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Educational Models for Energy Workforce Development

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Abstract

It is documented that the United States of America's manufacturing, energy, and software industries are facing severe shortage of well-trained and skilled workforce, and are on the verge of losing technical superiority to other nations. To this end, grass root efforts involving recruitment, education, and training of students from trade schools, high schools and two-year institutes are to be initiated and promoted to prepare students for careers in industrial sector with an emphasis on energy management. This paper describes the Department of Energy sponsored collaborative effort between a university, two-year college, Arkansas state energy office and industry to address the issues of education and training of students for careers in industrial energy sector.

1. Introduction

The U.S. Department of Energy, Society of Manufacturing Engineers, the Department of Labor and other professional organizations have recognized the need for well-educated and well-trained workforce to meet the need of the changing U.S manufacturing industries. The recognized competency gaps in today's work force, according to the Manufacturing Education Foundation [1], are: low level education, minimal skills to cope with high tech gadgets, lack of motivation for technical careers, poor communication skills, poor work ethics, unawareness of job opportunities, lack of adaptive skills, low skills in the use of energy related software, and low level knowledge in the use of instruments for energy measurements and equipment efficiency.

The Annual Energy Outlook 2004 (AEO2004) with projections to 2025 [2,3] presents a critical review of energy use of USA in the residential, commercial, industrial, transportation sectors for the period 1970 - 2025. The graphs from AEO2004 forecast an increase in energy consumption in most sectors, and that primary energy use will exceed 136 quadrillion Btu per year by 2025, 40 percent higher than the 2002 level. However, the forecast indicates that the increase can stabilize as more efficient energy generation and consumption technologies offset the demand for more energy. Arkansas's per capita energy use is similar to other states, with its energy use and savings dependent on the population and manufacturing industry. The current estimated population of the state of Arkansas is 2.7 million and is projected to be 2.84 million in 2010. Little Rock-North Little Rock, the location of this Initiative, Pine Bluff, Conway, and Hot

Springs (within 50 miles) have a heavy population concentration of nearly 1 million people. Demographics of the population indicate a significant and growing number of the younger population (0-19 year age group). As the number of young people increases there will be a unique opportunity for the state energy office and DOE to promote awareness of energy conservation and offer training and educational programs to steer them toward technical careers in the energy sector [3, 4].

This project under the sponsorship of department of energy (DOE) is designed to address the specific issue of education and training of students for careers in the industrial energy sector within the state of Arkansas. The partnership in this project will involve the University of Arkansas at Little Rock (UALR), a two-year college, Arkansas Energy Office, and large users of energy in this area.

2. Goals of the Initiative

The project is designed to enlarge the knowledge base of energy savings, methods of minimizing waste materials, monitoring and reducing pollutants, and adopting computerized tools to affect the energy savings in manufacturing industries. The specific goals of the project are

- Develop instructional materials and course offerings for a two-year degree program (Certificate program in energy management) to prepare engineering technicians and tradesmen for careers in energy related and manufacturing industries.
- Offer workshops and short-courses for industry to enhance the capabilities of workers in existing energy service and manufacturing industries.

Education/training plans will emphasize energy sources, patterns of energy consumption, energy machinery and equipment, efficient energy use, reducing waste, reuse and alternate uses of industrial materials, and computerized applications of energy software.

3. Partnership Coordination and Roles of the Partners

The Arkansas Energy Office is coordinating all activities of this Initiative. Instructors from educational institutions have developed educational programs to prepare skilled workforce for careers in energy related industries in Arkansas. Fig. 1 shows the collaboration between different partners in this workforce initiative.

Pulaski Technical College (PTC) with an enrollment of 6,150 students is accredited by North Central Association of Colleges and schools. The certificate programs in energy management and short courses are offered through PTC.

The University of Arkansas at Little Rock, faculty from department of Engineering Technology, have contributed to the development of instructional materials for the courses on preventive and predictive maintenance technologies, energy measurement devices and instrumentation, computerized DOE energy tools applications, and fluid power components of pumps, fans, and compressors. In addition, the university faculty together with PTC staff offered short courses to

the employees of energy service industries and small to medium manufacturing industries with significant energy consumption.

Local industries have played a key role in the design of energy related curricula for a license, certificate, or an associate degree. Curricula design and the course contents have been developed with the input from a committee consisting of faculty from PTC, UALR, and an industry group from manufacturing and service industries. Industry input helped build an effective energy related curriculum with strong emphasis on hands-on and applications-oriented technical curriculum.

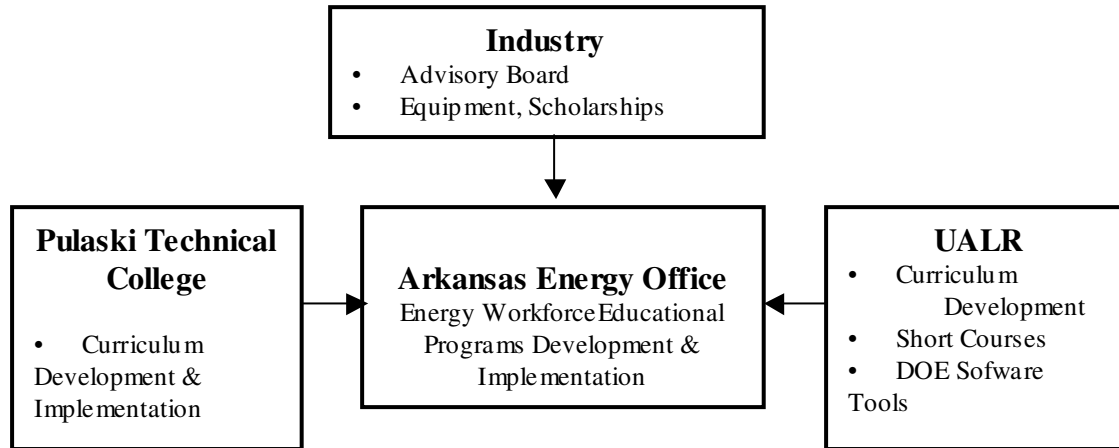


Fig. 1 Partnership to Develop Energy Workforce Education & Training

4. Educational Models of the Initiative

The educational program offerings of this initiative initially consisted of (a) offering 2-year associate of science degree, (b) selecting number of short courses, and (c) developing courses for a certificate/license.

Based on the discussions and feedback from Industrial Advisory Committee, project team decided to offer certificate programs and short courses at PTC as a part of this pilot program. This approach is suggested from the points of view of time and cost investment to the sponsoring industry and participating industry workers.

The basis for the design of curricula and selection of courses depended on the need of local industry (Entergy, International Paper, Georgia-Pacific, Weyerhaeuser, Kimberly Clark, AFCO, Coors Tek, and other small manufacturers in Little Rock and the region), competency gaps of today’s workforce, and the emerging trends in energy industry.

The technical courses for a certificate program are: Boiler Operations, Accident Prevention and OSHA Compliance, Lighting, Commercial Manual N, Environmental Sampling, Energy Measurement Devices and data interpretation, Energy Sources, Preventive and Predictive Maintenance Techniques, Waste Water Treatment, DOE Software Tools for Energy Management

Short courses for the employees of energy service and manufacturing industries are providing for students to receive certificates and also continuing education credits to retain their professional licenses. These proposed courses are: Energy Sources and Equipment, Energy Losses and their Source, Loss Prevention Methods, Energy Measuring Instruments and Data interpretation, Clean Environment, Standards, Pollutant Minimization Methods, Pumps and Motors Together, and Performance Characteristics, Heat Transfer in Boilers and Heat Recovery Methods, Preventive and Predictive Maintenance Strategies- Applications to Energy, Producing Equipment and Machinery, Computer Literacy- Excel, Power Point, Web page, and CAD Applications, and DOE Energy Software Tools and Applications

5. Implementation of the Energy Education Initiative

Certificate Program: Based on the discussion and feed back from Industrial Advisory Committee, project team designed a certificate program on energy equipment, energy use, and industrial safety issues. A 24-hour certificate program has been designed. At present, the PTC team is identifying various steps in approval processes and will soon prepare the necessary documentation for receiving approvals for the certificate programs at PTC.

Short courses: The project team developed a questionnaire to determine the importance of energy related courses and their relevance to Arkansas industries. The survey tool asked the Arkansas industry to rate the ten energy related courses. Survey tool was mailed to nearly 500 small and medium sized industries in Arkansas and responses from 57 companies were received. The project coordinators selected the top five courses to offer in state. The top five courses were:

1. Preventative and Predictive Maintenance Strategies and Applications
2. Energy Losses and Loss Prevention Methods
3. Electronic Control Methods for Energy Savings
4. Pumps, Motors, and their Performance (Energy Savings)
5. Meeting Environmental Regulations, Standards, Pollution Minimization Methods

So far, we have offered two short courses, “Preventative and Predictive Maintenance Strategies and Applications (PPMA)” and “Energy Losses and Loss Prevention Methods”. The course on PPMA attracted interest from industry and following survey indicated the participants gained energy based knowledge from these short courses.

6. Conclusions

The University of Arkansas at Little Rock partnered with two-year college, Arkansas state energy office and industry to address the issues of education and training of students for careers in industrial energy sector. The paper presents work in progress. The experiences we gained through the surveys for training needs of energy industry, development of appropriate courses for formal educational programs, identifying the contents of short courses and interaction with energy and manufacturing industries suggested that the gross roots efforts such as this Initiative to train students in two year colleges and workers in industry would have significant impact on the workforce development. Our partnership with two-year institution and industry

helped us to identify potential areas of training for workers with varying levels of competence and educational background. These experiences have also indicated these training modules could be duplicated in other parts of state. The certificate program will be implemented in fall 2006 and we will continue to support industry needs through selected short courses. The project will be continuously evaluated and assessment results will be presented in future.

Acknowledgments

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