



National Science Foundation

Meeting the Challenge of Energy Management in a Carbon-Constrained World, Award #1002931

Project Activities & Findings 2010-2013

Project Goals

1. Establish and disseminate industry identified skills-based training options supporting energy efficiency related industries in order to provide market responsive education for those taking on new responsibilities in energy efficiency and those seeking entry in energy management occupations.
2. Increase the number of qualified technicians with the skills to meet workforce needs in energy technology.
3. Increase career and educational pathways that span high school – baccalaureate levels.
4. Increase professional-development opportunities in energy management for secondary and community college educators.

Project Activities

Objective:

- 1. Establish and disseminate industry identified skills-based training options supporting energy efficiency related industries in order to provide market responsive education for those taking on new responsibilities in energy efficiency and those seeking entry in energy management occupations.**
- 2. Increase the number of qualified technicians with the skills to meet workforce needs in energy technology.**

Industry and Labor Task Force

In order to reach project goals, it is essential that industry and labor drive the design of building the skill profiles as they are the ones who can best define what is needed in the workforce. To help facilitate this, project researchers requested the participation of energy management industry leaders to form the Industry & Labor (I&L) Task Force. The I&L Task Force is small in number to drive quick work, yet diverse to incorporate different perspectives in the design (6 members: 2 women, 1 African-American male).

The I&L Task Force met twice in Year 1 to work on the design process. The first meeting went over the details of the grant and the process of building a skills profile. Discussion ensued over possible ways of grouping in order to maximize the efficiency of the project (as opposed to focusing on one occupation and its corresponding work functions). The Task Force preferred a

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clustering of occupations by function and developed the following titles for groupings: project management, audit, analysis, and field/measurement & verification.

The following table developed by the group organized a framework for discussion:

Phase	Project Mgmt	Audit	Analysis	Field or Implementation & Verification
Development	X	X	X	
Design	X	X	X	
Construction	X			X (commissioning)
Operations & Maintenance				X (measurement & verification)

At the second meeting, the I&L Task Force decided the first focus group would center on energy program/project management and proceeded to brainstorm a list for recruitment to the focus group work. This list included small, mid-size, and large firms, and correspondingly, possible participants while keeping cultural and gender diversity in mind. The I&L Task Force members left the meeting with the task to take this list and recruit participants for the first focus group.

Several members of the I&L Task Force also participated in a panel discussion, *Energy Efficiency in the Built Environment*, at the 6th Annual Energy and Construction Summit, *Smarter Grid Innovations 2011* on June 23rd.

During Year 2, the I&L Task Force met once to go over the results from the first focus group centering on *Energy Program/Project Management*. The results and process were discussed and parties were identified to verify the results to a broader audience of subject matter experts. The I&L Task Force recommended that project leaders continue research using the same methodology for another occupational work cluster. Commercial Building Analysis was identified as an area to develop; more people need these skills as more data is made available and emphasis on building performance over time grows within the industry. Again, the I&L Task Force brainstormed a list for recruitment to the focus group work, *Commercial Building Analysis*, and proceeded to recruit participants.

During Year 3, a member of the I&L Task Force participated in the Energy Educators Association Meeting and Educators' Institute at the 8th Annual Energy and Construction Summit, *Empower the Workforce -- Build the Economy* on June 19, 2013.

Focus Groups

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A continuing core feature of the project in Year 2 was to collect information directly from industry about energy management occupational work functions and key activities that could be used as competency standards for creating or improving energy management program curriculum. During Year 1, project researchers, with input from the Industry & Labor Task Force, prioritized the occupations of interest and researchers used a rigorous skills identification process to collect detailed information about the core knowledge, skills and abilities required of energy management professionals. The two primary occupational groups identified were energy project manager, and commercial building analysis. In Year 1, this systematic process was reviewed by the I&L Task Force and project leaders and then implemented during a one-day focus group event where data was collected and used to create a skill profile for energy project managers. Based on the success of this process, and upon the recommendation of the I&L Task Force, this process was repeated for Year 2 in a full-day focus group with commercial building analysts. The participants, identified by the Task Force and college Technical Advisory Committee members, comprised eight professionals from regional energy organizations who each had at least 3 years of work experience as commercial building analysts or in closely-related specialty occupations in which commercial building analysis was a core work function.

In summary, the process used to establish skill profiles generated detailed summaries of the knowledge, skills and abilities required to succeed in energy management occupations, beginning with energy project manager. The project manager profile is now being used by education partners and industry trainers to identify program gaps, and to develop or improve curriculum (see below), and has shown good potential for curriculum development applications in other energy occupations, and even outside of the energy field. Skill profiles are also useful because they can be used to clearly communicate workplace expectations, increase responsiveness of public education, workforce programs and service providers, enhance worker employability and portability of skills, and match programs and curriculum to workplace requirements in an industry that is rapidly changing.

To date, the focus group data for project managers has been collected, analyzed and verified by the original focus group participants, and through a survey of energy professionals across the state to confirm the critical work functions, key activities and workplace competencies required of energy project managers. A final review was conducted by I&L Task Force members and project education partners. Using the “Core Skills Analysis Tool”, Education partners are assessing and revising curriculum.

In Year 3 of this project, work to finalize the Skill Profile for Commercial Building Analysis continued. The focus group participants had identified: 1) the occupation specific knowledge, skills and abilities and 2) ranked the skills in order of importance to the occupation. The findings of the focus group were verified through a survey process conducted across the industry to ensure the validity of the findings. Those findings are now being compiled into a final report which will be consolidated into the report on the Project Managers’ Skill Profile resulting in one final report for both occupations. In addition, the “Core Skills Analysis Tool” will be adjusted to include the commercial building analysis skills information.

Integrating Skill Profiles into Curriculum

Effectively integrating skill profiles into curriculum can be challenging for faculty since they often do not have direct experience in the occupations under study and thus find it difficult to prioritize and contextualize the skills reported out from industry focus groups. This can be particularly challenging when creating advanced courses or curriculum focused on enhanced skills or when selecting a subset of skills and competencies for inclusion in new or modified courses. The focus group results in this project provided skills and competencies identified by industry representatives directly engaged in or supervising the work performed in the occupation under study. The skills and competencies were identified as required to support the critical work functions for each occupational group studied.

The methodology used for incorporating these results into curriculum is to provide the skills and competencies to interested faculty/trainers/curriculum developers as well as the skills importance rankings identified by the focus group participants. For existing courses/programs, curriculum developers can analyze the degree and depth of coverage of the identified skills and competencies using the “Core Skills Analysis Tool” developed by faculty researchers. They can then identify which skills and competencies to include in a new or existing course(s) to better align with industry input and educational needs. This is most effectively done in conjunction with professional development/mentoring from faculty researchers. The skills importance ranking is an innovation in this research and deserves further development and support.

In addition to faculty from Cascadia Community College and Edmonds Community College, we had six additional faculty from varying institutions use our “Core Skills Analysis” and “Skill Sheets for Skill Profiles” tools to help develop new curriculum. These faculty began the process at the Pre-Summit Educators’ Institute at the end of Year 2 and continued working with a faculty mentor from the Grant Team during the summer. At least 5 of these faculty are teaching new courses in Year 3 based on this work (specifics can be found under **Other Program Impacts** section).

Objective:

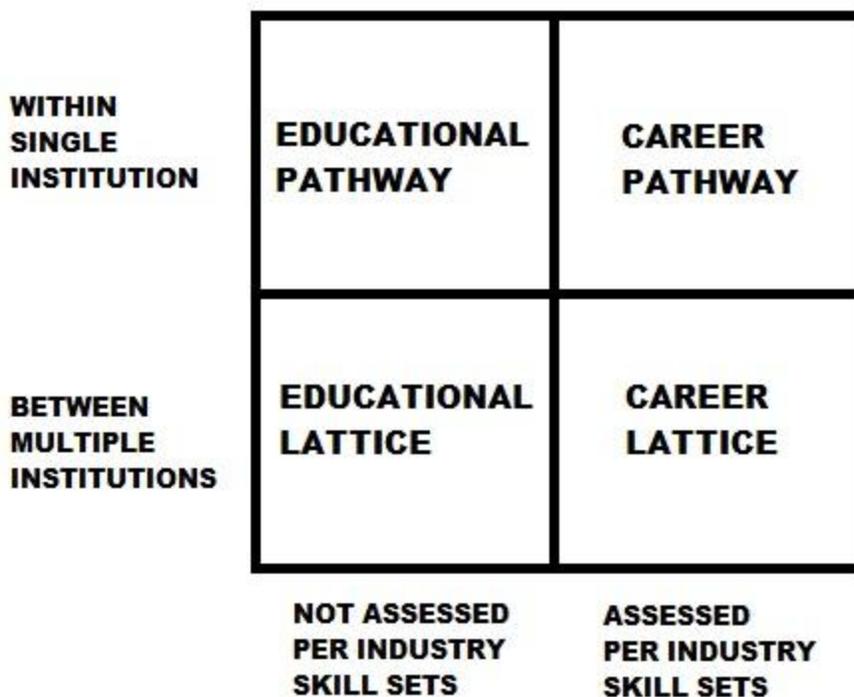
3. Increase career and educational pathways that span high school – baccalaureate levels.

Curricular Assessment and Alignment - Pathways and Lattices:

The development of tools which fulfill the twofold goal of allowing students, advisors and faculty to evaluate (1) the extent to which courses teach specific industry-derived skills, and (2) the extent to which curricula between neighboring institutions can be aligned/coordinated to deepen/broaden the career training experience, proved to be somewhat more complex than initially conceived. There are, as expected, trade-offs between the level of effort necessary to develop a tool and the quality of information that a tool yields. However, in many cases, the simpler tool may be perfectly adequate for the immediate purpose. Accordingly, with the goal of providing the “right tool for the job,” the following distinctions (and hence, tools) are proposed: “Educational Pathway,” “Career Pathway,” “Educational Lattice,” and “Career Lattice.” These can be conceptually arranged in the following manner and with the following definitions:

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Energy Education Pathway: This is an arrangement of energy courses within a single institution that, together with prerequisites and general education requirements, leads to a certificate or a degree. Educational Pathways are a familiar and useful tool, employed by advisors and faculty to guide students through a course of study toward a certificate or degree. Well-defined educational pathways in energy management are in place at Cascadia Community College (Environmental Technology and Sustainable Practices program) and at Edmonds Community College (Energy Management program.) Each program has been developed in consultation with a department-selected Technical Advisory Committee comprised of members from industry and labor. The first step in this investigation was to identify and characterize the existing “Educational Pathways” in each of the respective institutions’ energy programs. Understanding these is required for any subsequent construct.

Energy Career Pathway: This is an arrangement of energy courses within a single institution that, together with prerequisites and general education requirements, teaches specific industry-derived skills that have been determined to be essential to performing critical work functions. The goal here is to facilitate mastery of these specific skills in order to increase the probability of job success. Generally, new curricula can be developed to teach these skills, or existing courses can be assessed for the extent to which, in the aggregate, they teach the requisite skills. Utilizing the focus group-derived Skill Profiles for *Energy Program/Project Management* and *Commercial Building Analysis*, Cascadia and Edmonds Community Colleges have each begun the process of quantitatively assessing their respective programs for conformance to the skills required therein. (For more on this quantitative process, refer to the first 3 steps in the methodology described in “Energy Career Lattice,” below.)

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Energy Education Lattice: This is an arrangement of courses and/or pathways from two or more institutions that, together, depict a route to a student-chosen educational goal. While an Educational Lattice is developed by non-analytical means (by simple inspection) it is nonetheless an excellent and practical tool for advisors, students, faculty and program planners to understand how energy related pathways might be combined or supplemented with curriculum development efforts. The goal of this construct is to support students, who can access both institutions, to identify and pursue unique combinations of certificates or a 2-year degree with unique educational emphasis.

Energy Career Lattice: A “Career Lattice” is the most complex construct because it makes comparison of courses between two or more institutions more objective and relevant by grounding it in specific industry-derived skills. Through this research, the following methodology for building a career lattice has been developed:

- First, an “industry focus” is identified. This can be in the form of a specific occupation or it can be an occupational function. In this study, two were selected: “Energy Program/Project Management” and “Commercial Building Analysis.”
- Second, a focus group, comprised of experts from industry in the career area, is convened. They develop a list of Critical Work Functions pertaining to the industry focus. Further, they elaborate Key Activities that are essential to fulfill each Critical Work Function. Finally, the focus group develops a detailed list of required skills and competencies, and these are given an importance value by the focus group participants. Each skill though is *important* to performing the critical work function. Together, the critical work functions, key activities, skills and importance values constitute a Skill Profile
- Third, using the *Core Skills Analysis Tool*, each course within an existing energy certificate or degree program is assessed for conformity to the specific required skills that were identified by the focus group. For each skill, the courses are scored with two values: the maturity level to which the skill is taught and the extent of exposure of the skill in the course. The result is that each course can be rated on the extent to which it teaches a particular skill, weighted by the importance of that skill. Summing the ratings for each of the skills embodied across a group of courses in a program (certificate or degree), yields the extent to which the program fulfills the aggregate skill requirements for that industry focus. This provides valuable information to guide program direction.
- Finally, these aggregated skill scores can be juxtaposed to the scores of another institution’s energy program to determine if gaps in one institution’s program are complemented by strengths in the other program.

By building career lattices in this manner, one may determine if, by good fortune, or by realizing some specific adjustments, multiple sets of courses from different institutions can, together, more fully satisfy industry’s and students’ needs than either can separately. Building career lattices between institutions acknowledges that, in many cases, the energy field and its subject matter is so broad that no one single institution can “teach it all.” Hence the need to work

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together to develop complementary pathways that truly teach industry-derived requisite skill sets. In addition, natural alignments become apparent through the discovery process as it has in this project between institutions offering 2-year degrees, 4-year degrees, graduate-level degrees, certificates, and high school curriculum.

Energy Pathway and Lattice Activities

Career Pathways and Career Lattice Development:

A Core Skills Analysis Tool for Energy Project/Program Management and *Core Skills Analysis Tool for Commercial Building Analysis* have been developed for both Edmonds' and Cascadia's energy programs. Every course within their respective programs is being scored according to the extent to which each industry-derived skill is taught. These data will inform each institution's Career Pathway(s) and will also be integrated into a Career Lattice between the two institutions. The scoring process for Energy Project/Program Management is complete, and the scoring process for Commercial Building Analysis is underway.

Educational Lattice:

At the May 11th, 2012, Energy Educators Association meeting, a focused discovery process was conducted to begin developing a local Educational Lattice. 12 Educators were in attendance. Small groups, comprised of representatives of energy programs from Cascadia Community College, Shoreline Community College, Edmonds Community College, Lake Washington Institute of Technology, and University of Washington/Washington State University were formed. They inspected each others' programs using a set of prepared summaries of the major program components. In a short time, the participants gained considerable understanding of each others' programs and began to find relationships between them - a good start at seeing possible alignments and complementation, including:

Edmonds CC: Building energy assessment and project management - Short Certificates, ATA, and AAS-T

Cascadia CC: HVAC and controls, informatics, data analysis. Certificates and AAS

Shoreline CC: Solar photovoltaic design and install, electric vehicles. Certificates and AASS

Lake Washington Institute of Technology: sensors, controls, 4-year Engineering degree

UW/WSU: Smart Grid & Renewable Energy, MS degree in Electrical Engineering

Educational Lattice (Expedited):

During the Pre-Summit Educators Institute at the 2012 7th Annual Energy & Construction Best Practices Summit, held on June 20th, an expedited technique was used to build an educational lattice in "real-time." Approximately 50 educators attended. Each institution was charged with defining the "essence" of their energy program in a concise (few words) description. Small groups were convened, and most groups generated insights that led to concrete ways in which two or more programs could collaborate. This is a first step toward integration.

Career Pathway (Expedited):

During the Pre-Summit Educators Institute at the 2012 7th Annual Energy & Construction Best Practices Summit, held on June 20th, an expedited technique was used to guide the development of new curricula. 24 people attended this workshop. Participants used the "Skill

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Sheet for Energy Project/Program Management” or the “Skill Sheet for Commercial Building Analysis” for reference. These are comprehensive checklists of all the skills identified by the focus groups for each of these two “industry focus” areas. To the extent that either of these skill sets was deemed to be applicable to the participants’ envisioned curricula, they “scored” each skill as either “addressed” or “not addressed” within their courses. Concurrently, a workshop was held for participants to work with the *Core Skills Analysis Tool* to assess existing curricula against the *Energy Project/Program Management Skill Profile*. 6 people attended this workshop.

Objective:

4. Increase professional-development opportunities in energy management for secondary and community college educators.

Energy Educators Association

The Energy Education/Career Lattices are valuable tools to review and refine curriculum, integrate competencies, and expand Energy Management program offerings. However, without a venue for faculty to learn about the lattice and more importantly how to effectively contribute to the lattice, the benefits will be limited. Researchers have formed the Energy Educators Association as a mechanism for this work as well as organizing and facilitating the Pre Summit Educators Institute held on June 20th, 2012 and June 19th, 2013. The mission of the EEA is *to address the challenge of a carbon constrained world by supporting energy educators.*

The Energy Educators Association (EEA) provides opportunities for faculty/educators to meet together to:

1. Provide a venue for Cascadia and Edmonds Community Colleges to demonstrate the techniques, tools, processes and work product of the Energy Education and Career Lattice Construction Process.
2. Provide a venue for educational institutions to learn about the value of the Energy Education and Career Lattice.
3. Provide a mechanism for assisting educational institutions in participating in the lattice construction process.
4. Provide a venue for informal exchange of best practices around the construction and use of the Energy Education Lattice.
5. Provide a venue for formal sharing of the Energy Education and Career Lattice
6. Provide networking opportunities for faculty and administration to provide a state-wide or region-wide educational system that is: a. tied to industry based skill profiles; b. meets unique individual student talents, prior training, skills, and education; c. is flexible and fast enough to stay current in a rapidly changing field; d. facilitates the needs of the higher educational system to provide cost effective and flexible career training and education that lead to jobs. Provides a tool for sharing the full range of possibilities, different institutions, that are available to students coming out of the K-12 system or reentering the baccalaureate system.
7. Take advantage of the local “Five Star Consortium” efforts to “maximize efficiencies and promote institutional coordination and collaboration” between community and technical colleges directly north of Seattle: Cascadia, Edmonds, Everett, Shoreline Community Colleges and Lake

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Washington Institute of Technology. The EEA will work to provide non-administrative models for inter-program certificates and degrees, based on the educational lattices. The career lattice, based on the core skills analysis, will provide verification that these revised pathways will be valued in the industry.

Energy Educators Association Activities

The Energy Educators Association kick-off meeting was held as part of the Faculty Institute at the 6th Annual Energy and Construction Summit, *Smarter Grid Innovations 2011*, which was held June 23-24 at the Regional Education and Training Center, Satsop Campus. 25 people attended. Several key activities occurred at this kick off meeting.

1. Introduced the motivation and concept for the Energy Educators Association
2. Recruited an initial roster of energy management faculty interested in participating in the Energy Educators Association
3. Introduced the lattice construction process for discussion among participating energy management faculty.
4. Distribute an example of the work product resulting from step one in the lattice construction process described above, compiling programs and courses for a particular institution.
5. Discussed the Energy Educators Association concept among participating energy management faculty.

After the initial kick-off meeting last year, the EEA has met two additional times in March and May of 2012, and also as part of the June Pre-Summit Educators Institute (a precursor to the 7th Annual Energy and Construction Best Practices Summit: *Energizing America's Workforce for Tomorrow*). Project researchers have published a newsletter, *Energy Smarts*, summarizing and promoting EEA activities, especially in anticipation of the Pre-Summit Educators Institute.

1. March 9, 2012: Energy Educators Association Meeting (16 people attended)

Meeting summary:

- a. Alison Pugh (EdCC) provided NSF background information especially with respect to the Industry & Labor Task Force work and the value of the results of their industry analysis for Project/Program Management and Commercial Building Analysis for providing industry feedback on curriculum content.
- b. Next Mel Oyler (CCC) and Randy Sibley (EdCC) provided groundwork for the distinction between Educational and Career Lattices. This distinction grew out of the work of the grant Educational Subcommittee in preparing the means for promoting and making the skill-based curriculum assessment process valuable for the curriculum development process.
- c. Mel Oyler also presented material on "case-based learning" instructional models, thereby taking advantage of the EEA's ability to provide for cross-institutional instructional sharing/learning opportunities.
- d. Steve Addison (LWIT), a collaborator, provided an in-depth presentation of his new engineering program pathway (Bachelor of Applied Science degree). This provided opportunity for participants to consider and discuss how individual institutional pathways are inadequate for providing students and advisors pathways between various institutional programs, thus creating

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the need for at least educational if not also career lattices.

e. Finally, Tom Barr (EdCC) facilitated a brainstorming session around the goals for the EEA. The results of which are: creating new programs or courses, setting up more opportunities for inter-institutional collaboration, refining and improving pedagogy, improving student recruitment (from K-12 through returning students) and promoting the Energy Management field as well as verifying the connection between programs and industry/jobs.

2. May 11, 2012: Energy Educators Association Meeting (12 people attended)

Meeting summary:

- a. Mel Oyler (CCC) and Alison Pugh (EdCC) provided the connection between the other activities of the NSF grant, especially the I&L Task Force and the results for the skills analysis on the two careers chosen by industry for the skills profile work. This foundational research continued to provide a strong scientific basis and increased value for EEA members for their work on curricula and thence pathways and lattices (essentially pathways between programs/institutions).
- b. Kevin Schneider (UW), and Mel Oyler (CCC) presented their institutional Energy Management program pathways. Mel also began to cover the next step in creating lattices by speaking about both Edmond's and Cascadia's programs and various interuses. A side note: these presentations about program pathways provided an unexpected but significant opportunity for members to begin to know more about other programs and thus to begin to see how to they might reformulate their own Energy Management programs with respect to what other institutions were or were not doing (see above "Other Program Impacts"). This macro level coordination of programs is a precursor to the work at a more micro level where individual courses will be scored for conformance to industry-derived skills and assessed for both levels of 'maturity' and 'extent of exposure' based on the skills profile research.
- c. A focused discovery process was conducted to begin developing a local Educational Lattice. See "Educational Lattice" under "Energy Pathway and Lattice Activities" above.

In Year 3, the EEA met the EEA met two times in February and April of 2013, and also as part of the June Pre-Summit Educators Institute.

3. February 22, 2013: Energy Educators Association Meeting, Smart Grid Training Pilot (24 people attended)

The purpose of this meeting was to provide an audience to pilot the Smart Grid Train the Trainer program, an outcome of the Pacific Northwest Center of Excellence for Clean Energy's Department of Energy Smart Grid Training Grant. The Energy Educators Association provided feedback to the teaching team.

4. April 19, 2013: Energy Educators Association Meeting (15 people attended)

A good portion of Year 3 was spent laying the groundwork for the continuing sustainability of the Energy Educators Association after the grant. The grant team implemented a process for establishing membership and electing the first officers of the Energy Educators Association, which was shared at this meeting.

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- a. Monica Brummer provided members a tour of the Pacific Northwest Center of Excellence for Clean Energy's website, the main disseminating point for our National Science Foundation grant as well as the Department of Energy's Smart Grid Training grant.
- b. Randy Sibley (EdCC) led the members in a process of brainstorming future Energy Educators Association activities.
- c. Gail Alexander (CCC) introduced the election process for 2013-2014 EEA officers as well as beginning the nomination process for officers. Membership election and the election of officers were completed online after the meeting.

Faculty Institute 2011

The Annual Energy and Construction Summit hosted by the Pacific Northwest Center of Excellence for Clean Energy attracts industry, labor, and educators alike from Washington State and beyond to gather and share industry and education trends in energy and construction. The grant project provides the framework for faculty to integrate industry-identified skill profiles into curriculum, participate in the Energy Educators Association as well as work on recruiting and retaining underrepresented populations into technical programs. As part of the 6th Annual Energy and Construction Summit, *Smarter Grid Innovations 2011*, project researchers organized and led the Faculty Institute to begin this focused work. Five faculty were supported by the grant to attend the Faculty Institute. Proceedings from the first Faculty Institute occurred on June 23 and 24 and were as follows:

Panel: Energy Efficiency in the Built Environment. Alan Hardcastle moderated a discussion with four of the members of the Industry & Labor Task Force about the energy efficiency workforce of today and tomorrow.

Presentation: NSF Grant Overview. Alison Pugh, Alan Hardcastle, and Ron Wheadon presented an overview of the grant, progress report, and future activities, particularly as it pertained to participating faculty.

Round Table Discussion: Energy Educators Association. Mel Oyler led a discussion with participating faculty introducing the Energy Educators Association and the Education Lattice. Other conference proceedings at the Summit complemented the Faculty Institute and are further described in Outreach Activities.

Pre-Summit Educators Institute, June 20, 2012

This year's Pre-Summit Educators Institute evolved from a half to a full day program and was held in advance of the 7th Annual Energy and Construction Best Practices Summit: *Energizing America's Workforce for Tomorrow* (<http://cleanenergyexcellence.org/summit/>). Approximately 50 educators attended the Institute and included fourteen community, technical and four year colleges; three apprenticeship training programs; and four K-12 programs. The agenda focused on disseminating grant research results as well as providing hands-on workshops and mentoring for implementing these results into programs and course curricula. It was also a great opportunity to network and learn about other energy programs. Finally, the Institute provided the launch for stipends to faculty for in-depth curriculum development work using the

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Skill Profiles (8 educators are participating). The Pre-Summit Educators Institute was an effective sharing for attendees and although not officially verified yet, it was clear that the conjunction of events boosted and diversified attendance at the Summit as well. Evaluations on the event are currently being collected.

Morning Session

There were two plenary sessions held in the morning. The first session was the foundation for the rest of the Institute work: a summary and explanation of the I&L Task Force findings for the two occupational functions, Energy Project/Program Management and Commercial Building Analysis, including the Critical Work Functions, (CWF) Key Activities and Core Competencies/Skills categorized and prioritized within each of the CWFs presented by Alison Pugh, EdCC, and Mel Oyler, CCC). Participants found these research findings to be informative, useful, and accessible to facilitate curriculum development. All participants received copies of the the data and were informed that the analysis for Commercial Building Analyst was still only available in draft form. They were advised that it would be available when completed on the project's website: <http://cleanenergyexcellence.org/about/nsf-grant/> .

The second session focused on engaging workshop participants in the initial work of creating educational lattices. Participants broke into smaller discussion groups, roughly six, with instructions that individuals from the same institution were not to be in the same group so as to promote more cross-institutional exchanges. The groups were then required to reconvene and report out their findings, reporting on the core strengths, essence, or "soul" of each program and any opportunities for collaborations that were discovered, thus illustrating the value of the educational lattice.

Afternoon Session

After lunch, the participants elected one of three concurrent sessions: 1. existing course evaluation; 2. new course development; 3. strategic planning for energy programs. Our main goal for first and second concurrent sessions, was to start the stipend recipients and other interested educators and train them how to use the *Core Skills Analysis Tool* to create or evaluate energy curricula. These are described under "Energy Pathway and Lattice Activities" above. Because of the diverse backgrounds of the participants, the third concurrent session was developed for participants not directly working with course curriculum but still involved with creating pathways and lattices.

The second afternoon plenary session focused on providing training and information on incorporating hybrid and online learning (alternative pedagogy) into energy courses and programs. Presenters, Tom Barr (EdCC), Alison Pugh (EdCC) and Jeff Hammarlund (Portland State University) each brought a different perspective on the process of reducing the amount of face to face class time in part to increase the availability of educational courses to students regardless of their location. Clearly providing more content and/or courses online will facilitate access to a diverse student population but will also promote some of the important skills identified by industry. For example, for an Energy Project/Program Management position, one of the critical work functions, "communicate" listed as a core skill, "email" and it is the fifth most

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important of nine core skills. Though email proficiency is perhaps already obvious to most individuals in education or industry, this research provides a way for industry to explicitly rate and discuss the core skills important to employers and thus important for educators to teach and foster. The online/hybrid learning models help to develop certain technical and communication skills by virtue of their course delivery mode.

Pre-Summit Educators Institute, June 19, 2013 (76 people attended)

Because of the success of the event in 2012, in Year 3, project researchers continued to host a Pre-Summit Educators Institute in advance of the 8th Annual Energy and Construction Best Practices Summit, *Empower the Workforce -- Build the Economy*. This year, in addition to an Energy Educators Association Meeting, the Institute hosted activities related to Smart Grid Train the Trainer and Technology Transfer workshops with the Center of Excellence for Construction, Center of Excellence for Global Trade and Supply Chain Management, and the Center of Excellence for Marine Manufacturing and Technology.

At the EEA Meeting held in the afternoon of the Institute:

- a. Alison Pugh (EdCC) shared an update on NSF Grant activities
- b. Larry Owens and Ryan Bradt, faculty who developed curriculum using our grant research were spotlighted. Each talked about his experience and end result. An opportunity was extended to faculty present to use research and participate in a mentoring process to develop curriculum.
- c. Alison Pugh (EdCC) announced the new officers of the EEA:
 - President: Larry Owens, Shoreline Community College
 - Vice President Outreach: Carol Lewellen, Edmonds Community College
 - Vice President Events: Tom Barr, Edmonds Community College
 - Archivist: Gail Alexander, Cascadia Community College
 - Treasurer: Alison Pugh, Edmonds Community College
- d. Randy Sibley and Tom Barr (EdCC) led a conversation about energy training programs:

Training Programs: 400 ppm -- What's Next?

 1. What's new in your Educational/Training Program over the last year?
 2. How sustainable is your program? Environment/Economics/Equity
 3. What do you see on the horizon for Energy Education programs?

Educators who attended each received a flashdrive containing the following research tools:

1. Introduction to Curriculum Development Tools
2. Skill sheet for Commercial Building Analysis
3. Skill sheet for Energy Project/Program Management
4. New course development or existing course assessment template

Other Program Impacts

The information from the Skill Profile thus far have stimulated the following changes in the Environmental Technologies and Sustainable Practices (ETSP) program and in other areas of Cascadia Community College. Specifics are described below:

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1. Development of a new Certificate, *Community Energy Specialist*.
2. Development of a technology-focused Math in Society course (with technical application).
3. Development of a communications course, *Communication in Organizations*.
4. Development/redevelopment of four courses in the ETSP program. They are:
 - ETSP 110, Conventional Energy Systems
 - ETSP 206, Solar PV System Design and Site Assessment
 - ETSP 208, Large-Scale Solar Energy Systems
 - ETSP 210, Community Energy Systems
5. Redevelopment of the Physics 111, Physics of Sustainable Energy, syllabus.
6. Exploration of Green Informatics degree and/or certificate.
7. Institution-wide implementation for all courses offered to have a Sustainability designation.
8. Development of an option of ETSP in the water quality arena

The information from the Skill Profile, *Energy Project/Program Management*, has verified much of the program content in the Edmonds Community College Energy Management program although analysis is still continuing. The Key Activities identified by industry through the focus group work help faculty better understand how to organize activities using the skills/competencies to mirror industry work. Using the Skill Profile, *Commercial Building Analysis*, more changes are expected in the Edmonds Community College curriculum.

Six educators participated in developing curriculum based on project research. Courses developed are as follows:

- Alternate Energy Sources for Residential Construction, Green River Community College
- Basic Team Communication Skills for Project Management, Shoreline Community College
- Electronics for Renewable Energy Systems, Edmonds Community College
- Introduction to Foremanship for Craft Workers, Northwest Washington Electrical Industry Joint Apprenticeship & Training Committee
- Advanced PV Design, Shoreline Community College
- Living Building Renovations through Energy Management

Student Success

Another measure of our objective, *to increase the number of qualified technicians with the skills to meet workforce needs in energy technology*, is to report on graduates and placement into the workforce.

Cascadia Community College (placement statistics are in the process of being gathered) - these counts are unduplicated.

2011 Graduates

- 14 students completed the Environmental Technology and Sustainable Practices degree
 - 10 in Business option
 - 4 in Technology option
- 14 students completed their certificates in Energy Audit Specialist
- 12 students completed their certificates in Energy Management Specialist

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2012 Graduates

- 9 students completed the Environmental Technology and Sustainable Practices degree
 - 8 in Business option
 - 1 in Technology option
- 5 students completed their certificates in Energy Audit Specialist
- 1 students completed their certificate in Energy Management Specialist

2013 Graduates

- 9 students completed the Environmental Technology and Sustainable Practices degree
 - 6 in Business option
 - 3 in Technology option
- 3 students completed their certificates in Energy Audit Specialist
- 4 students completed their certificate in Energy Management Specialist

*Edmonds Community College*2011 Graduates

- 7 students completed the Energy Management Associate of Technical Arts Degree
- 3 students completed the Building Operations and Maintenance for Energy Efficiency short certificate
- 32 students completed the Energy Accounting Specialist short certificate
- 13 students completed the Energy Efficiency Technician short certificate
- 9 students completed the Commercial Lighting Auditor short certificate
- 26 students completed the Residential Energy Auditor short certificate

Some of the certificates have duplicate students as our short certificates are designed as modules to mix and match, but the degree completers are unduplicated between the certificates and the degree.

2012 Graduates

- 18 students completed an Energy Management Degree
 - 15 students completed the Associate of Technical Arts option
 - 3 students completed the Associate of Applied Science-Transfer option
- 1 student completed the Building Operations and Maintenance for Energy Efficiency short certificate
- 10 students completed the Energy Accounting Specialist short certificate
- 1 student completed the Energy Efficiency Technician short certificate
- 4 students completed the Commercial Lighting Auditor short certificate
- 4 students completed the Residential Energy Auditor short certificate

Some of the certificates have duplicate students as our short certificates are designed as modules to mix and match or as stepping stones to the degree, but the degree completers are unduplicated between the certificates and each degree option.

2013 Graduates

- 10 students completed an Energy Management Degree
 - 6 students completed the Associate of Technical Arts option
 - 4 students completed the Associate of Applied Science-Transfer option

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- 2 students completed the Energy Accounting Specialist short certificate
- 2 students completed the Residential Energy Auditor short certificate

Some of the certificates have duplicate students as our short certificates are designed as modules to mix and match or as stepping stones to the degree, but the degree completers are unduplicated between the certificates and each degree option.

Placements

For Edmonds Community College, we've had 38 graduates of the two-year degree, and 22 of them have jobs (58%). This includes recent spring graduates. For 2011-2013, we've had 56 unduplicated certificate graduates and 40 of them have jobs (71%). These statistics are heartening in a challenging economy and job market and help to confirm the program's industry relevance.

Findings

A central and pervasive finding that has emerged through our focus group data and profiling process is the increasing emphasis and importance reported by energy management employees of a growing need for solid data management/analysis, information technology, and general communications skills. Technology innovation and development has accelerated the implementation of advanced systems and devices designed to promote greater energy efficiency, and these new systems, devices and applications have elevated the expectations and requirements of employers concerning the skills required of energy project managers and building analysts. Just as the Smart Grid is adding new layers of technology-driven capabilities to the electrical grid, energy project managers and commercial building analysts described how their ability to collect, manage, analyze and make sense of ever-larger amounts of data has become increasingly important. This responsibility has meant building new skills and knowledge of information technology systems, software and applications which are used to organize, manage and analyze data, and as a conduit for communicating the meaning and utility of these data across occupations, departments and organizations. Technology enhancements have also enabled data and information exchange that is dynamic and not static, meaning that the intensity and methods for communicating energy data and information have increased, placing new demands on the ability of energy professionals to know and apply advanced communications systems, software and applications.

Another finding relates to the importance of project/program management as a "wrap-around" skill set for any energy management occupation. The two occupation areas selected by industry and labor correspond to two primary business processes within professional service firms which engage in the energy management and energy efficiency services industry. These are commercial building analysis and energy program and project management. The commercial building analysis occupations represent the business development process and the more general project/program management occupation represent the management of the service delivery process. These two processes overlap or coincide at the proposal creation Critical Work Function that they both hold in common. In short, commercial building analysis skills are required to identify if an opportunity exists and to specify credibly and reliably what

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specific improvement options might be committed in a contract proposal. The program/project management function then engages and manages the proposal generation and delivery of required services to effectively implement the services and other commitments that constitute the successful fulfillment of the contract. Maintaining this business context is crucial from an industry and labor perspective since it contextualizes the skills and is the motivation for the business operations. This business process contextualization is also very important in curriculum development efforts since it provides a relevant framework for contextualizing the skills and competencies within courses.

While the two processes are both critical to successful business operations in energy management firms, the program/project management skills and competencies are more general and have application in a wide variety of energy management firms and even other industries. This general applicability of project and program management skills and competencies, particularly in conjunction with technical assessment capabilities (commercial building analysis is an example) potentially provides an opportunity for educational institutions to leverage program/project management training in combination with other technical analysis training to diversify the career opportunities available within the community college professional technical education system. Leveraging this capability would require additional focus group research targeting different technical assessment occupations.

An innovation developed and implemented during this research extended the focus group approach previously used in other applications (DACUMS, skills panels, skill standards, etc.) to include rank ordering skills and competencies in terms of importance. The importance ranking for the skills and competencies were collected for each individual participant and this information was provided for dissemination to curriculum development faculty. This innovation provided two important benefits to the curriculum development process. First, the industry-endorsed importance ranking is valuable information for faculty making decisions regarding which skills and competencies to include or emphasize in curriculum development efforts. Second, since the skills importance ranking are collected on an individual participant basis, the variance is a measure of agreement between respondents indicating how consistent the importance of a particular skill is across different industry representatives. Both pieces of information are available for all skills and competencies and are important considerations when designing new courses or modifying existing curriculum. For example, the most important skills and competencies might be incorporated into the introductory project management course while other less critically important but none the less valuable skills are emphasized in a following, perhaps elective, course. Additionally, in modifying existing courses, the skills and competencies results can be used to make decisions regarding incremental additions of topics to an existing course. This occurred at Cascadia Community College where market analysis skills and strategic thinking skills were incorporated into the existing project management course based on the importance rankings from the energy program/project management focus group.

Lastly, the research team found great value in the condensed skills profile process in an emergent and rapidly changing industry, energy management. In the past, setting up new programs might involve the use of such methods as skill standards, DACUM, and job task

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analysis to ascertain what should be at the heart of the program or course outcomes. However, these methods, can be very costly to produce, difficult to revise and sometimes too detailed for the course/program development process. Project researchers observed at the Pre-Summit Educators Institute that faculty were able to readily and quickly start looking at their courses/programs to see whether or not they were well aligned with the industry-derived core competencies and skills, and moreover, with the ranking of these core skills, it was also possible to use a more rational approach to making choices as to which skills to include and how much time to spend presenting them.

The Commercial Building Analysis Skill Profile depicts the skills, knowledge and abilities for commercial building analysis identified by the focus group and verified through the survey process. One major finding of this work was that commercial building analysis, rather than being a discrete occupation, is a function that is embedded in multiple occupations. This has implications for how this information is used. It may be that the curriculum and training modules, developed for professionals who have building analysis as part of their job, will be included in a range of programs in order to reach everyone who does building analysis as part of their job.