UNIDO

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مركز تكنولوجيا الإنتاج الأنظف

مركز تحديث الصناعة
INDUSTRIAL MODERNISATION CENTRE

Ministry of Trade & Industry
وزارة التجارة والصناعة

SOLAR Heating for Industrial Process
Together Toward Efficient Production

Thermal Energy Efficiency

Training Outlines

2020

gef GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

Acknowledgment

Solar Water Heating in Industrial process (SHIP) project herby express special thanks and gratitude for AEE – Institute for Sustainable Technologies (AEE INTEC) team for developing this training curriculum and effectively transferring this knowledge to our team and trainees.

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This thermal energy efficiency training consists of 11 chapters each highlighting a separate topic of thermal energy savings or renewable energy substitution.

SHIP project would like to thank AEE INTEC team not only for developing the training curriculum; Also, for conducting this training professionally and dedicating extra time and effort conducting one to one interviews and site visits to assure the training is fully understood and applied. This training would not have been possible to undertake without the valuable support and dedication from your side.

Introduction

The training aims at assisting consultants and facility managers to understand the basic concepts of thermal energy efficiency in the factories and the major energy saving opportunities. The training was held over 4 days targeting 80 trainees representing Energy Consultants, Factory Managers, Maintenance Engineers and Solar Thermal Heaters Manufactures and Installers.

Training Outlines

- **Chapter 1:**

Introduction

Covering the training agenda and main objectives.

- **Chapter 2:**

Thermodynamics Basics

Discussing energy and power definition and difference as well as the forms of energy and its demand. In addition to heat transfer three main concepts as well as steam basics and energy conversion methods.

- **Chapter 3:**

Thermal Energy Auditing

This chapter is aiming at having a complete overlook on how to produce a thermal energy audit from the initiating phase to the submitting phase. Starting by standardizing the audit type to one of three main types known as follow;

1) Walkthrough energy audit
2) Detailed energy audit
3) Grade energy audit

This is followed by the three-energy audit executing steps known as follow;

1) Pre-audit step; discussing the main contact keys the auditor will need to address and the data acquisition techniques as well as the data processing and evaluation steps
2) Audit step; discussing the onsite detailed walkthrough as the key contacts interviews and the needed measurements
3) Evaluation status quo; Over here the auditor evaluates the acquired data and estimates or acquires the missing data after evaluation
4) Evaluation of optimization potential; where the auditor studies the energy suggested savings options

- **Chapter 4:**

Flow Sheets

Commonly used diagrams in process engineering to indicate the general flow of plant processes and equipment displaying the relationship between major equipment of a plant facility and neglecting minor details such as piping details and designations.
The chapter discuses processes and thermal process engineering definition as well as technologies characteristics. In addition to studying different industrial processes examples as;

A. Fruit, vegetable and sugar processing
B. Dairy process
C. Flour production
D. Textile industry process
E. Salt and mineral production
F. Brewery production
G. Meat processing

- **Chapter 5:**

Heating System

A mechanism for maintaining temperatures at needed level; by using thermal energy. This part of the training module develops the heating systems typically used in industries, which are hot water and steam production industrial boilers types and efficiency Improvement best practices

- **Chapter 6:**

Cooling System

A cooling system is used to reject heat from a process or plant. There are various types of cooling systems available that are used in industry. To best optimize the efficiency of a cooling system, a “systems approach” should be used to identify potential savings and performance enhancement. This chapter discuss chillers compression basic information and potentials for optimization as well as refrigeration energy consumption reduction measures and system efficiency improvement.

- **Chapter 7:**

Compressed air system

Compressed air is air kept under a pressure that is greater than atmospheric pressure. Compressed air is an important medium for transfer of energy in industrial sector. This chapter is studying compressed air types, physical and chemical air properties, air parameters, compression cycles, cost and treatment as well as its performance enhancement opportunities.

- **Chapter 8:**

Process Optimization

Process optimization is the discipline of adjusting a process so as to make the best or most effective use of some specified set of parameters without violating some constraint. The most common goals are minimizing cost and maximizing efficiency. This chapter studies improving production process itself as well as optimizing the energy system in addition to providing renewable energy alternative solutions.

- **Chapter 9:**

Heat Transfer and pinch analysis

Pinch analysis is a methodology for minimizing energy consumption of chemical processes by calculating thermodynamically feasible energy targets and achieving them by optimizing heat recovery systems, energy supply methods and process operating conditions. Also, it studies heat transfer and pinch analysis basics and influencing parameters. In addition to heat exchangers basics, design and network.

- **Chapter 10:**

Financial Analysis

Financial analysis is the process of evaluating businesses, projects and budgets to determine their performance and suitability. This chapter demonstrates the following financial parameters;

A. Types of simple investment costs
B. Time and size compensation for initial cost
C. Cash flow analysis
D. Present and Net Present value
E. Internal rate of return
F. Levelized cost of energy
G. Pay back period

- **Chapter 11:**

Solar water heating systems examples

This chapter demonstrates various Solar Water Heating systems integrations worldwide in multiple industrial applications as well as types of solar heating system integration with the industrial process as;

1) Integration to central heat supply
2) Direct integration into industrial process