

PROJECT DESCRIPTION

OVERVIEW

Sustainable development—development which minimizes impact on ecosystems and maximizes resource efficiency—is critical to the economic future of Oregon and Southwest Washington and to maintaining the quality of life that is central to the region’s appeal. Currently, construction-related industries are scrambling to keep up with best practices required for sustainable development. The **Sustainability Training for Technical Educators (STTE)** project, led by **Portland Community College (PCC)**, will help industry/employers in urban and urbanizing areas of Oregon and SW Washington meet the demand for a workforce that understands and adopts sustainable practices. The STTE project will focus on **professional development for educators** in the fields such as architectural drafting & design, building construction technology, facilities maintenance technology, engineering, energy management and landscape technology.

Intellectual Merit: The STTE project will help to ensure that educators understand how sustainability relates to their field of technical instruction; allow educators to develop a strong foundation in sustainable development theories, technologies, and practices; and incorporate new knowledge and skills that support sustainable development into their curriculum. Professional development activities will lead to changes in the practice of participating educators and serve as a catalyst for program improvements. Industry standards and workplace competencies relating to sustainable development will be integrated into the curriculum of a wide range of technical programs, improving the sustainability knowledge, skills, and competencies of students and the future construction-related workforce. The project design incorporates professional development models that have a proven track record of success. Evaluation will assess the impact of training activities on educators’ knowledge and teaching practice, and examine student learning. **Broader Impacts:** The STTE project responds directly to the findings of an NSF ATE Planning Grant (NSF #0603466), which explored the potential for establishing an ATE Regional Center for sustainable development education in the Pacific Northwest. The planning grant assessed regional workforce needs in the sustainable development sector and evaluated educational capacity to meet these needs. A major finding of the planning grant was that professional development for educators is an essential pre-requisite for improving sustainability education for students and incumbent workers in our region. Faculty members and teachers must first acquire knowledge, skills and experience in green building/sustainable development before program improvements can ensue. An industry advisory group validated this need and encouraged PCC to move ahead with a project focused on increasing instructional capacity. By building capacity amongst schools and colleges across the region, and cementing strategic alliances with a broad range of industry, government, and non-profit organizations, the project will strengthen the regional educational infrastructure and address the current and future demand for highly trained technicians in a variety of construction and development related industries. A comprehensive dissemination plan will inform stakeholders at the local, regional, and national/international level of project progress and accomplishments. The STTE project also represents a tactical stepping stone that will move project partners toward the long-term goal of establishing an ATE Regional Center for sustainable development. As such, the STTE project will have a positive impact on a diverse range of students at a large number of educational institutions across Pacific Northwest.

MOTIVATING RATIONALE

Rapid urban growth is driving the demand for development in Oregon and SW Washington communities. Between 2000 and 2006, Oregon’s population grew by more than 8%¹, and is expected to grow another 46% by 2040.² Washington and Oregon are projected to be the ninth and tenth fastest growing states in the nation over the next 25 years, growing 46% and 41%, respectively – significantly higher rates than the 29% projected growth of the nation.³ Job sectors involved in regional development are thriving. For instance, in April 2007 construction jobs were at a record level of 103,200, up 2,600 jobs or 2.7% since April 2006.⁴ The Oregon Employment Department’s (OED) job projections indicate that growth in the targeted fields is certain to continue through 2014, with over 17% growth projected in construction jobs; 26.4% growth in the field of landscape architecture; and growth in architecture projected at 28.2%.⁵ Similarly, civil, mechanical and environmental engineering technician positions are projected to grow by more than 15% by 2012.⁶ Moreover, in recognition of projected labor shortages and skill deficiencies amongst construction workers, OED recently identified construction as one of five priority industries that will benefit from a new Workforce Training Fund, which will be used to train new

and incumbent workers.⁷ Consequently, the outlook for jobs at the 2-year degree level in construction and development-related fields is excellent.

These population-growth projections create serious conflicts, both personal and economic, with the Pacific Northwest's environmental values. The exquisite beauty of the region's natural environment is highly prized by its residents, who consider it central to the region's high quality of life. This is clearly reflected in the region's history of innovative land-use regulations and government initiatives. In the early 1970s Oregonians established the nation's first urban growth boundary to protect wild- and farmlands from urban sprawl and it continues to guide land-use planning today. In addition, city and regional governments regularly partner with non-profits and business to connect citizens with numerous resources for composting, naturescaping, habitat restoration, green remodeling and purchasing renewable energy. The environment is also key to the Northwest's economy and is, in fact, a central feature of the region's priority economic development strategies. The states of Oregon and Washington, the City of Portland, and the Portland Development Commission (PDC) all have specific sustainability initiatives within their economic development plans. The PDC provides finance and development incentives to support business expansion that leverages investment and/or job creation in the sustainable industry sector and has identified green building among the five main sustainable industries thriving in the region. The PDC Green Building Policy requires that construction projects receiving public financing meet standards that address several categories, including water efficiency, energy efficiency, selection of materials and resources, and indoor environmental quality.⁸ Indeed, there is so much activity that the *Sustainable Industries Journal*⁹ was created in 2004 to follow economic growth in Pacific Northwest markets. Additionally, the Oregon Economic and Community Development Department recently held the first annual state of Oregon Sustainability Awards program "to promote and advance the inclusion of sustainable practices in government and the private sector."¹⁰ Portland's commitment to creating a healthy, sustainable city runs so deep that the Portland Visitors Association makes fun of the issue in its marketing motto: "It's Not Easy Being Green."¹¹ However, the region now finds itself at a critical crossroads, facing challenges of managing population growth in ways that preserve the environment and maintain the beauty and high quality of life that are so central to the Pacific Northwest's values and economy. Managing urbanization – stormwater, energy, materials, water consumption, and waste – is becoming increasingly important as fewer virgin resources and less developable land are available. The projected population growth will undoubtedly drive innovation to protect watersheds, habitat, and air quality that will impact development – and the region's workforce.

Concurrently, the region's environmentally-minded residents are demanding "greener" construction practices that are ecologically responsible, maximizing water and energy efficiency. The green building movement is thriving in Oregon and Washington. Green building principles address all aspects of development that might impact ecosystems, including building placement, materials, landscaping, energy sources, maintenance practices, and heating and cooling systems. Portland was the first city to tailor the U.S. Green Building Council (USGBC)'s Leadership in Energy & Environmental Design (LEED) certification to a local ecosystem, and in 2005 the City of Portland strengthened and expanded its Green Building Policy to ensure that new City of Portland buildings, retrofits, and tenant improvements all meet stringent LEED certification levels.¹² The City also plans to incorporate ecoroofs and Energy Star rated roofing when practical into all operations and maintenance. Guidelines for city-funded private sector projects were also improved in 2005, requiring large-scale private-sector development that receives financial assistance from the PDC and other public agencies to adopt LEED New Construction (NC) "Silver" standards. Indeed, in 2007, Portland was second only to Seattle for the most buildings certified and registered as meeting LEED standards, and Oregon and Washington, along with California and Pennsylvania, continue to lead the nation in green building.¹³ Through its own certification program, Portland General Electric's Earth Advantage has seen exponential growth since its inception in 2000. The number of homes certified annually as an Earth Advantage home has skyrocketed, from 14 in 2000 to 2526 in 2006, and currently there are approximately 1200 green homes in the pipeline in various stages of planning and development.¹⁴ Earth Advantage-certified homes are at least 15% more energy efficient than homes which are conventionally built and they have features that address indoor air quality, efficient use of resources, and environmental responsibility.¹⁵

There are many indications that residential customers' interest and knowledge in sustainability will continue to steadily increase. "Green building" is no longer concentrated among hard-core

environmentalists – it is quickly gaining mass appeal and growing in tandem with widespread concerns about spiraling energy costs and supply shortages. Since February 2007, the Regional Multiple Listing Service (RMLS), the region's most authoritative source of information on home sales, has incorporated the leading green building programs in its listings.¹⁶ The RMLS' decision made Portland the first—and likely the largest—metropolitan area where a real estate listing service includes green building information as part of standard search capabilities. Over the past year, mainstream publications including *Sunset: Life in the West* magazine have repeatedly highlighted strategies for incorporating eco-friendly alternatives in residential building, remodeling and landscaping. *Oregon Home*, a popular regional magazine, now publishes a spin-off, *Oregon's Home's Green Living*, which highlights Oregon homes with sustainable design elements such as eco-roofs, reclaimed wood, and renewable power. Local contractors report that news media coverage of the commercial green building movement is increasing awareness and demand from their residential customers. Yet, despite growing demands from customers, industry workers are not adequately prepared to respond. For example, in a 2005 survey, local residential construction company owners reported an increase in requests for sustainability-related elements in their projects (e.g. new composite materials, new insulation, daylighting systems, rainwater harvesting systems), but limited knowledge or experience related to green building skills among the average residential construction worker.¹⁷ Moreover, existing construction training programs continue to promote traditional skill “silos”, and do little to encourage a holistic, multidisciplinary understanding of the construction process that is both an essential tenet of sustainable development and an increasingly important skill in the emerging “green” workplace.

To meet regional development demands, educational institutions and industry must develop strategies for training workers in sustainable technologies to serve the region's growing population with fewer resources and ensure the well-being of all who live and work in built environments. Regional businesses in the fields of building construction, landscaping, engineering, facilities maintenance, and architectural design and drafting struggle to maintain a workforce of technicians that is up-to-date in the skills necessary to implement new sustainable development regulations and guidelines, such as on-site stormwater management or enhanced habitat protection requirements. Professionals in building design and construction must be able to incorporate energy and water conservation features and products made with sustainably harvested, recycled, and non-toxic materials into their projects. Northwest landscape contractors are faced with the double challenge of learning about new technologies such as bioswales and raingardens to facilitate stormwater infiltration while becoming experts on drought-tolerant landscapes and high-efficiency irrigation systems, to meet summer watering restrictions. Moreover, in order to maintain the integrity and efficacy of sustainable technologies, facilities managers and maintenance workers must be knowledgeable in how to effectively operate and maintain them and communicate how they work to influence occupant behavior. Workers in each of these occupations must also understand how their contributions impact the effectiveness of an overall project, and how best to align the sustainability efforts of all team members for maximum synergy.

Regional businesses in these fields have already identified the need for workers trained in sustainable technologies and by all indications will increasingly require highly trained technicians to fill job openings – including technicians with 2-year degrees (see letters of commitment). Specific examples include: engineering technologists, field engineers, architectural assistants/studio assistants, interior designers, kitchen and bath designers, remodelers, construction estimators, home builders, landscape designers, landscape contractors/supervisors, landscape maintenance company owners/employees, wholesale nursery growers, LEED for Homes (LEED-H) trainers, maintenance technicians, solar specialists (photovoltaic (PV) panels, hot water solar panels), water harvesting specialists, environmental technicians in government agencies, energy conservation specialists, and renewable energy technicians. These are only some of many positions at the associate's degree level where training in sustainable technologies is in high demand. Additionally, as sustainable technologies quickly evolve and increasingly infuse the market, a regional strategy and resource for the continuing education and retraining of technicians to keep current on emerging technologies is critical. The evolving nature of these technologies requires cutting-edge education – a long-term need that the STTE project can begin to address.

To date, no community college in the Portland region has tackled these workforce needs in any comprehensive manner – there has been limited coordination between industry and educators, and no sustained effort to promote professional development for faculty teaching these technologies. Educational

programs have not been aligned with regional sustainability guidelines and remain siloed by discipline. There is no central clearinghouse for curriculum or collaborative strategies for meeting professional development needs. Moreover, while Oregon universities have begun to coordinate advanced sustainability degrees, community colleges, including PCC, have not developed a plan to address the need for sustainability education in the fields involved in development. Yet, technician jobs requiring associate's degrees drive the key industries and have the most growth potential. Community colleges must develop a regional plan to address the gap in training technicians in sustainable technologies. The proposed Sustainability Training for Technical Educators project will provide a structure to address industry's unmet workforce development needs related to sustainable development. As mentioned previously, the project will also lay the groundwork for future, larger-scale efforts to establish a Regional Center for sustainable development.

Portland Community College is uniquely positioned and highly qualified to lead the regional academic reform required for training a workforce skilled in sustainable development technologies. PCC's ATE Regional Center planning grant (NSF #0603466), which concluded in June 2007, helped PCC faculty and staff develop strong relationships with many potential partner organizations, and identified priorities, strategies, and outcomes required to meet growing regional workforce education needs. In addition, PCC's recently completed NSF ATE Project *Framing Student Success* (NSF #0302945) was a successful model of partnership among K-12 schools, a 2-year college, a 4-year university, and industry, which provided high school students and teachers with applied mathematics and science experiences within the context of construction. Six new courses focused on green-building were developed through this project (see NSF Prior Support section and Attachment 1). Moreover, in response to industry needs, PCC recently developed a Certificate in Sustainable Building that combines architectural drafting and design, green-building construction technology, and environmental science courses (Attachment 2). Yet, despite such advances, more work is required. PCC's current "green" offerings (Attachment 3) are optional and based around the knowledge and enthusiasm of a few key instructors with a personal interest in sustainability. However, industry representatives involved in PCC's ATE Regional Center planning grant indicated that sustainability content needs to be infused throughout curriculum and become standard at the program level in order to truly equip students and fully integrate green practices into the workplace. Moreover, while individual instructors have acquired a scholarly understanding of green practices related to their particular technical field, the same instructors have typically not experienced the realities of applying such practices and technologies in the workplace. The STTE project will address these and other issues, broadening educators' knowledge and understanding of sustainable development, expanding "green" curriculum across programs, and preparing students for a wide variety of technical careers in design and construction related industries.

GOALS AND OBJECTIVES

The long-term goal of PCC and its partners is to supply regional building and design-related industries with high quality workers skilled in sustainable development technologies who understand and appreciate sustainability as it relates to their industries. To reach this long term-goal, PCC and its partners continue to develop a strategic plan for establishing an ATE Regional Center to lead the reform of the region's academic programs in order to produce a greater number and higher quality of workers who meet regional workforce demands and to ensure that curricula are aligned with national skills standards, industry best practices, and regional ecosystem constraints. **The goal of the STTE project is to implement the first steps of the Regional Center strategic plan, by increasing the knowledge, skills and interdisciplinary capabilities of educators in technical programs that have the greatest potential to impact sustainability as it relates to the built environment.** The project goal was developed directly from the findings of ATE Planning Grant (NSF # 0603466).

PCC will attain the project goal by accomplishing the following objectives:

- **Objective 1:** Improve educators' knowledge and understanding of sustainability issues, trends, technologies, and industry best practices.
- **Objective 2:** Translate this new knowledge into curriculum changes so that students in a variety of technical programs are better prepared for work in fields where sustainability is an emerging concern.
- **Objective 3:** Create a community of sustainability-focused technical educators and provide these educators with a venue for scholarly interaction and dissemination of educational materials.

ACTIVITIES AND DELIVERABLES

PCC will achieve the identified objectives through the following activities:

Activity 1: PCC will develop and host a Summer Sustainability Institute for instructors in target professional-technical programs at partner 2-year colleges, 4-year colleges, high schools, and union training schools.

The Summer Sustainability Institute (SSI), which addresses Objectives 1 and 2, will introduce 50 instructors from programs such as architectural design and drafting, building construction technology, engineering technology, facilities maintenance technology, energy management, and landscape technology, to broad concepts, theories and issues that are central to sustainable development. By convening a group of educators from a diverse range of technical fields and educational levels (high school, 2-year and 4-year college, and union training schools) the training will highlight the interdisciplinary nature of sustainable development and encourage collaborative work between instructors with different areas of expertise. In addition, the SSI will provide participants with tools and techniques needed to infuse sustainability content into curriculum, introduce educators to a variety of innovative pedagogical techniques, and require participants to revise at least one course to reflect their new knowledge and skills. The SSI will be modeled on successful professional development programs identified during PCC's ATE Planning Grant, such as The Piedmont Project¹⁸; The Ponderosa Project¹⁹; and CREATE California, an NSF ATE Regional Center that focuses on faculty development in technical programs.²⁰ The results of such projects have been impressive. For example, the Piedmont Project at Emory University, which was based on the 5-year experience of the Ponderosa Project at Northern Arizona University, reports that over 75% of faculty who engaged in sustainability workshops changed more than one course, and that a variety of innovative pedagogical methods were adopted, involving more hands-on learning, outdoor exercises, fieldtrips, innovative writing assignments and laboratories. Three-fourths of Emory faculty who participated in the Piedmont Project reported changing the way they taught.²¹ Similar outcomes are expected to occur as a result of PCC's Summer Sustainability Institute. The CREATE project provided valuable input on workshop design, including the necessity of tying a portion of stipend disbursement to follow-up sessions where curriculum changes are submitted and discussed. Such information directly informed the development of the budget for the SSI (see budget narrative for more detail).

Training cohorts will consist of 25 members; with two cohorts participating in training sessions over the three year project period (see timeline for details). Instructors will compete for places in the program by filling out an application that includes why they are interested in sustainable development and one course they would like to improve using the methods introduced during this institute. Participants will receive three days of in-person, intensive training, followed by curriculum revision time over the summer. Participants will be expected to revise the curriculum of at least one course that they teach to include/enhance sustainability content. Approximately ten weeks after the training, participants will reconvene for one day to present the revisions made to their courses and coach each other on teaching strategies. At this time, participants will also receive student evaluation materials to be utilized when the improved courses are taught. During the SSI, participants will also be introduced to a web-based clearinghouse of exemplary sustainability curricula, links to training resources, and information on sustainable development events to support participating instructors who are seeking to upgrade their sustainability skills and knowledge (see Activity 3). The website will also include an online shared workspace for participating faculty and instructors. In addition, training cohort members will be encouraged to participate in quarterly conference calls, organized by PCC, to share ideas, experiences, and help maintain contact and connections.

The SSI will be hosted on the campus of Lewis & Clark College, which provides highly competitive rates for food, lodging, and facility rental, along with a campus environment that models sustainability practices and is centrally located for field-trips throughout the Portland region. The following are examples of potential SSI training activities:

- Pre-training survey to gather baseline knowledge
- Introduce principles of sustainability (e.g. Natural Step framework, Eco-Footprinting, and LifeCycle Assessment)

- Present ideas for curriculum topics drawn from the findings of PCC's ATE Planning Grant. Examples include: systems thinking and integrated design; biomimicry; local industry supply chain; life-cycle costing; tools and technologies for resource conservation; metrics, data collection, analysis and modeling; critical thinking and innovative problem solving; policy, incentives, regulations and codes; interdisciplinary coordination and project management; health and safety of products/indoor air quality; public/client/employee education on sustainability
- Field trips to green building sites/businesses that exemplify sustainability principles and meet some of the project people who created them
- Discuss pedagogy and how to incorporate sustainability principles/curriculum topics into courses using tools such as project-based learning, collaborative campus projects, and online resources
- Utilize group projects to develop and present example teaching modules
- Evaluate training to see what was learned and give feedback about how to improve the SSI
- Participants introduced to website and online learning community. Participants also receive textbooks and a resource list (e.g. books, movies, websites) for use in curriculum development

The SSI will be organized, managed, and facilitated by Noelle Studer, (co-PI and PCC's Sustainability Coordinator). Technical content on sustainability topics will be delivered by Conservation Services Group, Inc (CSG), a national non-profit organization that specializes in the design, development, and delivery of energy efficiency and renewable energy training programs. CSG has over two decades of experience working with a wide variety of partners, including K-12 schools and colleges, to provide training workshops that address all aspects of energy efficiency, renewable energy, and emerging energy markets. CSG will donate their time and experience to the STTE project providing an important leveraged resource that will help ensure success (see letters of commitment). PCC's Office of Curriculum Support Services (CSS), which has expertise in curriculum development, course design, teaching methods, and technology and multimedia development support, will facilitate workshop discussions on pedagogy and teaching practice to assist participants with integration of sustainability topics/content into their curriculum. CSS will also offer this service at no cost to the project. In addition, PCC faculty members who have experience incorporating sustainability education into their courses (co-PIs Spencer Hinkle, Denise Roy, and John Shaw, plus their departmental colleagues) will attend workshop sessions and offer insights and perspectives learned from their efforts thus far.

Professional-technical educators from the following institutions located throughout Oregon have already expressed an interest in participating in the Summer Sustainability Institute: Klamath Community College, Central Oregon Community College, Clatsop Community College, Portland Community College, Mt. Hood Community College, Chemeketa Community College, Lane Community College, Oregon Institute of Technology, Rogue Community College, Linn-Benton Community College, Portland State University, Oregon State University, Portland Public School District, and Beaverton School District (see letters of commitment).

Deliverables for Activity 1: Deliverables for the Summer Sustainability Institute include:

1. Participants will be able to articulate sustainability principles and concepts.
2. Participants will incorporate sustainability principles, concepts and topics into a minimum of one of their existing courses.
3. Participants will incorporate resources from the sustainability clearinghouse in their classes.
4. Participants will make all revised course materials and resources developed as a result of training available for dissemination to other training participants and a wider audience.
5. Students taking revised classes will be exposed to sustainability principles and concepts in the context of their chosen professional-technical programs and demonstrate understanding/application of appropriate sustainable design techniques, materials, and construction/usage methods.

To test the concept of the SSI, PCC ran a 1½ day pilot training during June 2007, funded in part by internal PCC professional development resources and utilizing leveraged resources from Conservation Services Group. The pilot was offered as a voluntary add-on session to the first annual Northwest Building Construction Educator Summit. The Summit was part of the dissemination plan for *Framing Student Success* (NSF ATE award #0302945), and was designed as a venue for community college and high school educators to come together to talk about sustainability in construction programs. During the pilot, an

interdisciplinary group of 21 community college faculty and high school teachers from around the Pacific Northwest learned how to incorporate sustainability concepts into building-related professional-technical courses. The training included an introduction to sustainability concepts; field trips to sustainable businesses and buildings; guest speakers who led discussions on a variety of sustainability topics; and an exploration of curriculum development tools that can be utilized to incorporate sustainability concepts into classes. Participating instructors had a range of experience, interest, and knowledge of sustainability in the context of their respective disciplines. Some instructors were knowledgeable about specific technologies, but lacked a broader understanding of sustainability concepts and how such concepts relate to their field of instruction. Other participants had more grasp of overarching ideas, but lacked applied knowledge pertinent to their field of interest. Based on feedback, the majority participants shared immense appreciation for the opportunity to network and round-out their understanding of sustainable development. More specifically, instructors valued practical advice on issues such as how to identify and source sustainable materials, how to apply sustainability concepts to specific programs and classes, and found discussions on pedagogical tools and techniques to be very helpful.

Activity 2: Build in-depth, discipline-specific sustainability expertise amongst faculty from PCC's Architectural Design & Drafting/Interior Design program, Building Construction Technology program, and Facilities Maintenance Technology program, and significantly revise respective program curricula to include new sustainability content.

This professional development opportunity, which also addresses Objectives 1 and 2, will allow nine faculty members from three PCC departments (Building Construction Technology, Architectural Design & Drafting/Interior Design, and Facilities Maintenance Technology) to participate in industry internships. Internships will be designed to provide faculty with in-depth, hands-on, discipline-specific training, exposing participants to emerging best practices, techniques, and technologies related to sustainability. This activity differs from the SSI in both intensity and duration of training for faculty. In addition, by working closely with companies operating in local and regional markets, participants will deepen their understanding of local and regional influences (economic, political and social) that impact the adoption of “green” practices in their respective technical fields. Internship opportunities will be sought with companies that are recognized as regional leaders in sustainable development, such as those endorsed by Earth Advantage, the Northwest's premier green building program that promotes energy-efficiency and environmental sensitivity in residential design and construction. The Earth Advantage program will also serve as a framework to guide training and curriculum needs. Existing curriculum from the target programs will be mapped against the sustainable design and construction practices and principles developed by Earth Advantage, that focus on factors such as indoor air quality, energy efficiency, resource efficiency, and environmental responsibility. Areas where the sustainability content of curriculum can be improved will be identified, and internships designed to offer the appropriate training to instructors. On completion of the training, participants will significantly revise course curriculum or develop new curriculum to reflect the new content.

Preliminary mapping of current courses against Earth Advantage practices and principles indicates that at least ten Architectural Design/Interior Design (AD&D/ID) courses will be revised and twelve Building Construction Technology (BCT) courses will be revised (Attachment 4). Most of these courses will be upgraded to include new material that relates to each of the four Earth Advantage benchmark areas (indoor air quality, energy efficiency, resource efficiency, and environmental responsibility). While the mapping process has not yet been completed for the Facilities Maintenance Technology (FMT) program, faculty anticipate that six new courses will be created in FMT (Attachment 5), by extracting sustainability related content already present in existing courses, augmenting it with new curriculum developed as a direct result of internships, and repackaging the combined curriculum into new course offerings. The lead instructors from each participating department will also use release time in Year 3 of the project to plan collaborative activities that will promote cross-departmental cooperation and result in opportunities for interdisciplinary teaching and learning.

Each of the departments identified to participate in the internship program has unique needs with respect to training. Participating faculty members have different levels of existing knowledge, different gaps in experience, and are required to balance training opportunities with individual teaching schedules, administrative duties, and College policies for release time. Consequently, the internship program has

been tailored to accommodate the needs of each participating department. An overview of each department's internship/training plan is provided below. See Attachment 6 for more details.

Architectural Design & Drafting/Interior Design (AD&D/ID) - Two full-time faculty members from PCC's Architectural Design & Drafting/Interior Design program will participate in the training. In grant year 1 (2008-09), each instructor will receive half-time release during Fall and Winter terms in order to participate in internships, and half-time release in Spring term to revise course materials and curriculum. During grant year 2 (2009-10), both instructors will receive quarter-time release in Fall and Winter terms to participate in internships, and quarter-time release in Spring term to complete course revisions and write an instructional manual that will be shared with other instructors in the Interior/Architectural Design and Building Construction Technology programs. The AD&D project lead (Denise Roy, co-PI) will also receive a one course release during winter term 2011 to plan collaborative activities with BCT and FMT project leads.

Building Construction Technology (BCT) - Three full-time faculty members from PCC's Building Construction Technology program will participate in the training. In grant year 1 (2008-09), each instructor will receive one term, full time release, during which time each instructor will participate in eight weeks of internship followed by two weeks of curriculum revision. During grant year 2 (2009-10), instructors will repeat the process, receiving one term release each for internship and course development/revision. The BCT project lead (Spencer Hinkle, co-PI) will also receive a one course release during winter term 2011 to plan collaborative activities with AD&D and FMT project leads.

Facilities Maintenance Technology (FMT) - Three full-time faculty members and one part-time faculty member from PCC's Facilities Maintenance Technology and Electrical Trades program will participate in the training. In grant year 2 (2009-10), the three full-time instructors will receive half-time release in Winter or Spring term to participate in internships and begin curriculum development. In grant year 3 (2010-11), the same instructors will each receive quarter-time release during Fall term to complete internships and curriculum development. The part-time instructor will receive half-time release in Summer 2010 and quarter-time release in Fall 2010 (both Year 3) for internships and curriculum development. The FMT project lead (John Shaw, co-PI) will also receive a one course release during winter term 2011 to plan collaborative activities with BCT and AD&D project leads.

Several potential internship sites in the Portland area have been identified for participating faculty, including Earth Advantage, SERA Architects, GreenWorks, Better Bricks, Renaissance Builders, Coho Construction, Solar interior Design, Sky Limit design, the Office of Sustainable Development at the City of Portland, Neil Kelly Cabinets, Neil Kelly Remodeling, Barrs and Grenauer, and Conservation Energy Group, Oregon Solar Energy Industries Association, ALKO Construction, Mr. Sun Solar, Sky Limit Design, and Inland Electric (see Attachment 7 - letters of commitment).

Deliverables for Activity 2: While specifics will vary for participants from different departments, Activity 2 will result in increased instructor knowledge of design, application, and cost-benefit analysis of a wide variety of sustainable technologies, concepts, and systems. Examples by discipline include:

- **Architectural Design & Drafting/Interior Design** – Structural systems (e.g. raestra block, SIPS); residential building systems (e.g. water harvesting, passive solar, HVAC for LEED's, efficient lighting, water efficient plumbing fixtures & systems); residential landscape systems; sustainable finishes for residential applications; LEED-H; building energy analysis; sustainable finishes, materials, & furnishings; indoor air quality – analysis and impacts; energy efficient appliances and lighting design; plug load & impact on energy efficiency; integration of interior design with building systems such as passive solar, daylighting, photovoltaics, water harvesting.
- **Building Construction Technology** – Allergen control; recycling construction waste; safe disposal of hazardous waste; protecting soil; safe outdoor wood; efficient use of wood; sustainable or salvaged wood; key features of energy efficient homes; continuous insulation windows; performance testing; air leakage driving forces; selection and installation energy efficient windows, appliances & lighting; passive solar design, design of heating and cooling system for efficiency.
- **Facilities Maintenance Technology**– Mechanical systems (e.g. Sunny Boy, Sharp); residential building systems (e.g. water harvesting, passive solar, HVAC for LEED's, efficient lighting, water

efficient plumbing fixtures & systems); sustainable materials for residential applications; LEED-H; building energy analysis; indoor air quality – analysis and impacts; grid connection (energy efficient interfacing & backup power, plug load & impact on energy efficiency); integration of interior design with building systems (e.g. passive solar, water heating, photovoltaic, water harvesting).

In addition to technical expertise, faculty from the participating departments will also gain general knowledge about incentives available for installation of green systems; regulatory barriers; public/trade perceptions of green technologies; and educating customers and co-workers about green technologies. Such elements are equally as important as technical knowledge in promoting the growth of sustainable development.

As mentioned previously, on completion of the training, participating PCC faculty will revise a minimum of ten Architectural Design/Interior Design courses and twelve Building Construction Technology courses, and create six new courses in the Facilities Maintenance Technology program. Students taking the revised/new courses will become well versed in the theory, application, and implementation of sustainable practices relevant to their field of study and demonstrate mastery of content during class assignments. In addition, the revised instructional materials/curriculum will be shared with other full-time and part-time instructors in PCC's Interior/Architectural Design, Building Construction Technology, and Facilities Maintenance Technology programs, developing a broader base of shared expertise amongst a larger number of faculty members, which in turn will catalyze program-wide change. New curriculum materials produced as a result of the project will also be shared with instructors from associated programs at PCC such as Building Inspection Technology, Engineering, and Electrical Trades, along with local Home Builders Associations, community development organizations, high schools and community colleges from around the region, and other organizations with an interest in sustainable development (see Dissemination section for more details).

Activity 2 will also result in the development of new collaborative activities between PCC's BCT, AD&D/ID, and FMT departments. This is seen as an important deliverable of the STTE project as sustainable development poses such broad and encompassing challenges that it requires contributions from many disciplines. Collaborative activities could include cross-departmental guest lectures, joint presentations at PCC's Teaching and Learning Centers, co-creation of a teaching and learning resource on a PCC campus that would display sustainable technologies utilized in the various programs, and development of hands-on design and construction projects for cross-disciplinary teams of students.

ACTIVITY 3: PCC will develop and maintain a web-based clearinghouse of exemplary sustainability curricula, links to training resources, and information on sustainable development events to support instructors who are seeking to upgrade their sustainability skills and knowledge. The site will also include an online shared workspace for educators participating in the project.

This activity addresses Objective 3. The project Training Coordinator will oversee development and management of a project website that will serve as a resource hub, dissemination point, and online workspace for project participants. Technical expertise/web-development services will be supplied by PCC's Office of Information Technology. It is anticipated that the website will be based around a format such as Drupal or Moodle, which will afford interactivity for participants. Development of an online sustainability curriculum bank for technical educators was begun under PCC's NSF ATE Regional Center planning grant. The material collated under the planning grant will be migrated to the new website and new curriculum developed by STTE project participants added to the site. Due to the interactive nature of the web platform, participants will be able to offer feedback and ratings of curricula/teaching materials that they use, informing future use and refinement. The site could also feature blogs from industry representatives regarding skills needs, technological advances, and significant industry developments in the region. Video training modules will also be solicited from faculty at other regional community colleges who have expertise in specific sustainability topics, and be posted on the website as a resource for educators. Possible examples include: Increasing building energy efficiency using landscape design (Lane CC); Construction site soil management for on-site stormwater infiltration and water-wise gardens (Clackamas CC); Greeninfrastructure: Processing graywater using wetland plants (Chemeketa CC); Northwest edible landscape design using microclimate variation (Linn-Benton CC); and Sustainable building principles: Touring the Jean Vollum EcoTrust Building (Mt. Hood CC). The Training

Coordinator will be responsible for soliciting contributions to the website and encouraging project participants to utilize the resources provided.

Deliverables for Activity 3: The website/online forum described above will be the deliverable for Activity 3. Website use by project participants will be evaluated and inform improvements to ensure that the site functions as a valuable professional development resource for technical educators.

TIMETABLE

The following table highlights the timeline for major project activities. Corresponding evaluation activities are detailed in the Evaluation section. Dissemination activities will begin with attendance at the national ATE conference in October 2008, and proceed as appropriate throughout the project period (see Dissemination Plan section for more details). Please see Attachment 6 for a project Gantt chart that provides additional scheduling information.

Year 1 (2008-2009)	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Project Startup	x	x	x									
Project Team Meetings	x	x	x	x	x	x	x	x	x	x	x	x
Steering Committee Meetings	x			x			x			x		
Plan and recruit for first SSI				x	x	x	x	x	x	x	x	x
Develop project website							x	x	x	x	x	x
First SSI 3-day workshop												x
Internships/curriculum dev. for BCT faculty			x	x	x	x	x	x	x	x	x	
Internships/cur. dev. for AD&D/ID faculty			x	x	x	x	x	x	x	x	x	
Year 2 (2009-2010)	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Project Team Meetings	x	x	x	x	x	x	x	x	x	x	x	x
Steering Committee Meetings	x						x					
Follow-up session for first SSI workshop			x									
Plan and recruit for second SSI							x	x	x	x	x	x
Second SSI 3-day workshop												x
Internships/curriculum dev. for BCT faculty			x	x	x	x	x	x	x	x	x	
Internships cur. dev. for AD&D/ID faculty			x	x	x	x	x	x	x	x	x	
Internships/curriculum dev. for FMT faculty			x	x	x	x	x	x	x	x	x	
Year 3 (2010-2011)	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Project Team Meetings	x	x	x	x	x	x	x	x	x	x	x	x
Steering Committee Meetings	x						x					
Follow-up session for second SSI workshop			x									
Internships/curriculum dev. for FMT faculty	x	x	x	x	x	x						
One term release for lead faculty to plan collaborative, interdisciplinary activities							x	x	x			
Project closeout										x	x	x
Compile final report for project											x	x

MANAGEMENT PLAN

The Project Team and a Steering Committee will have primary responsibility for managing the STTE project. The Project Team will consist of a PI and four co-PIs, each drawn from a different department at PCC. The Steering Committee will be comprised of the Project Team plus the Division Deans and Deans of Instruction who supervise them. The Project Team will meet monthly throughout the grant period. The Steering Committee will meet quarterly during Year 1 and bi-annually in Years 2 and 3 (see timeline). The management plan illustrates the interdisciplinary nature of this project, the breadth of the project's impact within PCC, and the College administrations' commitment to making the project a success. Three professional-technical departments, each from a different PCC campus, are represented on the Project Team – Building Construction Technology (Rock Creek campus), Architectural Design & Drafting/Interior Design (Sylvania campus), and Facilities Maintenance Technology (Cascade campus), along with the PCC district Sustainability Coordinator and the PI who is a faculty member from PCC's Engineering program. In addition, three Division Deans (overseeing each of the participating

professional-technical departments) and three Deans of Instruction (one from each campus) will participate on the Steering Committee, providing institutional support for project process and execution. The Division Deans and Deans of Instruction will also provide a conduit for communication and relationship-building with other local community colleges, high schools, and 4-year colleges, aiding in the recruitment of educators for training, broadening awareness of PCC's efforts to promote sustainable practices, and laying the groundwork for enhanced collaboration on future efforts to establish an ATE Regional Center for sustainability education. The Steering Committee will be co-chaired by Barbara Van Amerongen, Dean of Instruction at PCC's Sylvania campus, and Todd Sanders, project PI. The PI will be responsible for providing the Steering Committee with regular updates on activity, timeline, budget, and outcomes via e-mail and in-person meetings. Based on this information, the Steering Committee will make recommendations for program modification as needed.

ROLES AND RESPONSIBILITIES OF PI AND CO-PIs

Todd Sanders, Ph.D., PCC Sylvania, General Engineering and Civil and Mechanical Engineering Technology Faculty, will serve as lead Principal Investigator (PI). As lead PI, Dr. Sanders will chair the Project Team, co-chair the Steering Committee, and provide overall project leadership and management. He will oversee and coordinate the budget and the activities of the co-PIs and the project evaluators. Dr. Sanders will also ensure that project activities are carried out on schedule and within budget, oversee dissemination efforts, and will be responsible for all reports to NSF. Dr. Sanders has a MS and Ph.D. in Physical Oceanography from University of Delaware and a BS in Civil Engineering from Michigan State University. Dr. Sanders also has expertise in environmental issues, particularly in the areas of wetlands and water. He is heavily involved with sustainability efforts on PCC's Sylvania Campus, and recently developed a project-based learning course in which engineering students designed, sourced, and built a biodiesel reactor that now supplies fuel, made from used cafeteria grease, to the College's Alternative Fuels program in PCC's Automotive Department. In addition, Dr. Sanders participated as Senior Personnel on PCC's NSF ATE Planning Grant (award #0603466) and was fully engaged in all aspects of planning and developing this proposal. He also served as PI on PCC's recently completed NSF CSEMS grant (award #0220875). Dr. Sanders is a strong choice for as PI due to his deep involvement with PCC's sustainability efforts to date, his close ties to faculty in the other participating departments, and his extensive experience managing grant-funded projects. In addition, the choice of Dr. Sanders will allow co-PIs from the building construction, architectural design, and facilities maintenance departments to concentrate their efforts on professional development, curriculum revision, and reorienting their respective programs to address sustainability. Quarter-time (0.25 FTE) release is anticipated to be adequate for Dr. Sanders to complete his PI duties, since the co-PIs will organize and manage individual professional development activities. Dr. Sanders will also have the support of a 0.25 FTE Administrative Assistant and a casual administrative employee. Please see the budget and budget narrative for more detail.

Four co-PIs will also manage the project. These individuals include faculty from PCC's three main campuses plus the PCC district Sustainability Coordinator. All have expertise in sustainable development education, particularly as it relates to their specific fields. The co-PIs, along with Dr. Sanders, will comprise the Project Team, and will also sit on the Steering Committee.

Spencer Hinkle, BA, PCC Faculty Chair, Building Construction Technology, was the PI on Framing Student Success (award #0302945), a recently completed NSF ATE Project, and was co-PI on PCC's ATE Planning Grant (award #0603466). Mr. Hinkle holds degrees in Building Construction Technology and Geography and is a Certified Kitchen Designer. He is the co-creator of PCC's Sustainable Building Certificate and developed PCC's sustainable building courses. In addition, Mr. Hinkle has extensive experience providing professional development to K-12 teachers and he has established excellent relationships with construction industry partners. Mr. Hinkle will receive one term release during Project Years 1 and 2, allowing him to participate in industry internships, redesign curriculum, and oversee the training and curriculum development work of two additional BCT faculty members. In project Year 3, Mr. Hinkle will receive one course release to plan and design cross-disciplinary collaborative activity with the other project co-PIs.

Denise Roy, MUP, M. ARCH, PCC Faculty, Architectural Drafting and Design, holds degrees in Design, Housing Studies, Urban Planning and Architecture. Ms. Roy was co-PI on PCC's ATE

Planning Grant (award #0603466) and is the co-creator of PCC's Sustainable Building Certificate. In addition, she has made extensive instructional improvements in PCC's Architectural Drafting and Design program, including the integration of sustainable building technologies into the curriculum and incorporation of service learning. Ms. Roy is well-connected to industry partners, including LEED certified architects and designers and Portland General Electric Earth Advantage. Ms. Roy will receive half-time release during three terms of Project Year 1 and quarter-time release during three terms of Project Year 2, allowing her to participate in industry internships, redesign curriculum, and oversee the training and curriculum development work of one faculty member from PCC's Interior Design department. In project Year 3, Ms. Roy will receive one course release to plan and design cross-disciplinary collaborative activity with the other project co-PIs.

John C. Shaw, MEd, PCC Faculty, Trades and Industry. Mr. Shaw holds certificates as Welding Inspector and Senior Manufacturing Engineer, is a certified Network Technologies Instructor, and holds an Oregon Electrical License. He has extensive curriculum design experience, having developed PCC's Fiber Optic Program and several solar energy training and solar home design courses for Yakima Valley Community College. Mr. Shaw has also developed student labs on a variety of sustainability-related topics including electrical, building energy efficiency, passive and active solar heating, heating and cooling systems, and building construction. Mr. Shaw has hosted many public educational projects and conferences and was the founder and president of the Yakima Solar Energy Association. Mr. Shaw will receive half-time release during one term in Project Year 2 and quarter-time release during one term in Project Year 3, allowing him to participate in industry internships, redesign curriculum, and oversee the training and curriculum development work of three other faculty member from PCC's Facilities Maintenance Technology department. In project Year 3, Mr. Shaw will also receive one course release to plan and design cross-disciplinary collaborative activity with the other project co-PIs.

Noëlle Studer, MS, MPA, PCC's Sustainability Coordinator will serve as Training Coordinator for the project, organizing, coordinating and participating in all SSI training events and activities. In addition, Ms. Studer will oversee development of the project website/online learning community, manage the website on an ongoing basis, and ensure coordination of the STTE project with other PCC sustainability initiatives. Ms. Studer served as Senior Personnel on PCC's ATE Planning Grant (award #0603466) and, through her strong connections to local and regional industry, non-profit, and government agencies involved in sustainability efforts, was integral to development of this proposal. Biographical sketches for all PIs are attached.

PLAN FOR SUSTAINABILITY

PCC's Sustainable Use of Resources Policy, adopted by PCC's Board of Directors December 7, 2006, states: *"Portland Community College is committed to becoming a leader in academic programs and operational practices that model the sustainable use of resources, so that the needs of current generations are met without impairing the ability of future generations to meet their own needs."*

Framed by this commitment, PCC's academic programs are evolving to infuse best practices in energy conservation, toxics reduction, and renewable energy into their courses. The STTE project is viewed as an important component of this long-term, College-wide effort has the full backing of the District President, Dr. Preston Pulliams (see letters of commitment). As mentioned previously, the STTE project is also considered the first tactical step toward establishing an ATE Regional Center for sustainability education, and NSF funding to support such an effort will be pursued in the future. In addition, if the faculty development measures presented in this proposal prove to be successful, PCC will also explore the use of College funds, such as those available through PCC's District Staff Development Office or campus funds, to expand sustainability training to a broader pool of full- and part-time faculty from a wide variety professional-technical programs, including Landscaping Technology, Electrical Trades, and Engineering, along with additional instructors from building construction, design, and facilities maintenance programs. It is envisaged that faculty who participate in the Summer Sustainability Institute during the STTE grant period will subsequently become candidates for in-depth training and industry internships, sponsored by PCC and/or industry partners. Through this process, a greater proportion of PCC's professional-technical programs will be "greened-up", providing a growing cadre of students with opportunities to participate and succeed in the sustainable development sector. By participating in professional development on an on-going basis, PCC instructors will also be poised to

serve as a resource to their colleagues throughout the region and encourage similar professional development programs to be adopted at other educational institutions. As such, the course revisions, new courses, and faculty training materials and models developed as part of this project will continue to be utilized by educators throughout the region well beyond the grant period.

EVALUATION PLAN

In line with NSF standards and practices, project evaluation will be performed by an external evaluator. While a final choice for evaluator has not yet been made, discussions are underway with Dr. Christine Cress, Chair of Educational Policy, Foundations, and Administrative Studies (EPFA) at Portland State University (PSU). Dr. Cress is also involved in the Post Secondary, Adult & Continuing Education (PACE) program at PSU and her specialty is faculty training. Dr. Cress has expressed interest in serving as evaluator for the project and is a strong candidate for the role (see Attachment 8 for Dr. Cress’ biography). PCC has also identified other highly qualified evaluators in our region who are appropriate possibilities, such as Northwest Regional Educational Lab and NPC Research. In accordance with PCC’s procurement policies, a request for proposals for evaluation services will be issued upon award of grant funding. The project PI, Dr. Sanders will be responsible for facilitating this process. The evaluation budget represents 7% of the total project budget, which is within the range typically recommended for NSF projects (5-10%).

While the final evaluation plan will be developed in conjunction with the external evaluator, evaluation efforts are likely to focus on three major components: 1) The training process (e.g. what did participants think of the training? What did PCC/industry partners learn about the training process? How could it be improved?) 2) The outcome of training on educators (e.g. what changes did participating faculty and teachers make in their teaching practice? How is their new knowledge being used in the classroom? How does new course content align with the Earth Advantage sustainability practices and principles) 3) The impact of training on students (e.g. what changes have been seen in student learning outcomes?). The following table outlines possible evaluation activities by year, based on the project timeline. Because the project year coincides with PCC’s fiscal year (July 1 to June 30), some activities that are intrinsically linked (e.g. 3-day workshop and 1-day follow-up session) are split between project years. It is anticipated that variety of evaluation tools and techniques will be employed, including surveys, interviews, tests, and case studies. Yearly benchmarks for progress will be defined as appropriate during development of the evaluation plan and ongoing evaluation will inform modification of project design to ensure that the desired project goals are achieved.

Summer Sustainability Institute	Industry Internships
Year 1	
a. Collaborate with Training Coordinator and training providers to devise evaluation strategy for Summer Sustainability Institute b. Evaluate SSI participants’ experiences during the first 3-day workshop (June 2009)	a. Collaborate with participating faculty to devise evaluation strategy for internships b. Evaluate internship experience and extent of subsequent curriculum change for five faculty members (3 from BCT, 2 from AD&D/ID)
Year 2	
c. Evaluate follow-up session from 3-day workshop and participants’ experiences with revising curriculum. d. Evaluate changes in teaching practice resulting from SSI training and use of online resources e. Evaluate changes in student learning outcomes f. Evaluate SSI participants’ experiences during the second 3-day workshop (June 2010)	c. Begin evaluation of internship experience and extent of subsequent curriculum change for eight faculty members (3 from BCT, 2 from AD&D/ID, 3 from FMT). This activity may spill into Year 3 as internships finish near the end of Year 2.
Year 3	
g. Repeat steps c) through e) above h. Compile final evaluation report on impact and outcomes of the SSI	d. Repeat c) above for four faculty from FMT. e. Examine outcomes of faculty planning for collaborative activity to promote interdisciplinary learning. f. Compile case study of internship experiences

DISSEMINATION PLAN

Dissemination will occur through various channels, promoting awareness of project outcomes at the college-wide, local, regional, and national/international levels. PCC faculty members who participate in the SSI and industry internships will share their experiences with their departmental colleagues during quarterly subject area advisory committee meetings and will also participate in cross-departmental guest lectures and joint presentations at PCC's Teaching and Learning Centers. If feasible, a teaching and learning resource on a PCC campus will be created displaying sustainable technologies utilized in the various participating programs. In addition, cross-departmental collaborative projects that arise from grant-funded planning activities will add to PCC-wide dissemination efforts. Project information and progress will also be posted on the BCT, AD&D/ID, and FMT department websites with links to the project website, which itself will function as an important dissemination portal.

Based on the information gleaned during faculty internships, and utilizing materials compiled as part of curriculum revision efforts, PCC will publish a booklet that will serve as a reference for increasing the sustainability content in the following professional-technical courses: Architectural Design & Drafting 101, 102, 124, 204, 224, and Interior Design 132, 120, 138, 238, 234, 236. The topics covered will focus on sustainable practices for Western Oregon and Washington, including: construction; passive solar design; daylighting; water harvesting; materials selection; energy efficient design, including structural systems, building science, embodied energy, and lighting design; indoor air quality; tax incentives; and local contacts and suppliers for architectural & interior design. This booklet will be used internally at PCC to orient new and current faculty, and could be used by additional Community Colleges in Oregon, Washington and other states (with appropriate modification). The booklet will also be a useful reference for high school teachers with classes in allied subject, and be distributed at home owner's repair fairs, such as those sponsored by the City of Portland's Office Sustainable Development. In addition, the booklet will be made available to local and regional Home Builders associations, Realtor's groups, and other organizations/individuals interested in promoting sustainability. Participating FMT faculty will produce a CD with Power Point presentations for classroom use, and a class series for electrical apprentices in training. As a member of Solar Energy Association of Oregon and in cooperation with the Energy Trust of Oregon, information about the project will also be exhibited at the annual Oregon Solar Conference. In addition, information gained during internships and curriculum development will be presented to City and County employees such as those working in building permit offices; to employees of local and regional Community Development Corporations, and at informal gatherings that serve the construction and sustainability community, such as home builder's lunch groups and Portland Greendrinks.

To disseminate project results to a state-wide audience of business leaders and lawmakers, PCC will report project progress and outcomes to the Oregon Economic & Community Development Department (OECCD). PCC is the technical education representative on the "Green Development Cluster" catalyzed by the OECCD. As such, PCC plays a critical role in connecting technical programs throughout the region to state-wide workforce development initiatives, as well as strengthening the Oregon Business Plan (OBP) narrative regarding technical training and workforce development. The OBP Policy Playbook, website, and other publications are also read by economic development planners around the country. Moreover, in the spring of 2011, the STTE team will convene a meeting of leaders associated with the Green Development Cluster, the Oregon Business Plan, Cascadia Region Green Building Council, the Oregon and Washington Governor's workforce policy advisors, the Oregon Department of Education, Presidents and academic administrators from participating schools to review accomplishments of the STTE project, and identify next steps for moving forward to establishing a Regional Center for sustainable development. Results of this meeting will be compiled into a report and shared with members of the American Association of Community Colleges Sustainability Group and presented at the Association for the Advancement of Sustainability in Higher Education (AASHE)'s national conference.

PCC will also submit project information for publication in Home Power, an independent bi-monthly magazine that provides information, news, and resources about sustainability topics such as energy efficiency, solar hot water systems, space heating and cooling, green building materials, and green home design. Home Power is available at major news retailers throughout the US and Canada. In addition, PCC will seek to publish a case study of the STTE project through UNESCO-UNEVOC International Center on Technical and Vocational Education and Training (TVET).²² UNEVOC is interested how sustainability can be woven into TVET programs. Indeed, education for sustainable development (ESD) was one of the

main themes examined at the UNESCO international experts meeting *Learning for Work, Citizenship and Sustainability*, held in Bonn, Germany, October 2004 and was further examined in subsequent regional meetings, and ESD case studies are prominently featured on the UNEVOC website.

RESULTS FROM EVALUATIONS OF PRIOR NSF SUPPORT

PCC has received three prior NSF grants that support the proposed STTE project. The development of STTE was informed most directly by PCC's NSF ATE Center Planning Grant (NSF #0603466; PI Tom Robertson Ph.D.; \$69,998; 12 month duration) included in June 2006. The grant allowed PCC and its project partners (Lane Community College, Portland Public Schools, and Portland State University) to explore the feasibility of establishing an ATE Regional Center to support the growth of Oregon's sustainable development cluster. As part of this Planning Grant, PCC convened a series of workshops with the goal of defining emerging needs related to sustainability education and identifying methods of meeting these needs. The workshops included representatives from local industry, government agencies, non-profit organizations, advocacy groups and educational institutions. The deliverables of the Planning Grant included a strategic plan for implementing an ATE Regional Center for sustainability education. The STTE project represents the first phase of this strategic plan, and addresses the most fundamental need identified in the planning process – the fact that PCC and other regional educators cannot improve sustainability education for students and incumbent workers until our faculty have first acquired the requisite knowledge, skills and experience in green building/sustainable development. An industry advisory group, formed to provide feedback on the strategic plan, validated this approach and encouraged the project team to move ahead with a project focused on increasing instructional capacity. In addition, project staff working on the Planning Grant researched operational models of ATE Regional Centers and used this information to guide development of the management plan and professional development models presented in this proposal.

PCC also recently completed a second NSF ATE Project, *Framing Student Success* (NSF #0302945; PI: Spencer Hinkle; \$717,500; 36 month duration) STTE project. Framing Student Success strengthened mathematics, science and technology skills among high school and college students in building construction technology programs. Two courses for high school students (Alternative Building Design and Construction I and II) were developed and delivered, introducing 24 high school students to green-building techniques for the first time. Participating high school students led the design and construction of a straw bale structure on PCC's Rock Creek Campus which was subsequently used as a weather station for PCC's Environmental Studies Center. Intensive professional development summer workshops for K-12 teachers, focused on the application of mathematics and science within construction, were also developed. Ten teachers have participated to date. In addition, six new college courses were developed under the grant and subsequently offered through PCC's Building Construction Technology program (see Attachment 1). Moreover, as part of the project's dissemination plan, the Building Construction Technology Department at PCC hosted the first annual Northwest Building Construction Educator Summit, collaborating with Earth Advantage and ENERGY STAR® New Homes to provide a venue for educators to come together to talk about sustainability in construction programs and focusing on developing best practices and program evaluation. The summit was primarily aimed at community college faculty from Oregon and Washington State, although some local high school program instructors also attended. As mentioned earlier in this proposal, the Northwest Building Construction Educator Summit was also used as a venue to pilot a version of the Summer Sustainability Institute training proposed under the STTE project.

Finally, PCC completed its NSF-funded *Advanced Materials Joining for Tomorrow's Manufacturing Workforce*, (NSF #0053300; PI: Matthew Scott; \$547, 787; duration 36 months) in 2004. This successful project is an excellent illustration of PCC's capacity to solicit meaningful industry input into curriculum and the College's successful experience revising curriculum to enhance mathematics and science. Examples of project accomplishments include development and implementation of "Back-to-Practice" internships for PCC faculty with local companies, creation of six new courses developed through partnership with industry, the development of bridge initiatives between PCC and local high schools such as summer institutes and curriculum, and significant contributions of equipment and in-kind support from corporations. Through these successful projects, PCC has demonstrated its ability to collaborate with industry in developing and implementing instructional improvements.