

Industrial Energy Management in the 21st Century

INTRODUCTION

Energy is essential to modern life and industry, and energy management is a key element of sustainable development. In addition, energy costs are often a major component of process economics, and energy efficiency can be a key factor in competitiveness.

Industrial Energy Management in the 21st Century is a three-day workshop aimed at improving the delegates' knowledge and understanding of the principles involved in designing and operating industrial processes at optimum efficiency. The primary focus is on process equipment and utilities, with an emphasis on overall systems.

The information imparted during the workshop will underpin existing knowledge and increase learning and comprehension of the various components and systems, thereby contributing towards efficient and economic operation of entire plants as well as individual equipment items.

WHO SHOULD ATTEND

The seminar is aimed at energy managers, energy coordinators, process engineers, and operations & maintenance supervisors, in oil & gas, refining, chemicals, and other process industries.

PROGRAMME OBJECTIVES—Participants attending the program will be able to:

- Accurately describe the systems involved and their operation.
- Use a range of computer tools to evaluate plant energy performance and define improvements.
- Identify the main factors affecting the energy efficiency of each key item of equipment and process system.
- Understand the main steps that can be taken to minimize energy wastage in each key item of equipment and process system.
- Apply basic thermodynamic principles to improve process energy efficiency.
- Set up an energy efficiency program.

TRAINING METHODOLOGY

In addition to formal lectures, the delegates will learn by active participation in problem-solving exercises, software demonstrations, group discussions, and analysis of real-life case studies. Delegates will receive a CD containing software to assist in energy efficiency evaluations.

WORKSHOP LEADER

The Course Director, **Dr. Alan Rossiter**, is President of Rossiter & Associates, an industrial energy efficiency consulting company based in Bellaire, Texas. Clients include ExxonMobil, ConocoPhillips/Phillips 66, Citgo, Syncrude Canada, Sasol (Pty) Ltd. (South Africa), LyondellBasell, Albemarle, and the Government of Canada.

Dr. Rossiter worked for nearly ten years with ICI (Imperial Chemical Industries) in England, serving in a variety of technical and managerial positions in process design, operations and troubleshooting. He also worked for eight years with Linnhoff March, Inc., a consulting firm specializing in pinch analysis.

A native of Zimbabwe, Dr. Rossiter holds a Ph.D. in chemical engineering from the University of Cambridge, England, and has more than 25 years of engineering and management experience. A frequent conference speaker and course instructor, he has more than 70 publications in energy efficiency and waste minimization, including the McGraw-Hill book, “Waste Minimization through Process Design” (1995), the “Energy Management” article in the *Kirk-Othmer Encyclopedia of Chemical Technology, 5th Edition*, (John Wiley & Sons, 2005), and his newest book, *Energy Management and Efficiency for the Process Industries* (AIChE/Wiley, 2015). He is a chartered engineer, a registered professional engineer (Texas), and a fellow of the AIChE.

PROGRAM SUMMARY

This workshop will improve delegates’ knowledge about various aspects of industrial energy management. These include fundamental principles of thermodynamics, cogeneration, equipment for processes and utilities, and heat integration. Energy efficiency programs are also discussed.

COURSE OUTLINE

1. INTRODUCTION

- Forms of Energy
- Uses of Energy in Industry
- By-Product Energy
- Fuels
- Energy Efficiency Improvements
- Energy and the Environment

Session 1 provides an overview of global energy use, as well as specific details on how energy is used in the process industries. This essential background information helps delegates to develop an understanding of key issues and concerns in energy management, and provides the context for the remainder of the workshop.

2. ENERGY EFFICIENCY PROGRAMS AND ACTIVITIES

- Reasons for Action
- Dimensions of Energy Efficiency Activities
- Best Practices in Operation and Maintenance
- Identifying Economic Investment Opportunities
- Management Systems to Sustain Progress
- Case Studies: Illustrations of successful energy efficiency programs

Companies need to approach energy management in an organized, structured way if they are to achieve and maintain efficiency improvements. Session 2 examines the types of programs that various companies have implemented (including ISO 50,001), the rationale behind the approaches adopted, and the successes that have been accomplished. Case studies are used to illustrate the various types of programs that have been used.

3. ENERGY TECHNOLOGY

A. Introduction to Thermodynamics

- Review of the First & Second Laws
- Heat and Power
- Group Exercise: Identifying factors affecting ideal heat engine efficiency using a computer tool

B. Power Recovery and Cogeneration

- Steam Turbines
- Software Demonstration: Identifying factors affecting steam turbine efficiency using a computer tool
- Gas Turbines
- Combined Cycles
- Comparison of Cycle Efficiencies

So what did all that thermodynamics at college really mean? Session 3 starts with a light-hearted review of basic thermodynamic principles, and goes on to explain how they are relevant to energy management, especially when considering the important relationship between heat and power. We look at various common types of power cycles, and use a group exercise and software demonstrations to explore the performance of both ideal and real power generating systems.

4. STEAM SYSTEMS

- Boilers
- Deaerators
- Steam Turbines (in the overall steam system)
- Gas Turbines, Heat Recovery Steam Generators and Waste Heat Boilers
- Steam Distribution
- Condensate Recovery
- Energy Efficiency Measures
- Group Exercise: Assessing the efficiency of a steam system using a steam system scoping tool
- Measures to Improve Steam System Efficiency
- Software Demonstration: Modeling a steam system using a steam system evaluation tool

Steam is the principal medium for energy distribution in most process plants. Session 4 introduces the main components of steam systems, and examines how they can be optimized to improve energy efficiency. Software tools are introduced to assist in understanding the performance of your steam system.

5. OTHER UTILITY SYSTEMS

- Electrical
- Cooling Water
- Compressed Air
- Refrigeration
- Group Exercise: Identifying factors affecting refrigeration efficiency using a software tool
- Alternative Refrigeration Cycles
- Condensing Organic Vapor

Steam is not the only medium used to distribute energy. Session 5 provides an overview of the other energy utilities that are commonly found on process plants, including electricity, cooling water, compressed air and refrigeration. We examine some novel technologies for reducing the cost and improving the efficiency of these utilities, and introduce a software tool for evaluating refrigeration cycles.

6. PROCESS HEAT INTEGRATION

- Heat Recovery Equipment
- Group Exercise: Exploring effects of heat exchanger size and configuration on heat recovery using a software tool
- Heat Pumps
- Pinch Analysis Overview
- Case studies: Examples of energy efficiency improvements obtained through pinch analysis.

Recovery and reuse of heat is a very important means of improving energy efficiency. Session 6 starts with an overview of the types of equipment that are commonly used for heat recovery, and goes on to introduce the basic principles of pinch analysis – a technique which is widely used to identify non-obvious heat integration opportunities. Case studies and computer exercises are used to illustrate the session. (We also offer a separate two-day course that provides a more in-depth treatment of pinch analysis.)

7. KEY PROCESS EQUIPMENT ITEMS

- Distillation
- Drying
- Evaporation
- Compressors
- Pumps
- Vacuum Systems
- Furnaces
- Software Demonstration: Identifying factors affecting furnace efficiency using a computer tool
- Insulation
- Software Demonstration: Calculate economic insulation thicknesses using a computer tool

There are many different types of equipment that affect the energy efficiency of a process. Session 7 summarizes the most common and important of these, and discusses ways that we can improve their design and operation to enhance performance and efficiency. Software tools are introduced to assist in the analysis of energy efficiency opportunities.