational innovations like TekBots. And all of these components help leverage public investment to increase quality in all that we do.

The public investment in OSU's goals for Oregon has attracted \$120M in private funding since 1999.

Oregon is endowed with a high quality of life and a vibrant economy. Both of these depend upon the work of engineers and Oregon's investment in ETIC's program will help ensure our prosperity far into the future. OSU is committed to doing its part by building a program that will deliver the impact on innovation equivalent to America's best engineering colleges. And this proposed investment will help OSU deliver on that commitment.

### **Portland State University**

The proposed investment will allow PSU to hire twenty additional faculty members during the 2009-11 Biennium. This increase, together with an additional 30 faculty members in subsequent biennia, would take PSU Engineering to a total of roughly 145 faculty members by 2017, moving the college closer to its aspirational peers (University of Virginia, New Jersey Institute of Technology, and University of Texas at Arlington) and creating the possibility of achieving degree granting and research productivity similar to those engineering schools. The focus of this investment funding will be in six specific areas:

**Sustainability:** 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. This is a critically important area where academia can make important contributions to systems and technologies that are required to engender a sustainable society. Related technologies include energy creation and collection, such as wind power and photovoltaics, as well as energy efficiency and management, such as power management, transportation systems, manufacturing of green technologies, process control, and public safety.

**Instrumentation:** This discipline concerns the collection of data on engineered structures (physical, electrical, material) in operation, as well as on dynamic systems (intelligent transportation systems for example). There are exciting new applications for distributed sensor networks in the integrity assessment of physical structures, and the monitoring of power utilization and efficiency. Other applications include the modeling and analysis of electromagnetic and acoustic wave phenomena for the development of advanced sensor applications. Potential applications for advanced instrumentation include health monitoring, the detection of explosive devices, remote sensing for urban and coastal areas, the monitoring of critical environmental components such as salmon population, coral reefs and water resources, urban planning, and for monitoring the status of various roadways for efficient and safe transportation. The college already has a significant number of faculty working areas synergistic to this focus.

**Bioengineering and Health:** The research and educational objectives of Bioengineering/Biotechnology at PSU are to generate and disseminate knowledge that will improve human health through synergistic advancements in engineering, biology, physics, chemistry, mathematics, computation, and medicine. Faculty and students are actively engaged in activities which enable PSU to access national health care research funding initiatives, address critical health care and multidisciplinary problems, increase community and, most of all, produce work-ready graduates in this inter-disciplinary area. Because of the close physical proximity to OHSU, and in particular, to OHSU's BioMedical Engineering department, PSU is working jointly with OHSU to increase the various collaborative efforts that support this focus area. The National Academy of Engineering has recently announced its list of fourteen grand challenges facing the field, in this list is the reverse engineering of the brain, which includes such topics as systems neuroscience, biologically inspired computing and neuro-prosthetics, where PSU already has research programs.

**Technology Transfer and Management:** As innovation continues to be the engine of economic growth, the management of existing and emerging technologies and the transfer of technology from research to implementation will be the dominant mechanisms for competitiveness. In addition to being an integral part of many, if not all, of the other focus areas, this topic includes forecasting and road maps for energy alternatives, increasing yield in semiconductor industry, improving services, commercializing technologies, selecting among strategic alternatives, analyzing decisions for optimum resource allocations, and streamlining operations in every sector.

**Undergraduate Education:** To increase our contribution to the economy of Oregon and the Portland metropolitan region, and to improve the quality of our graduate research programs, the PSU College of Engineering is embarking upon a strategic program to enhance our undergraduate engineering program with a focus on increasing quality of the experience as measured by meeting our goals for increasing retention. Increased funding will be used to create a new program in undergraduate engineering education, a new program for recruiting and retaining underrepresented students, and a recruitment effort focused on attracting better prepared and higher achieving students.

**Manufacturing / Materials:** The final focus area involves the college's participation in PSU's Materials and Manufacturing Research Institute (MMRI), which has funding from both the Oregon Innovation Council (OR InC) and PSU. This Institute was established to support Oregon's manufacturing infrastructure and economy, and to provide the technology and workforce necessary to support the international competitiveness and growth of Oregon's manufacturing cluster. Funding from the Option Package will be used to support two positions in this cluster for the 2009-11 biennium.

The following table shows planned faculty hiring in each focus area.

<b>Sustain-ability</b>	<b>Instru-mentation</b>	<b>Bioeng-ineering &amp; Health</b>	<b>Technolog-y Transfer &amp; Managem-ent</b>	<b>Under-graduate Educatio-n</b>	<b>Manu-facturing &amp; Materials</b>	<b>Total New Facul-ty</b>
1	3	0	1	1	2	8

**Southern Oregon University**

The increased funding will allow Southern to purchase the equipment it needs to stay current with that underlies the courses computer science and material science courses it teaches. It will also provide Southern an increased capability to experiment with cutting edge and emerging applications and hardware in order to make its course offerings not only relevant but what students, both current and future, are seeing in the world around them. The funding would positively impact Southern's graduate assistantship program as well as student hires and give it more leeway to reach out to future students with innovative and exciting recruiting efforts such as a traveling demonstration of what being a computer/material scientist is all about as well as the types of challenges these professionals address and solve.

**University of Oregon**

The Graduate Internship Program at the University of Oregon builds on the strengths of Oregon’s existing and growing industry clusters. New investments during the biennium will expand the UO’s highly successful graduate internship programs in materials science, including starting a new biotechnology internship track plus additional track(s) covering energy, water, or other related technologies. The investment will also allow UO to expand federally funded graduate, K-12 outreach, community-college partnership programs.

The proposed funding enables a significantly more aggressive growth plan for the Graduate Internship Program that will propel it to national prominence as the top graduate masters program in the country by investing in four areas:

1. **Staff Support:** An additional staff member will work closely with OECD to recruit companies to Oregon, retain companies in Oregon and encourage growth of companies in Oregon through workforce enhancement by graduates of the Graduate Internship program and through expansion of CAMCOR (the Center for Advanced Materials Characterization in OREGON), Oregon’s “High Tech.” extension service. The increase in staff will also allow the program to maintain its virtually 100% student placement in internships and retention towards graduation
2. **New Faculty Positions:** The proposed funding enables the addition of two new faculty positions to the physical sciences which has major impacts on the growth of the research enterprise within the Materials Science Institute

- and significantly increases the rate of the “cultural” changes on the Oregon campus spearheaded by the internship program. The University of Oregon has committed to the ongoing funding of the proposed faculty positions after the initial ETIC investment in start-up funds, laboratory renovations and salary.
3. Laboratory expansion: The proposed funding enables each of the Graduate Internship Program tracks to double its capacity by the acquisition of key laboratory equipment requested by our company partners to enhance the training of the graduate student participants.
  4. Matching funds for grant proposals: This fund will facilitate the growth of successful proposals to expand the federal funding of these programs leading to the growth of the Ph.D. programs in the sciences at the University of Oregon through the graduate stipends provided. The proposed funding also provides resources to obtain “signature” analytical tools in CAMCOR.

### **Pre-college Investments (Oregon Pre-engineering & Applied Science Initiative)**

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.

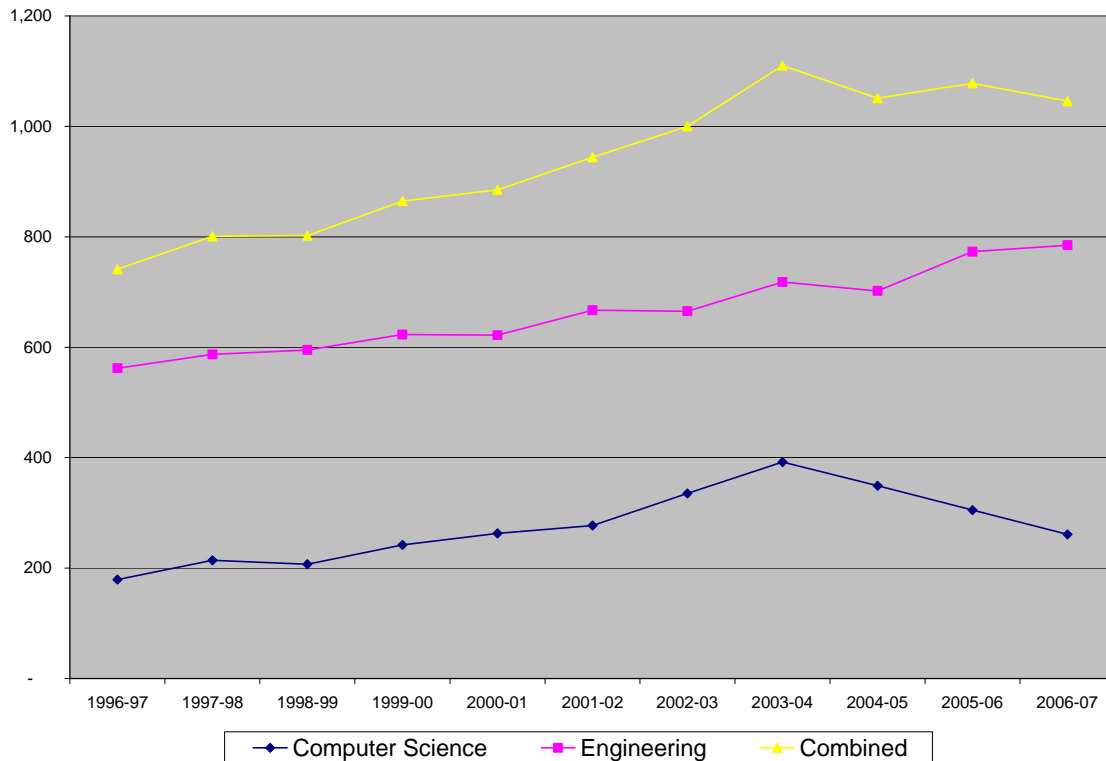


Figure 1: Engineering and computer science bachelor's degrees have grown by 41% from 1997 to 2007. But recently computer science degrees have been dropping, and growth in overall engineering and computer science degrees has stalled.

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.

**Additional Information:** See [www.oregonetic.org/nb.htm](http://www.oregonetic.org/nb.htm)

**Expected Outcomes:**

Additional faculty and facilities needed to make additional progress toward

- Enhancing the cooperation between academic programs and between these programs and industry.
- More than doubling number of work-ready graduates available to Oregon economic clusters by 2020.
- Six-fold increase in the amount of federally funded research serving as a source of innovation for Oregon’s clusters by 2020.
- 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)

New Faculty During Biennium	
Total FTEs	33.50
New Positions	42.50

**ETIC Metrics Forecast:**

Total Degrees		
Academic Year Ending June	EBL	Policy Option Package
1999 Actual	1,151	1,151
2007 Actual	1,520	1,520
2013 Forecast	1,716	1,884
2020 Forecast	1,852	2,343

Externally Funded Research -- \$ million		
Academic Year Ending June	EBL	Policy Option Package
1999 Actual	\$29.9	\$29.9
2007 Actual	\$55.9	\$55.9
2013 Forecast	\$72.6	\$78.1
2020 Forecast	\$82.9	\$119.4

***Budget Outline:***

\$ million	EOU	OIT	OSU	PSU	SOU	UO	OPAS	Total
<b>State Funds</b>	0.400	2.000	20.000	8.000	0.080	6.000	3.250	<b>\$ 39.738</b>
<b>Forecasted Private Support</b>	-	2.000	20.000	7.771	-	17.300	-	<b>\$ 47.074</b>