

Engineering and Technology Industry Council Campus Investment Proposal Biennium from July 1, 2011 to June 30, 2013

Campus: Oregon Institute of Technology (OIT)

Contact Name: Charlie Jones, Dean of the School of Engineering, Technology and Management

Date of Submission: April 30, 2010

Summary of Proposal:

OIT's Center of Excellence in Renewable Energy is based on core competencies – BS and MS Renewable Energy degrees so successful that OIT cannot keep up with demand, and the Oregon Renewable Energy Center that underwrites applied research and provides technical assistance to the community. OIT offers the benefits of being a statewide polytechnic university with campuses in Klamath Falls, which has unique geothermal and solar attributes, and in Portland with proximity to key industry resources. ETIC's investment in OIT will build capacity, enhance curriculum and laboratories, further expand good industry partnerships, and promote Sustainable Engineering.

Vision and Goals Statement

OIT's programs and industry-experienced faculty prepare engineers who excel in the workplace. Industry partnerships make OIT a leader in applied research, and new, exclusive degree programs produce graduates who have the skills to harness renewable resources for Oregon's contribution to the national and global economy.

Investment Description for Sustainable Engineering at OIT

1. Building University Capacity

Rationale

Demand for OIT's Renewable Energy Programs is outstripping capability. OIT has the first Bachelor of Science in Renewable Energy Engineering (BSREE) program in North America, and the only one pursuing ABET EAC accreditation. Enrollment has grown from four students to more than 220 in five years, attracting students from more than 25 states and other countries.

Although OIT recently received a federal grant to strengthen the REE program, the funding did not include the equipment outlined in this proposal, which will significantly increase the ability of the REE students to work with renewable energy sources, integrating them into the grid. OIT's focus on true applied research (testing, verification, and assessment) fills an important role in the "long-term approach to economic development" that Oregon InC lists as a goal for Clean Technology

industries. OIT leaves fundamental research to other Oregon universities, and concentrates on bringing students face to face with emerging technologies in the laboratory, at the test bench, and on the shop floor, giving them the experience to be a part of a ready workforce that will take the latest renewable energy technologies into the workplace.

Need is great for Sustainable Engineering graduates. BSREE students and graduates are heavily recruited by utilities, renewable energy developers, and traditional and high-tech companies. Among them are Portland General Electric, Bonneville Power Administration, Vestas, Stantec, Power Engineers, SNC-Lavalin, Johnson Controls, Clear Edge and Enerfin. Other areas such as power electronics, embedded systems, power quality and conditioning, and smart-grid technologies benefit from OIT's Bachelor of Science programs in Electrical Engineering and in Embedded Systems Engineering Technology. One of the reasons that OIT graduates are so highly valued is their agility in dealing with new technologies. OIT embodies the qualities that the Oregon Business Plan describes as necessary for prosperity as "our collective capability to continuously learn and adapt in an ever-changing economic world."

Another challenge facing the industry is the impending retirement of an aging electric utility industry workforce. The October 2009 study, Clean Tech Job Trends 2009, notes that "In the face of mass retirement and adoption of clean technologies, the utility industry's workforce is undergoing a significant transformation, one that will present great opportunities for those hoping to work on the front lines of the clean-energy economy."

Investments

- **Equipping a new Green Power lab** in Klamath Falls to provide an array of student applied-research opportunities aligned with current industry challenges, such as distributed power systems testing. This includes new geothermal labs in Klamath Falls, using the new power plants as the kind of student research opportunity that the Board of Higher Education's Subcommittee on Sustainability Initiatives believes will "provide Oregon and the University System a competitive advantage, making Oregon a living laboratory for teaching, testing, and practicing new ways of living needed in today's world."
- **Producing an interdisciplinary, project-based sequence of courses** to specifically encourage collaboration among diverse backgrounds and emphasize the team work required to be successful in work situations. (The interdisciplinary approach will restructure traditional undergraduate engineering education to promote an integrated team approach, mirroring the experience in industry.)
- **Supporting OIT leadership** in the REE degree programs, at the Oregon Renewable Energy Center, and in the Information Technology programs. ETIC's continuing support has been vital to continuity, strategic planning, and strong interdisciplinary collaboration that have enabled OIT to build its successful programs and work toward expansion of sustainability efforts on all fronts.

2. Expanding Industry Partnerships

Rationale

Oregon needs an educational model that depends on industry partners for practical focus, as was described in “Carbon-Free Prosperity 2025,” citing the belief of many industry leaders that limited business engagement is a “critical weakness” of research institutions. ETIC investment will allow OIT to expand its industry-directed, hands-on approach to serve more students and produce more well-qualified engineers.

OIT will further develop its excellent industry partnerships in the renewable energy engineering field. The far-reaching list of business leaders who volunteer on the REE Industry Advisory Council shows the depth of industry commitment to OIT, and demonstrates that they believe their companies will benefit from their involvement, ensuring that OIT Renewable Energy Engineering graduates meet the needs of the industry.

Investment

Extending industry engagement through advisory council input, bringing more industry experts to teach, creating more "in the field" internships and sponsored senior projects. ETIC investment will support faculty who will continue to coordinate these efforts.

3. Strengthening University Collaboration

Rationale

As a smaller university with limited resources, OIT explores any partnerships with larger institutions that can offer beneficial opportunities for OIT students. (For example, Boise State was awarded \$4.9 million from the U.S. Department of Energy to lead a consortium that includes the University of Utah, OIT, Stanford University and the University of Nevada, to establish a National Geothermal Data System, a project that will employ students as well as advancing the usefulness of the Geo-Heat Center.) The University of Oregon and OIT have signed a memorandum of understanding that will implement a “4 + 1” Master’s program through which OIT graduates in Renewable Energy, and Mechanical and Electrical Engineering will be able to enroll in U of O programs in Applied Physics or Chemistry to complete their Master’s degrees. OIT and the University of Oregon have been developing other means of collaboration as well as the 4 + 1 program, such as shared lab space.

Investment

OIT will be using shared laboratory space in the U of O’s CAMCOR Lab (Center for Advanced Materials Characterization in Oregon) on a fee basis.

Private Support

Industry Partners

For a recently funded proposal to the U.S. Dept. of Energy, eight of OIT's industry partners made commitments to providing student internships for the Renewable Energy program in this and the next biennium. There are representatives of 12 major energy-related corporations serving on the Renewable Energy Engineering Advisory Board and participating actively in planning and program support as well as provision of scholarships and student projects. OIT's two new geothermal power plants in Klamath Falls will be living laboratories, fully resourced to support preparation of work-ready graduates, with the assistance of private sector partners, such as Johnson Controls, Inc.

In the last fiscal year Renewable Energy Engineering, OREC, and IT reported more than \$600,000 dollars in private support, a great deal of it from industry partners, some in the form of software and hardware donations, and some in the form of student scholarships and intern salaries.

Results and Benefits

Short-term

ETIC investment will help increase the number of BSREE graduates from the current fifteen a year to thirty and will also help launch a Master's program that will graduate fifteen per year by the end of the 2011-2013 biennium.

A Center for Excellence in Renewable Energy relates directly to ETIC's strategy.

The labs and equipment listed below will complement the strengths of the current faculty and facilities, and build the REE program into the most effective possible source of renewable energy expertise for Oregon's workforce. It will be a true Center of Excellence in the field that will support ETIC's area of Sustainable Engineering by

- leveraging OIT's strengths in attracting students with its hands-on curriculum and opportunities, and
- contributing to doubling the number of work-ready technical graduates by 2020. (By 2020, OIT will increase its Renewable Energy graduates from zero in 1999 to 80.)

New laboratory equipment will be used in the Green Energy Laboratory Complex, housed in Purvine Hall on the Klamath Falls campus (one hardware platform will also be available in the Portland REE labs). The new lab will provide actual hardware platforms (rather than simulation software that has traditionally been used) for electrical grid integration experiments, using sources of renewable energy such as solar, wind and fuel cells for integration into the electrical grid, as well as for general source characterization and analysis.

Electrical grid-related research at the undergraduate level is restricted by the lack of the power industry equipment. By relying on simulations with ideal models, experiments cannot be done on non-ideal conditions and parameter adjustments for RE-generated

sources/distributed grid. Because industry equipment is too costly and bulky for use in school labs, some vendors (LabVolt, Feedback, and Hampden Engineering) have developed instrumentation platforms that are scaled in size and cost, and that is what OIT is proposing for the Green Energy laboratory.

In the electrical power grid field there is a great demand for system engineers with renewable energy skills and application-based research experience. The current Oregon job forecast shows growth in the area of “green jobs,” and in the renewable energy area, this lab project will lead to enhanced skills for graduates, developed in cutting edge capstone projects, and lab projects in upper division courses such as Electrical Power Systems Design and Hydroelectric Power.

The new lab will give students a platform to research integration issues of OIT’s geothermal power plant, and there will be at least two to three MCU/Sensor-based integration projects for the power grid. Currently we are adding three new power engineering courses in System Design, Protection/Relaying, and Transmission and Distribution. Another course in Smart Grid Systems is planned, as well pending resource allocations.

Equipment for the Green Power lab will include:

- Electrical power generation platforms and monitoring instruments
- Electrical power load platforms and monitoring instruments
- Switching Panels/Controls, Improved Supervisory Control and Data Acquisition (SCADA) Units, Phase Measurement Units (PMU) and Instruments
- Special “smart grid control” instrumentation and control units for end users (residential and commercial) in the distribution system
- Alternative Energy Platforms (Solar, Wind etc.) for micro-grid integration, two-way grid control and efficient energy utilization on the grid
- Improvements to current distribution and transmission schemes to provide an adaptable, secure and fast responding “smart grid.”

Medium-term

The expected results between July 2015 and June 2020 are an increase in Renewable Energy BS and MS graduates from an expected 70 in 2015 to an expected 95 by 2020, when the program’s growth potential is expected to have leveled off. These results indicate an increase in institutional educational capacity and productivity, made possible by ETIC investment, increased private support from industry partners that will result from the investment, and increased collaboration with other Oregon universities. These results will move OIT’s program toward its strategic goal of being a leader in applied research and a primary contributor to Oregon’s role in the national and global economy. Better laboratory facilities and broader faculty expertise will provide more opportunities for OIT faculty and students to engage in externally funded applied research, while better coordinated industry partnerships will increase the number of patents, licenses, and spin-offs.

Future Plans & Resources

Plans

An important component of the proposed Center of Excellence in Renewable Energy is the strong relationship that OIT has with the companies that hire its graduates and from which come many of its faculty. This relationship has grown between the university and the renewable energy industry during the incubation and birth of the Renewable Energy Engineering degree program. These connections will be nurtured further, as described above in this proposal, to help OIT build the infrastructure and related capacity to produce more graduates ready to be technical leaders in the burgeoning field, which is technically complex, changing quickly, and subject to evolving government policies. OIT will maintain these external connections as its sustainable engineering programs evolve beyond 2013.

Funding

OIT's long-term funding plan calls for an expansion of these relationships: in number of industry partners and in types of organizations (e.g., high tech, national labs, research organizations, etc.). Doing so will keep OIT on the cutting edge of renewable energy technologies and applications by promoting intellectual exchange.

Sustainable Technology Park Concept

A key element of OIT's long-range facility and educational plan is a Sustainable Technology Park on the Klamath Falls campus. It will occupy its own site on the campus, combining state-of-the-art sustainable buildings with an array of services and educational programs to promote energy conservation, renewable energy, and sustainability in Oregon by focusing on real-world projects and practical information. It will also symbolize the important role OIT is playing in creating a sustainable future through its practical, hands-on work in education, applied research, and economic development activities. The OIT Sustainable Technology Park will serve the entire state with educational, research, and public information. Moreover, with its focused activities in applied research, economic development, and distance education, its reach can be national and international.

Future Resources

Under President Christopher Maples, OIT is currently revamping its university-wide development effort. The university is in the process of hiring a major gifts officer, and a vice president for development has been appointed. A new Development Plan is in the final stages, and the Development Department has increased support staff by three positions, including a fundraising database manager. The OIT leadership recognizes that renewable energy is the key opportunity for the university in its development and fundraising efforts because of the university's national leadership in renewable energy education, its three decades as a leader in geothermal energy through the OIT Geo-Heat Center, and the unparalleled geothermal resources being deployed at the university's Klamath Falls campus.

Two positive indicators of the potential to raise money are the increasing public awareness of energy and growing private and governmental initiatives to address problems and opportunities. Strategically, OIT is well placed in the landscape of research and education by its focus on true applied research – testing, implementation, demonstration, verification – and by its reputation in technical education of combining a strong theoretical foundation with extensive laboratory and field experience. Its highly competent graduates and strong industry ties have given OIT many good connections in business and government. ETIC seed funding for the proposed Center of Excellence in Renewable Energy would be a vital, strong foundation for an educational and testing program unique in the OUS.

Proposed Investment and Private Support Forecast (\$M)

| | | 2011-2013 Biennium |
|----|---|-----------------------|
| 1 | Sources of funds | |
| 2 | Base budget for ETIC-related programs -- all sources except ETIC allocation & private support | \$ 9.33 |
| 3 | Proposed allocation from ETIC budget (\$M) (3) | \$ 1.93 |
| 4 | Expected private support (\$M) (4) | \$ 1.93 |
| 5 | Total (\$M) | \$ 13.19 |
| 6 | Personnel supported (FTE) (5) | |
| 7 | Existing faculty (1) | 4.0 |
| 8 | New faculty(2) | 0.0 |
| 9 | Existing staff (1) | 1.5 |
| 10 | New staff(2) | 0.0 |
| 11 | Total | 5.5 |
| 12 | New positions created (6) | |
| 13 | Faculty (2) | 0.0 |
| 14 | Staff (2) | 0.0 |
| 15 | Total | 0.0 |
| 16 | Uses of ETIC funds in line 3 | |
| 17 | New facilities | \$ - |
| 18 | Improvements to facilities (7) | \$ - |
| 19 | Laboratory equipment (7) | \$ 0.515 |
| 20 | Other equipment (7) | \$ - |
| 21 | Other one-time expenses | |
| 22 | Existing faculty salaries & benefits (1) | \$ 0.933 |
| 23 | New faculty salaries & benefits (2) | \$ - |
| 24 | Existing staff salaries & benefits (1) | \$ 0.410 |
| 25 | New staff salaries & benefits (2) | |
| 26 | Services & supplies | \$ 0.072 |
| 27 | Other | \$ - |
| 28 | Total (8) | \$ 1.930 |
| | (1) Hired through June 2011 that will be supported by ETIC funds during 2011-13 | |
| | (2) To be hired with ETIC funds during 2011-2013 biennium. | |
| | [3] N/A | |
| | (4) Consistent with ETIC Private Support Policy dated 1-23-02. | |
| | (5) FTE expressed as percent of full time over 2 years of biennium. | |
| | (6) FTE on an ongoing basis. | |
| | (7) Improvements and equipment to be purchased with ETIC funds | |
| | (8) Totals on line 3 and line 28 should match. | |

Metrics Forecast (for programs/departments receiving ETIC funding):

Assuming CSL ETIC Funding of \$1,328,349 during Biennium

| | Actuals (1) | | Projected (2) | | |
|--|-------------|---------|---------------|---------|---------|
| | AY 99 | AY09 | AY13 | AY15 | AY20 |
| Undergraduate student credit hours | 23,263 | 23,517 | 26,499 | 29,633 | 32,768 |
| Graduate student credit hours | 0 | 533 | 761 | 950 | 1,254 |
| Graduation rate, 6-year (3) | 29.80% | 45.90% | 46% | 47% | 49% |
| Bachelor's degrees granted | 165 | 183 | 216 | 255 | 301 |
| Master's degrees granted | 0 | 7 | 15 | 19 | 25 |
| PhD degrees granted | 0 | 0 | 0 | 0 | 0 |
| Women graduating (4) | 10% | 7% | 11% | 12% | 14% |
| Minorities graduating (5) | 7% | 11% | 13% | 14% | 16% |
| Externally-funded research expenditures (See 6.) | N/A | \$0.207 | \$0.375 | \$0.422 | \$0.705 |
| Invention disclosures (7) | 0 | 0 | 5 | 6 | 11 |
| License/options (8) | 0 | 0 | 2 | 2 | 3 |
| License income received (9) | 0 | 0 | \$0.027 | \$0.049 | \$0.750 |
| Spin-off Companies (10) | 0 | 0 | 2 | 2 | 3 |
| National ranking of program or department (11) | N/A | N/A | N/A | N/A | N/A |
| National ranking of college | N/A | top ten | top ten | top ten | top ten |
| Notes | | | | | |
| (1) Actuals for 12-month period ending in June of the year shown. | | | | | |
| (2) Forecast for the 12-month period ending in June of the year shown. | | | | | |
| (3) Percentage of undergraduate students who started ETIC-Supported program as freshmen six years earlier who completed an ETIC-supported bachelor's degree (source: OUS retention reports) . | | | | | |
| (4) From engineering, computer science, and other programs directly benefiting from ETIC funding, stated as percent of all those graduating (currently special emphasis on increasing). | | | | | |
| (5) Racial and ethnic minorities who are US citizens or permanent residents, stated percent of US citizens or permanent residents graduating (currently special emphasis on increasing) . | | | | | |
| (6) Total OIT research expenditures in AY99 were \$329,006. Information not available on whether external dollars, and how much spent by ETIC-related departments towards research. | | | | | |
| (7) See Association of University Technology Managers (AUTM) survey definitions. | | | | | |
| (8) Number of license or option agreements executed during the year. See AUTM survey definitions. | | | | | |
| (9) License issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software end-user license fees equal to \$1000 or more, but not research funding, patent expense reimbursement, valuation of equity not cashed-in, or end-user license fees less than \$1000. See AUTM survey definitions. | | | | | |
| (10) New companies that were dependent on the licensing of your program's technology for their initiation. See AUTM survey definitions. | | | | | |
| (11) US News and World Report, for Public Universities in the West (Departments not ranked) | | | | | |

Assuming ETIC Funding of CSL plus \$600,000 totaling \$1,928,349 during Biennium

| | Actuals (1) | | Projected (2) | | |
|--|-------------|---------|---------------|---------|---------|
| | AY 99 | AY09 | AY13 | AY15 | AY20 |
| Undergraduate student credit hours | 23,263 | 23,517 | 26,877 | 30,056 | 34,918 |
| Graduate student credit hours | 0 | 533 | 936 | 1,168 | 1,542 |
| Graduation rate, 6-year (3) | 29.80% | 45.90% | 46% | 47% | 49% |
| Bachelor's degrees granted | 165 | 183 | 219 | 256 | 312 |
| Master's degrees granted | 0 | 7 | 16 | 20 | 27 |
| PhD degrees granted | 0 | 0 | 0 | 0 | 0 |
| Women graduating (4) | 10% | 7% | 11% | 12% | 14% |
| Minorities graduating (5) | 7% | 11% | 13% | 14% | 16% |
| Externally-funded research expenditures (See 6.) | N/A | \$0.207 | \$0.412 | \$0.464 | \$0.775 |
| Invention disclosures (7) | 0 | 0 | 5 | 6 | 11 |
| License/options (8) | 0 | 0 | 2 | 2 | 3 |
| License income received (9) | 0 | 0 | \$0.027 | \$0.049 | \$0.750 |
| Spin-off Companies (10) | 0 | 0 | 2 | 2 | 3 |
| National ranking of program or department (11) | N/A | N/A | N/A | N/A | N/A |
| National ranking of college | N/A | top ten | top ten | top ten | top ten |
| Notes | | | | | |
| (1) Actuals for 12-month period ending in June of the year shown. | | | | | |
| (2) Forecast for the 12-month period ending in June of the year shown. | | | | | |
| (3) Percentage of undergraduate students who started ETIC-Supported program as freshmen six years earlier who completed an ETIC-supported bachelor's degree (source: OUS retention reports) . | | | | | |
| (4) From engineering, computer science, and other programs directly benefiting from ETIC funding, stated as percent of all those graduating (currently special emphasis on increasing). | | | | | |
| (5) Racial and ethnic minorities who are US citizens or permanent residents, stated percent of US citizens or permanent residents graduating (currently special emphasis on increasing) . | | | | | |
| (6) Total OIT research expenditures in AY99 were \$329,006. Information not available on whether external dollars, and how much spent by ETIC-related departments towards research. | | | | | |
| (7) See Association of University Technology Managers (AUTM) survey definitions. | | | | | |
| (8) Number of license or option agreements executed during the year. See AUTM survey definitions. | | | | | |
| (9) License issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software end-user license fees equal to \$1000 or more, but not research funding, patent expense reimbursement, valuation of equity not cashed-in, or end-user license fees less than \$1000. See AUTM survey definitions. | | | | | |
| (10) New companies that were dependent on the licensing of your program's technology for their initiation. See AUTM survey definitions. | | | | | |
| (11) US News and World Report, for Public Universities in the West (Departments not ranked) | | | | | |