Energy Management Job Creation
&
Skills Retraining Program

Comprehensive Four Week
Energy Management Training Program

- ***140 Hour Minimum Training Program***
- ***Skill Level: Technical***

The American Recovery and Reinvestment Act of 2009 ("The Stimulus Bill") includes specific funding to provide "job training projects that prepare workers for careers in energy efficiency and renewable energy".

In the ***U.S. Department of Labor Training and Employment Guidance Letter*** 14-08 it indicates: "The energy efficiency and renewable energy industries offer workers new opportunities that may require additional training and certification. Through the Recovery Act, a number of other federal programs will receive large investments in programs and projects that could create "green jobs." These include investments in renewable energy infrastructure, energy-efficiency home retrofitting, biofuel development, and advanced drive train/vehicle development and manufacturing. As states receive Recovery Act funding for the WIA and Wagner-Peyser programs and implement training and reemployment strategies, ETA encourages states to recognize opportunities to prepare workers for "green jobs" related to other sources of federal funding. States are also encouraged to expand existing training programs, such as registered apprenticeship programs that have the potential to prepare workers for careers in the renewable energy sectors and for other "green jobs."

The complete TEN 14-08 is available on the Department of Labor website at
http://wdr.doleta.gov/directives/corr_doc.cfm?DOCN=2728

The Association of Energy Engineers, a non-profit, 501c, is offering an intensive energy efficiency training course is for engineers and people with documented energy experience to provide the tools for success in high level jobs in energy management and the green energy industry. At the conclusion of this program, the optional Certified Energy Manager's (CEM®) exam will be offered to attendees. The CEM® designiaition is widely sought after and often required by employers representing industry, utilities, government, institutions and when hiring energy professionals.

The CEM® provides a recognizable affirmation of demonstrated competencies in a wide range of energy related principles and practices. This program helps an individual distinguish themselves and helps them obtain their career objectives. The board constantly reviews the program and makes modifications to the program's content based on relevant industry standards, mandates, corporate greenhouse gas (GHG) reduction strategies, and Federal & regional policy changes and incentives. The Certified Energy Manager designation and program is widely accepted both in the United States and internationally.

The following is the four week course outline for the Energy Management Program.

Week 1: Energy Management Basics

Day 1: Introduction to Energy Management

1. **THE NEED FOR ENERGY MANAGEMENT:** An overview of how companies are implementing energy efficiency, advance energy technologies and hiring energy managers to help them lower their operating costs, reduce greenhouse gas (GHG) emission and be competitive in a global marketplace.

2. **GREEN JOBS**
    - Salary Potential (Discussion of potential and average salary and compensation.
    - Employment Opportunities (Which industries are hiring and why)

3. **BASICS OF ENERGY MANAGEMENT**

Basics of Energy Management includes a discussion of the need for energy management, and then moves on to an introduction of the basic concepts and terminology for energy in the form of heat, electricity, gas, oil, and coal. Common energy units are discussed, and calculations involving conversions from one form of energy to another are introduced. Basic forms of energy such as kinetic and potential energy are discussed, along with a simplified approach to the more advanced properties of energy including the First and Second Laws of Thermodynamics. Also included is a presentation of statistics on national energy supply and use. Sources of energy including oil, gas, coal, and renewables are shown in terms of their contribution to our total national energy supply. Energy use is broken down into the sectors or residential, commercial, industrial and transportation. Detailed pie charts of electrical use are included

4. **BASIC ARITHMETIC AND CALCULATOR SKILLS**

This section contains a review of arithmetic and calculator skills and provides a large number of practice calculations and problems to help people who have been away from school and away from performing technical calculations for some time. There are a number of practice calculations and expression evaluations that are typical of one's encountered in the energy management area. In addition, many sample problems are provided to enhance problem solving skills in terms of identifying important information and identifying a solution method. These skills are all important and necessary to successfully recommend and justify common energy management projects.

5. **ALGEBRA AND ANALYTICAL SKILLS**

This section contains a review of algebra and analytical skills, and provides a large number of practice calculations and problems to help people who have been away from school and away from performing technical calculations for some time. There are a number of practice calculations and expression evaluations that are typical of one's encountered in the energy management area. In addition, many sample problems are provided to enhance problem solving skills in terms of identifying important information and identifying a solution method. These skills are all important and necessary to successfully recommend and justify common energy management projects.

6. ENERGY UNITS AND UNITS OF CONVERSION

This section is devoted to energy units and energy unit conversions using the Railroad Track method. All common energy units are discussed, and calculations involving conversions from one form of energy to another are shown in detail using the Railroad Track method.

Heat content of common fuels are examined, as well as calculating both purchase cost of fuels per common unit of energy, and point of use cost of typical fuels. Energy accounting, energy use indices and energy cost indices are presented, and typical calculations and analyses are covered. Finally, in this section, the concepts of economic analysis are introduced, and common economic cost effectiveness measures are discussed along with examples of their determination and use.

Day 2: Energy Economics, Alternative Financing and Energy Service Companies

ECONOMIC ANALYSIS OF ALTERNATIVE INVESTMENTS

- Economic decision analysis
- Simple economic measures
- The time value of money
- Present and future values
- Cost and benefit analysis
- After tax cash flows

ALTERNATIVE FINANCING

- Role of performance contracting and energy service companies
- Different sources (loans, stock sales, bonds, etc.)
- U.S. DOE, Office of Federal Energy Management Programs and alternative financing -True lease, capital lease, bonds, etc.

Day 3: Introduction to Energy Auditing

INTRODUCTION TO ENERGY AUDITING

- Energy auditing fundamentals
- Energy units, estimating energy usage, conversion factors
- Energy auditing procedures and planning
- Data required for energy analysis
- Prioritization of energy efficiency measures
- Audit tools, energy audit software

CONDUCTING AN ENERGY AUDIT

- Purpose of the energy audit
- Facility description and data needs
- Major systems in the facility
- Data forms for recording information
- Collecting the actual data
- Identification of preliminary energy management opportunities

ENERGY AUDIT INSTRUMENTATION

- The need for instrumentation
- Light level meters
- Electric meters – Voltages, current, power, energy, power factor
- Temperature-measuring instruments
- Combustion efficiency measurement
- Air flow and air leak measurement
- Thermograph
- Data logging

BUILDING ENVELOPE

- Heat flow concept
- R and U values
- Walls, roofs, windows, Low E glass
- Infiltration
- Energy management opportunities

LIGHTING SYSTEMS

- Measurement of light
- Efficiency / efficacy
- Light color-CCT/CRI
- Lamp lumen depreciation
- Lamp types and characteristics
- Controls
- Energy management opportunities

Day 4: Energy Auditing: Air Conditioning, Heating, Motors and Drives

AIR CONDITIONING

- HVAC basics
- Load estimating
- Efficiencies
- Components
- Chillers — electric, gas-driven, absorbers
- Piping arrangements
- Energy savings opportunities

HEATING SYSTEMS

- Boilers: fire tube, water tube, cast iron
- Distribution systems
- Terminal Units
- Boiler energy management opportunities
- Furnaces — electric, gas, pulse, condensing

- Furnace energy management opportunities

MOTORS AND DRIVES

- Types of motors
- Squirrel cage induction motors
- Operating characteristics
- Efficiencies
- Variable frequency drives
- Energy management opportunities

Day 5: Energy Audits: Heat Pumps, HVAC, Ventilation Systems, Domestic Hot Water, Water Conservation and Utility Analysis

HEAT PUMPS

- Operation
- Efficiencies
- Classifications
- Energy management opportunities

VENTILATION SYSTEMS

- Types
- Characteristics
- Heat recovery methods
- Energy management opportunities

DOMESTIC HOT WATER SYSTEMS

- Types
- Efficiencies
- Circulating pumps
- Heat pump water heaters
- Energy management opportunities

WATER CONSERVATION AND AUDITS

- Rate structures
- Water conservation methods
- Irrigation and landscaping
- Leak detection
- Water audit

UTILITY ANALYSIS

- Demand and energy
- Rates classifications
- Identifying billing errors
- Energy accounting

Week 2: Building Commissioning Basics

Day 1: Introduction to Building Commissioning

WHAT IS BUILDING COMMISSIONING?

- New Buildings
- Retro- and Re-Commissioning Existing Buildings
- Continuous Commissioning
- Total Building Commissioning
- Understanding the Big Picture/Paying Attention to the Detail

WHY WE NEED COMMISSIONING – ALIGNING THE OWNER/DESIGNER/ CONTRACTOR/OPERATOR

- The Existing Paradigm
- What Needs to Change
- What are the Motivators Toward Creating Change
- The Opportunities

TYPICAL PROJECT SCHEDULE – COMMISSIONING PERSPECTIVE

- Design-bid-build-operate
- Bid-design-build-operate

THE PROJECT TEAM

- Roles and Responsibilities
  -Owner/Developer
  -Construction Manager
  -Architect/Engineer
  -Construction Contractors
  -Controls Contractor
  -Equipment Supplier
  -Agency Official
  -Commissioning Professional
  -Commissioning Technician
  -Operations and Maintenance Staff
- Leadership and the Commissioning Professional
- Commissioning Diplomacy

Day 2: New Building Commissioning

CONCEPT/PROGRAMMING PHASE OBJECTIVES

- Design intent
- Basis of design
- Preliminary commissioning plan

DESIGN PHASE OBJECTIVES

- Dynamic Documentation (changes in design)
- Comprehensive design review
- Commissioning specifications
- Budgeting
- Testing specialist

CONSTRUCTION PHASE OBJECTIVES

- Dynamic documentation (as-builts, TAB results, etc.)
- Updating commissioning plan
- Construction observations
- CX team meetings
- Testing adjusting and balancing
- Controls
- Submittals / RFIs

ACCEPTANCE PHASE OBJECTIVES

- Acceptance and warranty
- Continuous testing
- Changes
- Indoor environmental quality
- Energy use
- Operations & maintenance and Training

Day 3: Retro-Commissioning (Includes Re-commissioning)

CONCEPT/PROGRAMMING PHASE OBJECTIVES

- Retro-commissioning, re-commissioning, and building tune-ups
- Developing, planning and communicating
- Budgeting
- Choosing the commissioning professional for retro-commissioning
- Reviewing and updating building
- Commissioning plan
- Team meeting
- Original design intent vs. current use

INVESTIGATION PHASE OBJECTIVES

- Communication
- Occupant impact
- Operation and maintenance
- Commissioning documents
- Retesting and re-monitoring
- Training

PROJECT TURNOVER OBJECTIVES

- Final Report

Day 4: Total Building Commissioning

WHAT NEEDS TO BE COMMISSIONED AND HOW ARE THESE SYSTEMS COMMISSIONED?

- Structural, Envelope, Interior, Conveying systems
- Environmental and energy systems (lighting/M/E/P)
- Communications systems
- Site and landscape systems
- Protective systems

TAB AND VERIFICATION, SYSTEM BY SYSTEM

COMMISSIONING AND THE LEED RATING SYSTEM

COMMISSIONING GUIDELINES AND BENCHMARKING

- SMACNA
- ASHRAE/NIBS – Guideline 0 – 2005
- AABC
- BCA
- PECI
- NEBB
- ENERGY STAR

ECONOMIC ANALYSIS

COMMISSIONING AND THE FEDERAL GOVERNMENT

BUILDING CODES

COMMISSIONING TOOLS AND TECHNOLOGY

COMMISSIONING PROCUREMENT

Day 5: Review

QUESTION AND ANSWER

Week 3: Carbon Reduction & Sustainable Development

Day 1 - Introduction, Executive Briefing & High Level Strategies

INTRODUCTION AND THE NEED FOR CARBON REDUCTION

- Trends and data the global challenges we face (data students can apply)
- Why monitor and reduce your organization's carbon footprint?
- History, legislation, and terminology
- Examples of successful programs: profits, results, and benefits

CLASS MEMBER INTRODUCTIONS (STUDENTS' GOALS)

REVIEW SELECTED STUDENT OBJECTIVES & PROFILES, LOCAL CHALLENGES, PROBLEMS & BARRIERS

Day 1 - Introduction to the Carbon Reduction Process

INSIGHTS FROM CLASS/INSTRUCTOR

CARBON REDUCTION PROCESS OVERVIEW

- Reduce, reuse, recycle, and apply energy efficiency/management
- Implement green power/renewable energy sources
- Implement offset/trade strategies

PROTOCOL OVERVIEW AND TERMINOLOGY

- Kyoto's 6 listed greenhouse gases, GWP factor, control vs. equity share approaches, De-Minimis, base year and adjustments, transitional periods, tier quantification system. ISO 14064 and 14065 as well as trading term like CCX, CDM, JI, VER, etc.
- Emissions types: direct, indirect, fugitive and mobile; Scope I, II, III, and biogenic

OVERVIEW – CARBON AUDIT AND REPORTING PROCESS (GETTING CREDIT FOR WHAT YOU DO)

- Identify boundaries (tenant vs. communal areas), sources
- Quantify, report and verify emissions

Day 2 - Carbon Footprint Measurement & Monitoring

COMPONENTS OF A CARBON AUDIT

- Identify carbon intensity
- Electricity, gas, and fuel usage (Scope I and II emissions)
- Scope III emissions: extended audit components (travel, personal travel, "cradle to cradle" products and processes)
- Class exercise on a carbon audit/carbon map of their operations

EXACT STEPS TO SETTING UP A CARBON REDUCTION PROGRAM AND REPORTING SOFTWARE

- Protocols and timelines to calculate, certify, and report your emissions
- Establishing reduction goals as well as monitoring and reporting tools
- Verification process tools
- Direct, indirect, mobile, and fugitive source management

REPORTING SOFTWARE/REPORTING FORMATS

- Reporting content must include
  -Info on organization, emissions, offsets (and locations)
  -New goals to further reduce GHG emissions

VERIFICATION PROCESS

EMISSIONS CONVERSION FACTORS AND WHERE TO FIND THEM

Day 2 - Practical Strategies & Tactics to Reduce Your Carbon Footprint

QUICK REVIEW, INSIGHTS FROM CASE STUDIES

PROVEN TACTICAL MEASURES TO REDUCE YOUR CARBON FOOTPRINT

- Re-engineer processes to reduce carbon
  -Design, materials, manufacturing/process changes
- Resources for building it "right" (LEED plus more)
- Energy efficiency and management
- Energy procurement and green power
- Emissions conversion exercises – *to help students convert energy savings into avoided carbon emissions*

Day 3 - More Practical Strategies & Tactics to Reduce Your Carbon Footprint and Environmental Impact

QUICK REVIEW, INSIGHTS FROM CASE STUDIES

- Renewable and other sustainable technologies
- Tax benefits
- Green janitorial
- Water management/reuse/recycling
- Reduce, reuse, recycling practices + waste minimization
- Green transportation and administrative functions
- Greening your suppliers and distributors

LOCAL STRATEGIES AND TECHNIQUES

Day 3 - Carbon Credits, Trading and new Revenue Tactics

CARBON TRADING AND CREDIT TERMINOLOGIES

- Renewable energy certificates
- Green and white certificates, offsets explained
  -Wind, solar, methane recovery…certified credits
  -Fleet management
  -Bulk purchasing credits
- Additional profit-generating as well as bartering strategies

CREATING AN ONGOING GREEN PROGRAM

- Justification for a "green" manager

PROCESS FOR FINDING PROFITABLE GREEN STRATEGIES

Day 4: Management and Policy Aspects of Developing a Sustainability Plan

INTRODUCTION TO SUSTAINABLE DEVELOPMENT

- How did the concept of sustainability evolve?
- What were the drivers and events?
- Theories of sustainable development

SUSTAINABLE DEVELOPMENT – DEFINITIONS AND APPLICATIONS

- Development of the concept in the 1970s
- Growing interest in the 1980s - Sorting out the agenda
- Why sustainability has numerous definitions and what it means today.
- Rio Conference and Agenda 21 - the development of international protocols
- Linkages between energy and sustainability
- Energy systems and their importance in achieving sustainability
- Why a systems approach is key to achieving sustainability

LOCAL SUSTAINABILITY POLICY PROGRAMS

- Features of local sustainability programs
- Recycling programs, first step to sustainability
- Schools and universities have taken the lead
- Discussion about local governmental solutions to sustainable cities
- Sunbelt cities and their sustainability programs
- Sustainable cities in Europe

BUILDING SUSTAINABILITY

- The importance of building systems
- Green buildings - material and components in green construction
- Energy Star
- International energy conservation code
- LEED buildings - new construction and existing buildings

CORPORATE AND INDUSTRIAL SUSTAINABILITY PROGRAMS

- How some corporations are developing internal sustainability programs
- Commercial case studies: Home Depot and Disney
- Manufacturing case studies: UPS, Toyota, and BMW
- Service sector case studies: Microsoft

IMPACT OF SUSTAINABLE DEVELOPMENT POLICIES ON PLANNING

- Brief history of why planning processes are important
- What planning techniques are being used to achieve sustainable development
- Case study: a sample development designed for sustainability
- Transportation systems - alternative fuel technologies available to reduce the energy and environmental impacts of transportation systems.
- Clean Cities program
- Kyoto Treaty and the Montreal Protocol

MANAGEMENT APPROACHES TO DEVELOPING AND IMPLEMENTING SUSTAINABILITY PROGRAMS

- Management components of a sustainability plan
- Policies associated with sustainability programs
- Designing corporate sustainability programs (roundtable workshop)
- Resources and websites
- Approaches to implementing sustainability programs.

Day 5: Technical and Financial Aspects of Developing a Sustainability Plan

INTRODUCTION TO TECHNICAL AND FINANCIAL ASPECTS OF DEVELOPING A SUSTAINABILITY PLAN

- Real "value" vs. sustainability "drivers"
- Technical limitations vs. opportunities
- Sustainability cost issues

RENEWABLE ENERGY SOLUTIONS

- Wind energy
- Solar energy
- Geothermal systems
- Bioenergy
  -Ethanol and biofuels
  -Bio Power
  -Bio-based products
- Geothermal energy
- Hydrogen, hydropower and ocean energy

ZERO ENERGY FACILITIES AND DISTRIBUTED GENERATION

- Combined heat and power
- Fuel cells
- Everything "green"

BUILDING SUSTAINABILITY

- ASHRAE Standard 90.1
- Climate Action Registry: certification protocol

ENVIRONMENTAL ISSUES ASSOCIATED WITH SUSTAINABLE DEVELOPMENT

- Air and water quality issues and prevention
- Waste minimization
- Global warming - local, state, national, international concerns and efforts toward international cooperation

ENERGY AND EMISSIONS CREDITS, OFFSET AND TRADES

- The Chicago Climate Change Index
- Green tag, white tag and carbon offset purchasing
- Renewable energy credits (REC's)
- Emissions trading processes
- Carbon offset aggregators
- Carbon offset providers and verifiers

INSTITUTIONAL AND INDUSTRIAL SUSTAINABILITY CASE STUDIES: HOW GOVERNMENT AND INDUSTRY IS FOCUSING ON ENERGY AND ENVIRONMENTAL SOLUTIONS

- Energy management approaches
- Central plant solutions
- Process optimization
- Pollution prevention
- Emerging technologies - plasma arc, stream bed turbines
- Changing manufacturing processes: materials, components
- Utility programs
- Manufactured products and materials
- Waste heat recovery
- Boiler and steam systems
- Compressed air systems

DEVELOPING *YOUR* SUSTAINABILITY PLAN

Week 4: How to be An Energy Manager

Day 1: Energy Codes, Rates and Standards

ENERGY CODES AND STANDARDS

- Building codes
- ASHRAE standards (62, 15, 3, 90.1)
- ASME, IEEE, and other standards
- Federal legislation – NECPA, PURPA, NGPA, CAAA, NEPA of 1992
- CFC replacements – Montreal Protocol, Global Climate Change
- National Energy Policy Act of 2005
- Proposed tax incentives 2002

BUILDING ENERGY USE AND PERFORMANCE

- Fuel types and costs
- Energy content of fuels
- Energy conversion factors
- Building envelope
- Natural gas purchasing
- Retail wheeling of electricity
- Major building energy use systems

ENERGY ACCOUNTING IN BUILDINGS AND FACILITIES

- Energy use index, energy cost index
- Where energy is used in facilities
- Lighting and HVAC energy use

ENERGY RATE STRUCTURES

- Identifying types of energy used
- Electric rates, gas rates
- Oil, coal, and other rates
- Steam and hot water rates
- Factors in controlling fuel costs
- Utility incentive programs

ELECTRIC RATE STRUCTURES

- Short history of electric rates
- The difference between power and energy
- Electric meters
- Components of electric rates
- Example rate structures
- Factors in controlling electric costs
- Electric utility incentive programs

- Special schedules (interruptible, TOU, real-time pricing)

WASTE HEAT RECOVERY

- Objectives: design criteria
- Types and maintenance of heat exchangers
- Recuperators; economizers

Day 2: Energy Management

LIFE CYCLE COSTING

- Concept of life cycle costing
- Purchase costs vs. operating costs
- Example analyses
- Government standards — FEMP

FUEL SUPPLY AND FUEL SWITCHING

- Alternative fuel choices
- Technology choices – HVAC systems, boilers, heaters, industrial processes
- Benefits of deregulation – electric, gas, and oil

ELECTRICAL ENERGY MANAGEMENT

- Peak load reduction
- Power factor improvement
- Energy management control systems
- Load management
- Harmonics and other power quality issues

LIGHTING

- Basics of lighting and current lighting technologies
- New lighting technologies
- Economic evaluation of example lighting improvements
- Lighting standards
- EPA Green Lights program
- T12, T8, T5 lamps
- Compact fluorescents
- HID, sulfur lamps

Day 3: Technologies

MOTORS AND ADJUSTABLE SPEED DRIVES

- How motors work
- High-efficiency motors
- Examples of cost-effective motor changes
- Use of adjustable speed drives

- Example of cost-effective ASD use
- Improved motor belts and drives
- Compressed air management
- Adjustable speed drive alternatives:
  – eddy current clutches
  – permanent magnet clutches
  – variable frequency drives
  – inlet and outlet vane control, etc.

HVAC SYSTEM

- Types of HVAC systems and new technologies
- The vapor-compression cycle
- Air conditioning loads
- Chiller improvement example
- Control, thermal storage, absorption systems

CONTROLS AND ENERGY MANAGEMENT

- Night set back
- Optimum start/stop
- Enthalpy economizers
- Temperature resets
- PID controls, pneumatic controls
- Control characteristics
- DDC

INSULATION

- Types of insulation
- Heat flow calculations
- Economic levels of insulation
- Passive thermal energy
- Process insulation

Day 4: Technologies

BOILERS AND STEAM GENERATION

- Basics of combustion systems – excess air control
- Boiler efficiency improvement – blow down management, condensate return, turbulators
- Combustion controls
- Waste heat recovery
- Steam traps – purpose and testing
- Process insulation
- Example of boiler improvement

COGENERATION (CHP)

- What is cogeneration
- Types of cogeneration cycles
- Examples of cost-effective use of cogen
- QF's and deregulation
- Use of waste for fuel
- Fuel cells, micro turbines, etc.

GREEN BUILDINGS, LEED® & ENERGY STAR

- Green buildings and sustainable design
- U.S. Green Buildings Council and LEED
- LEED certification: LEED -- NC, EB, CI, CS
- ASHRAE 90.1 energy cost budget method
- Energy and atmosphere, indoor environmental quality, water efficiency
- EPA and the ENERGY STAR program
- ENERGY STAR building label
- Energy performance ratings and profile manager

Day 5: Maintenance & Financing

MAINTENANCE

- Maintenance management systems
- Monitoring for maintenance
- Infrared photography for maintenance
- Cost of – Air, steam, gas leaks; un-insulated surfaces

ALTERNATIVE FINANCING

- Different financing methods
- Attributes of each method
- After-tax cash flow analysis

Instructors: Four Week Training Program

PAUL BANKS, P.E., C.E.M., C.B.C.P., a LEED accredited mechanical engineer, is a founding partner of B2Q, an engineering/project management consulting firm located in the Boston area. B2Q, specializes in assisting facility owners, developers, contractors and design team professionals in achieving their goals in the design, construction, and commissioning of safe, efficient, and productive buildings. Prior to founding B2Q, Mr. Banks served as CEO of Vanderweil Engineers, a leading MEP engineering firm specializing in the design of new and retrofit building systems for large commercial and industrial projects. Mr. Banks led Vanderweil's Facility Services Group, which provided master planning, as well as the design and commissioning of utility infrastructure, energy, central plant, and MEP building systems. *(Week 2: Days 1-5)*

BARNEY L. CAPEHART, Ph.D., C.E.M., is a professor emeritus of industrial and systems engineering at the University of Florida in Gainesville. He has broad experience in the commercial/industrial sector having served as director of the University of Florida Industrial Assessment Center from 1990 to 1999. He personally conducted over 100 audits of industrial facilities, and has helped students conduct audits of hundreds of office buildings, small businesses, government facilities, and apartment complexes. He regularly taught a University of Florida course on energy management to about 50 engineering students each year and currently teaches energy management seminars around the country for the Association of Energy Engineers (AEE). A fellow of IEEE, IIE, and AAAS, and a member of the Hall of Fame of AEE, he has contributed to several well-known texts in the field. *(Week 1: Days 1 and 2, Week 4: Days 1-5)*

WARREN M. HEFFINGTON, Ph.D., P.E., C.E.M., is the founding director of the Industrial Assessment Center at Texas A&M University, which has provided over 450 industrial assessments. The U.S. DOE has contracted with this center to provide national training on the industrial assessment process. Dr. Heffington personally has directed about 200 industrial assessments and has supervised the review of over 300 energy audit reports for commercial and institutional buildings. He has been active in research on industrial demand and duty factors, and on the energy audit process. He is an associate professor of mechanical engineering at Texas A&M University, where he teaches a graduate course in industrial energy management. *(Week 4: Days 1-5)*

TERRY NIEHUS, P.E., C.E.M., is the founder of Lakeshore Consulting, a firm specializing in technical training and energy auditing. Mr. Niehus has extensive experience as a trainer, having taught courses on a broad spectrum of topics in addition to energy auditing, including commercial building energy systems, motors and drives, HVAC, compressed air, cogeneration and thermal energy storage. He has also authored training and technical resource manuals in areas related to his training programs. As a consultant, he has performed over 1,000 energy analyses for governmental, commercial, and industrial facilities. *(Week 1: Days 3-5)*

STEPHEN A. ROOSA, Ph.D., is an account executive with Energy Systems Group in Louisville, KY. He has over 25 years' experience in commercial energy management and performance contracting. He is considered internationally to be an expert in energy conservation, energy management, and urban sustainability. Past experience includes energy studies for over 3,500 buildings with over $50 million in energy conservation and management projects developed for various customers. Dr. Roosa is a Certified Sustainable Development Professional, Certified Energy Manager, a Certified Indoor Air Quality Professional, a Certified Measurement & Verification Professional, a Certified Energy Monitoring and Control System Designer, a Certified Demand Side Management Specialist, a Certified Building Energy Management Professional, and a LEED Accredited Professional. He holds a Ph.D. from the University of Louisville in Planning and Urban Development, and his dissertation concerned sustainable development policies for urban environments. *(Week 3: Days 4-5)*

WAYNE C. TURNER, Ph.D., P.E., C.E.M., is a regent's professor in the School of Industrial Engineering and Management at Oklahoma State University. As founder/director of OSU's Energy Analysis and Diagnostic Center, he has conducted or supervised well over 700 energy audits for industrial and commercial facilities. Dr. Turner has broad experience in energy management, and has authored five textbooks and numerous articles in professional magazines and journals. He has won many teaching

and professional awards, and is listed in several Who's Who. He has served as past president of the Association of Energy Engineers (AEE) and is in AEE's Hall of Fame. *(Week 4: Days 1-5)*

ERIC A. WOODROOF, Ph.D., C.E.M., is a trainer and writer, widely recognized both nationally and internationally for helping energy/environmental projects get approved and implemented. His focus is to help clients benefit financially and simultaneously help the environment. He has over 15 years of experience, 20 publications and has identified profit-improvement strategies at over 200 facilities. He has also been a Board Member of the Certified Energy Manager Program since 1999.

Tuition for 4-week Training Program

- $8,500 per student. A minimum of 20 students is required.
- Included: Exam application fee, workbooks, 1 year AEE membership, 1 year job placement service on www.aeecenter.org/jobs
- Client will provide training facilities and A/V equipment expense.