Technical Volume

of a proposal to the

US Department of Energy

for

Industrial Assessment Centers

Funding Opportunity Number: DE-FOA-0002452

Oregon Commercial Building Efficiency Workforce Development Program

Topic Area Number	Topic Area 2: Commercial Building Efficiency Workforce Development Pilot Project
Lead Organization	Oregon State University (Corvallis, OR)
Organization Type	University
Period of Performance	60 months
Budget	$500,000 (federal)/$125,000 (cost-share)
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Oregon State University (OSU), Corvallis, OR, and Lane Community College (LCC), Eugene, OR, will develop a program to conduct energy assessments of small to medium-sized commercial buildings while providing hands-on building efficiency technical training for OSU and LCC students. We will leverage the established energy assessment experience of the OSU Industrial Assessment Center (IAC) with the technical training of the LCC Energy Management program. The LCC program prepares students to conduct building audits through technical courses in building science and the energy auditing process. OSU students participating in the commercial building audits will find a direct transfer of industrial assessment knowledge to the built environment. We will recruit from the diverse pool of students in the two-year program at LCC and the four-year engineering program at OSU. Teams of 2-3 students will conduct ASHRAE level 1/2 energy assessments of buildings throughout the Pacific Northwest, under the supervision of faculty from LCC and OSU. Buildings in underserved communities will be prioritized as assessment candidates. Individual building reports will be prepared, reviewed using the well-established OSU IAC peer-review process, and delivered to the client and DOE.

1 Delivering Commercial Building Technical Training

LCC energy analysts will be recruited from the two-year Energy Management program at LCC. While the LCC program is online and includes participants from the entire West Coast, we will initially recruit students that are located in western Oregon. The pilot project provides an opportunity for hands-on application and reinforcement of the technical training students receive as part of their degree program. The Energy Management program has evolved over the years and currently trains students in commercial building energy management with a focus on building controls systems. The program orients students to building energy consumption by introducing the topic through home energy using systems like the building shell, heating and cooling systems, lighting, and the relevant heating and cooling load calculations. The students are familiar with their homes so starting there makes the topic relevant and interesting.

The program presents four sequenced in-depth HVAC classes and five courses in building automation systems. Students also are introduced to lighting technology, energy calculations, and financial considerations of commercial building energy efficiency options, all in their own individual classes. Building energy consuming loads and efficiency topics including space heating and cooling, ventilation, water heating, lighting, cooking, refrigeration and plug loads associated with equipment are covered in detail. Table 1 summarizes the principal technical core classes in the Energy Management program. Each course is 10 weeks long.

Table 1: List of required technical courses in LCC Energy Management program

NRG 111	Residential Energy Analysis	**NRG 131**	Lighting Fundamentals
NRG 112	Commercial Energy Use Analysis	**NRG 142**	Energy Accounting
NRG 121	Air Conditioning Systems Analysis	**NRG 181**	Direct Digital Controls 1
NRG 122	Commercial Air Conditioning System Analysis	**NRG 182**	Commercial HVAC Controls
NRG 123	Energy Controls Strategies	**NRG 183**	Controls Retuning and Troubleshooting
NRG 124	Energy Efficiency Methods	**NRG 184**	Direct Digital Controls 2
		NRG 185	Lighting Controls

LCC students will be recruited to start at the end of the first year of their program, conducting audits over the summer and throughout their second year. Students will have the opportunity to continue to work through the second summer, with hours counting towards a required 2,000 hour apprenticeship program. LCC student participants will qualify to sit for **the Association of Energy Engineers Certified Energy Manager Exam**, leading to certification.

OSU students will be recruited first as industrial energy analysts from the OSU College of Engineering. Each student will complete the IAC training program described in the Topic 1 Technical Volume, which covers complementary topics including combustion systems, refrigeration, water heating, motors, and utility analysis. In Year 1 of the project, OSU and LCC faculty will jointly develop supplemental training modules that fill any gaps between this knowledge and the specialty topics required for commercial building energy auditing. These modules will be delivered to all OSU students interested in the commercial building program.

The collaboration will require OSU and LCC analysts to work in teams with diverse backgrounds and expertise. **This practical training is representative of what students can expect in industry.** By conducting assessments with analysts from each institution, we will leverage the strengths of the students from each program. This unique approach will yield better trained engineers, technicians, building operators, and other skilled professionals in the commercial building energy industry.

2 Promoting Diversity, Equity, and Inclusion in the Pilot Program

The OSU plan for promoting diversity, equity, and inclusion is discussed in the **Topic 1 Technical Volume** and **Diversity and Inclusion Plan**. Lane Community College is the community's college. In the case of the LCC Energy Management program, the "community" is the greater western United States, as the program is entirely online and open to all that apply. Critically, LCC is the resource for reskilling/upskilling for the energy industry of individuals who have lost their employment, need additional or continuing education, or are transitioning from one career to another through the Department of Labor Trade Act. The uniqueness of community colleges are the low barriers to entry. Students need only apply and they can begin down the road of higher education regardless if they are starting with developmental education (beginning math or writing) or have completed enough Advanced Placement classes as a high school student to enroll as a sophomore when first entering the college. Lane has a **support center for Veterans**, a **Gender Equity Center** that includes programing for **Women in Transition, LGBTQ Support and Advocacy**, **Healthy Masculine Identities**, and **Title IX Sexual Assault Prevention**. Lane also supports Disabled students through the **Center for Accessible Resources**.

Energy analysts from LCC will be employed directly by OSU. The recruitment, interview, and evaluation process for these students will be the same as described in the Topic 1 Technical Volume. OSU faculty are trained search advocates, a unique program established in 2008 by OSU that enhances equity, validity, and diversity in university hiring. Their preparation includes a 16-hour workshop series addressing current research about implicit bias, diversity, the changing legal landscape in hiring, inclusive employment principles, practical strategies for each stage of the search process, and effective ways to be an advocate on a search.

3 Partners in Small Building Energy Efficiency

The **Energy Trust of Oregon** is a key partner in small building energy efficiency that has worked with the OSU IAC center on industrial efficiency for several years (see MOU, attached). The Energy Trust of Oregon has cash incentives to help lower costs of commercial building efficiency improvements including HVAC, water heating, computer equipment, lighting, and others, in both Oregon and Washington. Per our MOU, we will work closely with the Energy Trust of Oregon to notify building owners/operators of possible incentives and additional engineering support and analysis to increase implementation of our recommendations.

4 Building Energy Assessment Process

We plan to conduct fifty (50) assessments of small to medium-sized commercial buildings throughout the Pacific Northwest. Audit teams will include a principal auditor from LCC, and 2-3 students depending on the building size and complexity. We will support 8-10 LCC students and 8-10 OSU students each year as paid energy analysts. The commercial building operational plan is similar to the Topic 1 operational plan (Section 2.2, in prior section). The audits will follow an ASHRAE Level 1 or Level 2 approach, depending on the site access and complexity. ASHRAE Level 1 audits focus on no- or low-cost modifications to improve energy efficiency, while Level 2 include collection of sufficient data to motivate projects requiring some investment.

Identify Clients. Potential clients will be identified through a combination of leads/ recommendations from utility representatives, regional partners, municipalities, and/or direct requests to the program through the OSU EEC/IAC website.

Pre-Assessment Work. Potential leads will be screened for eligibility (< 100,000 square feet, per the FOA). Student teams of 2 to 3 will be formed based on facility size/complexity and a lead student identified. The lead student will coordinate the release of the utility bills (electric, gas, and water) from the site. A pre-assessment interview will be conducted to understand building operation and energy concerns about energy use. The utility information will be used to benchmark the building using EPA Energy Star Portfolio Manager.

On-Site Visit. A one-day site visit will be conducted by the student team and faculty principal auditor. After introduction and safety orientation, the team will walk through the building with relevant personnel. After the walkthrough, the team will brainstorm potential areas of focus with building personnel and develop data collection plans. Students will then spend the rest of the visit collecting data including a lighting and mechanical equipment audit (nameplates, thermostat locations, service zones, etc.), water use audit (fixture accounting and flow tests as necessary), placing of data loggers to collect data over time (electrical, temperature, lighting, etc.), and assessment of the building envelope. Prior to leaving, the team will make initial recommendations of low- or no-cost, on-the-spot improvements such as changes to operation or maintenance that would have immediate payback. These recommendations and others will be more rigorously quantified in the post-site visit reporting.

Post-Site Visit Reporting. Following the assessment, a report will be generated and delivered to the client and the DOE within 60 days. The report format will follow the to-be-determined requirements from the IAC program, per the FOA. The report will summarize identified energy conservation and efficiency measures, operation and maintenance changes, and potential capital projects to reduce energy consumption and carbon emissions. Each recommendation will be backed up with appropriate energy saving calculations. The team will make specific recommendations for implementation, and direct the building operator/owner to utility, state, or other incentive programs for any recommendations requiring investment.

Implementation Follow-up. The project team will follow up with each site at least twice after the assessment. General feedback about the assessment process is solicited approximately three months after the visit. Then, an implementation call is held within 12 months of the report submission to check on implementation of recommendations and any quantitative or qualitative energy savings realized through the program.

5 Project Team Qualifications

Qualifications for OSU personnel **Dr. Karl Haapala, Dr. Brian Fronk** and **Joe Junker** are provided in Topic 1. **Topic 2 LCC** partners are **Roger Ebbage**, **Suzanne Marinello**, and **Brenda Cervantes**.

Roger Ebbage is Program Director and creator of the LCC Energy Management Program. The program has become the national model for commercial building energy efficiency education and is a constant resource for other community colleges planning programs. Ebbage has been involved with the energy industry at all levels including serving on ANSI 17024 accreditation committees in Energy Efficiency (IREC), Solar Installation (NABCEP), and an accreditation in building controls. Ebbage has secured several National Science Foundation grants to support the growth of the energy industry. His most recent award is from the US DOE ($500k) to develop and implement an Energy Management and Controls Apprenticeship program, due to launch fall term 2021. Ebbage served as a subject matter expert in developing the Green Buildings Career Map (http://greenbuildingscareermap.org/). ***Ebbage*** *will lead the workforce development effort, assist in the development of training materials, recruit participating LCC students, and arrange building audits.*

Suzanne Marinello, P.E., a Sr. Mechanical Engineer at Colebreit Engineering Inc. and part-time Instructor at LCC, has been providing professional mechanical engineering consulting services throughout the United States for over 30 years. Her expertise includes the design of heating, ventilation and air conditioning systems, energy analysis, LEED project management and building systems auditing. Marinello has been teaching in the Energy Management program for 10 years. In 2011, under her consulting firm at the time, she partnered with the LCC Energy Program to audit Oregon schools through the SB1149 Schools program. The program, managed by ODOE sought proposals from engineering and auditing firms interested in conducting audits of school district buildings. Marinello Engineering and partner LCC Energy Management program were cited by the ODOE as the best auditing team among those who won the award to conduct SB1149 audits. The Energy Program typically audits campus buildings (Campus-as-a-Living-Lab) to train students, but is often asked by local area building owners to audit their buildings. ***Marinello*** *will lead building audits and assist in the development of training material.*

Brenda Cervantes is a project manager at LCC. She has more than 20 years of project administration experience in a broad array of industries. At LCC she manages projects in the area of water and energy funded the by the US DOE and NSF. ***Cervantes*** *will manage the project budget and logistics and oversee coordination between LCC and OSU.*

6 Estimated Budget and Abbreviated SOPO/Task Structure

The estimated budget for this program is $500,000 with $125,000 of cost share for a period of performance of 60 months. An abbreviated SOPO is provided below in Table 2.

Table 2: Abbreviated SOPO/Task Structure

Task	Year	Task Description
1.0	**1-5**	Develop formal structure of OSU/LCC collaboration and standardization of new commercial building report format. Work with regional partners to extend pilot project impact.
2.0	**1-5**	Develop and provide training and other educational opportunities to students in the form of introductory seminars, online resources, and direct mentoring. Engage 8-10 LLC and 8-10 OSU students per year.
3.0	**1-5**	Recruit commercial building clients and develop outreach program through regional partners, center contacts, and general marketing of services and resources available from the OSU/LCC program.
4.0	**1-5**	Field teams of a principal auditor and 2-3 students to conduct a minimum of fifty (50) assessments over the project period of performance.