

## Request for a New Graduate Certificate Program

Purdue School of Engineering and Technology, IUPUI

### **Energy Management and Assessment Certificate**

*To be offered as a Purdue Certificate at IUPUI*

Jan. 7, 2012

#### **Purpose of the program**

The potential benefits of energy efficiency are tremendous. According to the National Action Plan for Energy Efficiency, more than half of expected growth in demand for electricity and natural gas can be avoided over the next 15 years. Globally, new energy efficiency standard, ISO 50001, has been established and implemented. Accordingly, the Department of Energy (DOE) has developed Superior Energy Performance (SEP) criteria. The companies certified by the ISO 50001 may be granted with the SEP status, which will give the companies tremendous advantages to do business globally. The implementation of this new standard and concept requires a workforce with an expertise in energy management and efficiency. Experts in energy efficiency will be greatly needed for improving energy efficiency, energy auditing, and SEP certification. There is an urgency to train our engineering workforce to be industrial energy efficiency experts and to educate our industrial leaders to be more energy conscious.

The Departments of Mechanical Engineering, Purdue School of Engineering and Technology, IUPUI has established a Bachelor of Science in Energy Engineering (BSEEN) program. Recently, an Industrial Assessment Center (IAC) sponsored by DOE has been established at IUPUI aimed at creating the next generation energy engineers possessing a unique mixture of engineering and energy management expertise, combined with hands-on experience obtained by working directly with small and medium sized industrial and manufacturing facilities. The center has been developing a number of courses that cover the fundamentals of energy management and energy assessment. These graduate level courses provide discipline specific training to existing undergraduate/graduate students and engineers to make a smooth and effective transition to the new area. In this document, a curriculum for an Energy Management and Assessment Certificate (EMAC) program is presented. This program is in partial fulfillment of the IAC's objectives.

This certificate program is designed to address industry's increased needs for engineers who have expertise in energy management and efficiency. It will prepare today's engineers to be competitive in taking on the new challenges of energy efficiency facing industry so that our Indiana companies can compete globally.

The purpose of this new graduate-certificate program in mechanical engineering is to enable engineers to become certified in energy assessment without formally pursuing a graduate degree. The certificate will provide a core set of courses on energy management, industrial process, and energy assessment tools. Also, the students are required to do real world energy assessments for companies. Students completing this certificate will be able to understand the foundations of energy assessment, standards, and

management and to use the knowledge combined with previous engineering training to serve the respective companies effectively.

The certificate is being proposed as a Purdue University certificate that would appear on a student's transcript upon completion.

**Relation to existing certificate programs**

Currently, there is no certificate program in "Energy Management and Assessment" area available on the IUPUI campus. It is not anticipated that similar certificate programs would be developed by other disciplines in engineering and sciences.

**The target audience**

Indiana is a manufacturing state, which has significant amount of various sized manufacturing companies such as Delphi, General Motor, Allison Transmission, Think City, Cummins, Chrysler, Remy International, EnerDel, Rolls-Royce Corporation, Eli Lilly and Company, and their suppliers. The new ISO 50001 standard and SEP status require these companies to develop energy management plans and processes for energy efficiency, which require engineers trained in energy management and assessment. It is anticipated that both our students and practicing engineers who joined the workforce after bachelor's degree would be interested in obtaining training on these new technologies. The proposed certificate program will provide them with the required technical skills.

After completing the certificate program, Students may choose the option of applying to the M.S. program in Mechanical Engineering (MSME) with the courses taken during the certificate program transferred.

**Plan for sustaining steady-state enrollment**

In the first year starting Fall 2012, five to ten students will likely participate in the program. It is anticipated that this number will rise rapidly to 15 students per year in the next five years, as the awareness of the program increases. The potential exists for much greater growth beyond this in subsequent years.

**New resources**

The required infrastructure (energy assessment equipment, computers and software) needed to support the certificate program is already in place in the DOE Industrial Assessment Center in the Departments of Mechanical Engineering. The graduate level courses will be taught by the faculties in the School of Engineering and Technology and can be used for other degree programs. Therefore, the certificate program can be offered with no additional demands for faculty or facilities.

**Proposed date of the initiation of the certificate program**

Proposed date of implementation is Fall 2012, assuming all necessary approvals have been obtained.

**Person designated as the certificate program head**

Dr. Jie Chen, Professor and Chair of Mechanical Engineering will serve as the program director.

**Faculty initially involved in the program and their credentials**

Dr. Jie Chen

Professor and Chair

Department of Mechanical Engineering

*Research and Teaching Interests:* System design and simulation, engineering design, energy storage, and solid mechanics.

Dr. Ali Razban

Senior Lecturer

Department of Mechanical Engineering

*Research and Teaching Interests:* Energy Management, Robotics, Industrial Standards, Industrial Assessment.

Dr. David Goodman

Assistant Professor of Electrical & Computer Engineering Technology

*Research and Teaching interests:* Energy Assessment, Renewable Energy.

Dr. Sohel Anwar

Associate Professor of Mechanical Engineering

*Research and Teaching Interests:* Hybrid and Electric Vehicle Design / Control, Mechatronics / Robotics, Vehicle active safety system design, Fault tolerant control, Drive-By-Wire, Autonomous vehicles

Dr. Jian Xie

Assistant Professor of Mechanical Engineering

*Research and Teaching interests:* Polymer Electrolyte Fuel Cells, Advanced Batteries, Hydrogen Generation and Storage, Energy, Composite and Nano Materials, Electric Propulsion Systems for EV and HEV, Electrochemical Engineering, Renewable Energy

**Admissions requirements and procedures**

In order to be eligible to this certificate program, the students must have a bachelor's degree in an area which provides the necessary mathematical preparation for an engineering degree with a recommended minimum GPA of 3.0 out of 4.0. Students who are seniors in the BSME program or enrolled in the MSME degree program with a cumulative GPA above 3.0 may also join the program. Appropriate work experience also will be taken into account in making decisions about admission. Students will be required to submit a statement of interest and two letters of recommendation.

Students admitted directly to the Purdue University graduate program can be considered for this certificate program, provided the student formally applies for the certificate program and receives admission. Courses completed under certificate program are not automatically transferred to a graduate degree program, unless the student makes a petition to the graduate committee of the department.

**Completion requirements, audit and certification procedures**

**a. Requirements for the certificate program**

Total requirement: 12 credit hours.

It is not necessary to be admitted to the Graduate School to earn the certificate. However, at most twelve hours of course work taken prior to admission to Graduate School can be counted towards a graduate degree provided that the admission requirements are met. Thus, decision to apply to Graduate School by qualified students should be made at an earlier time in order not to lose credits. Credits earned in the certificate program with a grade of B or better may be applied towards the Master's degree subject to approval by the Graduate Education and Research Committee in the department.

To earn a certificate, the students admitted to this certificate program are required to complete twelve credit hours of graduate courses. There are four courses specifically designed for the program.

The courses consist of:

- ME59700 Fundamentals of energy assessment tools
- ME59700 Energy assessment industrial processes
- ME59700 Energy Management Principles
- ME59700 Assessment projects

Substitutions to the above courses are possible with approval of the Graduate Education and Research Committee of the Department.

**Minimum overall GPA**

Successful completion of the certificate requires at least a B average over all courses counting towards the certificate. Courses with a grade of C- or less must be taken again to count towards the certificate. The minimum grade that will be accepted in any single course is C.

**Maximum number of credits that can be transferred from another institution**

Applicants who have already earned credit for one or more of the equivalent courses from other institutions and other certificate programs may request to apply up to a maximum of three credits of these courses toward this certificate. Any waivers or substitutions have to be approved by the graduate committee that oversees the program.

**Maximum number of undergraduate courses that can be applied**

No undergraduate courses can be applied to this certificate program.

**Maximum time for completion**

All requirements for the certificate must be completed within three years. Two years may be needed for a part-time student to complete the courses if the participating student takes one course per semester.

**Number of credit hours taken prior to admission to the certificate program that may be counted to completion of the degree**

Up to 6 equivalent credit hours taken prior to admission to the certificate program including 3 hours taken from another institution may be counted towards the certificate. The rest of the courses must be completed at IUPUI within two-year period from the time of admission.

**Course lists for the program including course descriptions**

The majority of the graduate courses are offered in late afternoon hours to accommodate the needs of part-time students. In addition, a number of course lectures may be available online via video streaming. The following list contains the catalog description of the courses.

**ME 59700 – Fundamentals of energy assessment (3) Class: 3 Lab: 0 Rec: 0**

This course is a comprehensive course in energy assessment and covers the wide-range of available energy assessment tools and theoretical foundation (or underlying principles/theory). Tools include assessment tools used by DOE, industry and other Industrial Assessment Centers.

**ME 59700 - Energy Assessment Industrial Processes (3) Class: 3 Lab: 0**

This course covers common industrial and energy assessment processes. It teaches the skills for auditing and analyzing the efficiency of a company's energy usage, cost savings, and other prevalent industrial systems.

**ME 59700 - Energy Management Principles (3) Class: 3 Lab: 0 Rec: 0**

This course covers energy management principles and their real world applications including: understanding utility billing and identifying costs; identifying and quantifying energy savings opportunities at industrial facilities; determining investment payback scenarios and considerations.

**ME 59700 Assessment projects (3) Class: 0 Lab: 3 Rec: 0**

This is a project-based course in energy assessment and audit. Students are trained to go through the entire energy assessment process by participating in real-world company energy assessments. Energy analyses, assessment recommendations, site visits, and audit report are performed.

**Procedures for governing the program including construction of committees that will provide oversight**

A committee comprised of Dr. Jie Chen, Dr. Ali Razban, and Dr. David Goodman will jointly oversee the program. All advising will be done by participating faculty members listed in this document. The Department of Mechanical Engineering will take responsibility for all record keeping and tracking of students.

**Procedures for program evaluation including the criteria for success**

Upon completion of the program, exit interviews will be conducted for all students to determine the effectiveness of the program in meeting their needs and to identify how they are using the skills and tools learned in the program in their professions. Follow-up interviews will be conducted after three and five years. Given the projected enrollment of this program, and the fact that many of the graduates will remain employed locally, it is anticipated that most students will be tracked this way.

Success of the program will be defined in terms of demand (enrollment) and the responses of the students surveyed upon completion of their degree and in the follow-up interviews.