

Short Course on Audit of Existing Buildings For Energy Efficiency

Offered By

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COURSE OUTLINE

Since, most of existing buildings are not energy efficient, there are several opportunities for engineers to upgrade these buildings with more efficient system designs and newer equipment. This course will describe easy methods of screening buildings for energy efficiency using utility data, and how to address the building owner's concerns of efficiency and comfort. Attendees will learn systematic yet flexible approaches for auditing existing buildings in order to improve their energy efficiency and reduce their operating costs. Focus areas for energy auditing include building envelope, electrical systems, and HVAC systems. Moreover, the course will expose students to sound economic analysis to assess the cost effectiveness of energy efficiency measures as well as state-of-the-art calculations methods and simulation tools for energy analysis of existing buildings.

COURSE BENEFITS

After completing the course, you will be able to:

- Analyze utility bills to estimate retrofit opportunities
- Gather preliminary data on the building's operations
- Audit the facility to gather equipment design data for electrical and HVAC systems
- Conduct an on-site inspection and determine actual equipment performance
- Determine specific retrofit opportunities for HVAC as well electrical systems
- Analyze the cost-effectiveness of each energy efficiency measures
- Be familiar with the latest methods for measuring and verifying energy savings.
- Prepare and present the report to the owner

LECTURER:

Moncef Krarti, PhD, PE is Professor at the Civil, Environmental, and Architectural Engineering Department in the University of Colorado at Boulder. He has conducted over one thousand of building energy retrofit projects throughout the world. He is also the author of over 100 technical articles on building energy efficiency including a textbook on energy auditing.

COURSE SCHEDULE

The course is scheduled over five days to be delivered in two afternoon sessions. Each session is 2-hour long with about /12 hour break period.

<i>Day</i>	<i>Session 1 (2 hours)</i>	<i>Session 2 (2 hours)</i>
Day-1	Introduction to Energy Analysis and Energy Audit	Overview of economic analysis of energy efficiency measures
Day-2	Introduction to State-of-the-art Computer Simulation and Screening Tools	Energy Audit of Building Envelope Systems and related in-Situ Testing Techniques
Day-3	Energy Audit of Electrical Systems.	Discussion of Benefits of Improving Power Quality.
Day-4	Energy audit of HVAC secondary systems	Energy audit of HVAC primary systems
Day-5	Discussion of Advanced Technologies in Reducing Energy Costs	Introduction to Methods to Verify and Measure Energy Savings from Retrofit Projects

COURSE CONTENTS

The topics to be discussed during the short course are outlined below:

DAY 1:

Introduction to Energy Analysis and Energy Audit:

- General procedures for energy management are presented including walk-through, detailed energy audit, energy commissioning, and building energy rating.
- Energy efficiency measures and advanced energy management techniques commonly considered to improve the energy performance of buildings.
- Case study of an energy audit conducted on a commercial building in Seoul Korea.

Overview of Energy Analysis of Energy Efficiency Measures

- Discussion of common economic analysis methods used to determine the cost-effectiveness of energy efficiency measures.

- Presentation of calculation procedures suitable for Life-Cycle Cost (LCC) analysis.
- Introduction to BLCC tool (a computer software available for free from the US Department of Energy).

DAY 2:

Introduction of Computer Simulation Tools

- Discussion of several computer simulation tools suitable for energy analysis of buildings.
- Detailed presentation of state-of-the art simulation tools including VisualDOE, Energy10, and EnergyPlus.
- Introduction to energy analysis tools based on inverse models such as artificial neural networks.

Energy Audit of Building Envelope Systems:

- Presentation of graphical methods to determine the overall building load coefficient from utility data.
- Estimation of energy savings using simplified methods for selected measures such as adding thermal insulation and improving the air-tightness of building envelope.
- Discussion of in-situ tests used to determine the infiltration rates and leakage areas for both residential and commercial buildings.

DAY 3:

Energy Audit of Electrical Systems and Power Quality Improvements

- Discussion of easy to implement energy efficiency measures for lighting, motors, and electrical distribution systems including transformers and wires.
- Presentation of procedures of measuring and improving power quality for buildings due to low power factor and/or high harmonics (typically caused by electronic equipment).
- Discussion of experimental tests suitable for evaluating energy use of electrical systems and for identifying any power quality problems.
- Calculation of energy and cost savings due to improvements in electrical systems performance and power quality.

DAY 4:

Energy Audit of Heating Ventilating and Air Conditioning (HVAC) Secondary and Primary Systems:

- Discussion of the benefits of various HVAC systems in reducing energy use.
- Presentation of selected energy efficiency measures to operate HVAC systems including better controls, and improved maintenance procedures.
- Estimation of energy and cost savings due to better controls and operating HVAC systems including air handling units as well as boilers and chillers.
- Presentation of in-situ testing procedures to determine the energy performance of various HVAC systems.

DAY 5:

Discussion of Advanced Technologies

- Presentation of the benefits of thermal energy storage (TES) systems in reducing demand costs. In particular, optimal control strategies for TES systems will be discussed.
- Discussion of heat recovery systems and their cost-effectiveness for various applications.
- Overview of cogeneration systems and their feasibility in commercial and institutional buildings.
- Presentation of energy efficient cooling systems including passive cooling and desiccant cooling systems.

Introduction of Energy Savings Verification and Measuring Methods

- Discussion of the types and the benefits for energy performance contracting approaches.
- Presentation of accepted protocols for verifying and measuring energy savings due to the implementation of energy efficiency measures in existing buildings.

COURSE TEXTBOOK

“Energy Audit of Building Systems: An Engineering Approach”, M. Krarti, CRC Press, Boca Raton, FL, 2000. See Cover page below.

