

COMPREHENSIVE 5-DAY TRAINING PROGRAM FOR ENERGY MANAGERS

SEMINAR OUTLINE

THE NEED FOR ENERGY MANAGEMENT

- Building energy cost control
- Utility DSM programs and deregulation - energy efficiency and peak demand reduction
- Commercial business energy cost control
- Industrial plant operation improvement

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
- Thermography
- Data logging

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)

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
Different sources (loans, stock sales, bonds, etc.)
FEMP and alternative financing
True lease, capital lease, bonds, etc.

WASTE HEAT RECOVERY

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

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

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

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

BOILERS AND STEAM GENERATION

- Basics of combustion systems – excess air control
- Boiler efficiency improvement – blowdown 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, microturbines, etc.

MAINTENANCE

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

ALTERNATIVE FINANCING

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

Eligibility

The prerequisites to qualify for the certification process have been designed to take into account the possible diversity of education and practical experience an individual may have. However each CEM candidate must meet **one** of the following criteria:

Education		Experience
4-year degree in engineering or architecture OR Professional Engineer or Registered Architect	AND	3+ years of experience in energy engineering or energy management
4-year degree in environmental science, physics, or earth science	AND	4+ years of experience in energy engineering or energy management
4-year degree in business (or related field)	AND	5+ years of experience in energy engineering or energy management
2-year energy management associate's degree	AND	6+ years of experience in energy engineering or energy management
2-year technical associate's degree	AND	8+ years of experience in energy engineering or energy management
NONE	AND	10+ years of experience in energy engineering or energy management



****If you don't yet meet the education or experience eligibility requirements for the CEM, you may be interested in pursuing our [Energy Manager in Training \(EMIT™\)](#) certification.***

(Note: Letters of reference and verification of employment must be submitted.)

Examination and Training Requirement

All CEM candidates must attend one of AEE's [preparatory CEM training seminars](#), and complete and

pass a four-hour written open-book exam, proctored by an approved exam administrator. (Information on seminar training options is provided below.)

Beginning May 1, 2012, all CEM candidates taking the exam in the United States (only) will take the revised format CEM Certification Exam. The new format exam contains the same number of questions as previous versions, 130, and the exam duration will remain 4 hours. The new exam will not include optional sections, as in the past; rather, the exam will include questions from all 17 sections of the CEM Body of Knowledge. **You must bring a hand calculator to the exam since the CEM test does not allow computers, tablets or cell phones to be used for calculations on the test.**

An intensive jobs task analysis was performed for the CEM and a weighted percentage of topics was developed for the CEM Body of Knowledge. Although a specific number of exam questions for each topic will not be provided, as it may change, the number of questions on the exam will align with the content percentages listed in the following CEM Body of Knowledge.

	Content/Questions	
	Percent	
	Min	Max
CODES AND STANDARDS	4%	6%
ENERGY ACCOUNTING AND ECONOMICS	11%	14%
ENERGY AUDITS AND INSTRUMENTATION	11%	15%
ELECTRICAL SYSTEMS	5%	7%
HVAC SYSTEMS	5%	7%
MOTORS AND DRIVES	5%	6%
INDUSTRIAL SYSTEMS	4%	6%
BUILDING ENVELOPE	4%	5%
CHP SYSTEMS and RENEWABLE ENERGY	4%	5%
FUEL SUPPLY AND PRICING	4%	5%
BUILDING AUTOMATION AND CONTROL	4%	6%

SYSTEMS		
HIGH PERFORMANCE BUILDINGS	4%	5%
THERMAL ENERGY STORAGE SYSTEMS	3%	4%
LIGHTING SYSTEMS	5%	7%
BOILER AND STEAM SYSTEMS	4%	6%
MAINTENANCE AND COMMISSIONING	4%	6%
ENERGY SAVINGS PERFORMANCE CONTRACTING and MEASUREMENT AND VERIFICATION	4%	5%