Introduction

Course Objectives

- The objective of the course is to apply energy efficiency concept in day to day life in order to save money and energy and thereby protect the environment.
- By obtaining necessary knowledge and information on the main operating principles of devices/appliances that are in common use and information on which to make the right decision in selecting the most energy efficient and economical choice.

Day-to-Day Energy Use
What is Energy?

- “Energy is a property of matter that can be converted into work, heat or radiation.

Energy Scale

- BTU-One BTU is the equivalent to the energy required to raise the temperature of one pound of water by one degree Fahrenheit.

- ENERGY SCALE

<table>
<thead>
<tr>
<th>Energy needed to raise the temperature of one pound of water by one degree Fahrenheit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average daily human food intake</td>
</tr>
<tr>
<td>Energy in one gallon of gasoline</td>
</tr>
<tr>
<td>U.S. per capita annual energy consumption</td>
</tr>
<tr>
<td>World per capita annual energy consumption</td>
</tr>
<tr>
<td>World annual energy consumption</td>
</tr>
<tr>
<td>Annual energy from sun reaching earth</td>
</tr>
</tbody>
</table>

Introduction
Energy Source-Fuels

Classification

Non renewable (limited in quantity or depleting)
- Fossil Fuels
  - Coal
  - Natural Gas
  - Petroleum
  - Oil Shale
  - Tar Sands
  - Nuclear Fission

Renewable (unlimited by rate of use or non-depleting)
- Solar
- Hydro
- Wind
- Tidal
- Biomass
- Nuclear Fusion

World Fossil Fuel Distribution

Environmental Issues

- Energy and Environment
  - Greenhouse effect and global warming
  - Ozone Layer Destruction
  - Acid Rain Formation
  - Radiation and Health
Energy Conservation and Environmental Protection

**Fundamental Forms of Energy**
- Mechanical: Potential and kinetic
- Heat
- Radiant: Sunlight
- Electrical
- Chemical: Food we eat and a tank of gasoline
- Nuclear: Nuclear reactor, bombs used in war

**Energy Measurement**
- Units
  - BTUs
  - Calories
  - calories
  - kWh
  - Joules
- One can be converted to another if the conversion factor is known

**Conversion Factors**
- 1055 Joules = 1 Btu
- 1 Calorie = 1,000 calories
- 1kWh = 3,412 Btus
Energy Conservation and Environmental Protection

Energy Transformations

Energy Conversion Devices

Energy Input
- Hair Dryer
- Lawn Mower
- Trees
- Solar
- Automobile

Energy Output

Power

Power is the rate at which work is done.

Energy = \frac{\text{Work}}{\text{Time}}

• Energy is the capacity to do work
• Power is the rate at which work is done

• Unit 1 watt = 1 J/s = 3.412 Btu/h
Unit of Power is watt (W) defined as

\[ 1 \text{ Watt} = 1 \frac{J}{s} \]

1 hp (horse power unit) = 550 \( \frac{\text{ft lb}}{\text{s}} \)

\[ ? \times 1 \times R = 1 \times R \]

Illustration-1

On a winter day a home needs \( 1 \times 10^6 \) BTU of fuel energy every 24 hours to maintain the interior at 65°F. At what rate is the energy being consumed in watts?

Recall that Watt=J/s and 1,055J=1 BTU

\[ \frac{? \times 10^6 \text{ BTU}}{24 \text{ h}} = \frac{? \times 1055 \text{ J}}{? \times 1 \text{ h}} \]

\[ \frac{? 12,200 \text{ J}}{?} \times \frac{12.2 \times 10^3 \text{ J}}{?} = \frac{? 12.2 \text{ kW}}{?} \]
Illustation

• A 100W light bulb is left accidentally on overnight (8 hours). How much energy does it consume?
• And how much money does this cost, if electricity cost 10 cents per Kilowatt hour?

Illustration

Energy Use = Power x Time of Power Use

\[ \text{Energy Use} = 100 \text{W} \times 8 \text{h} \]

\[ = 800 \text{Wh} \]

\[ = 0.8 \text{kWh} \]

Cost of the Energy = Energy Used x Cost of Unit of Energy

\[ \text{Cost of the Energy} = 0.8 \text{kWh} \times 0.10 \text{$/kWh} \]

\[ = 0.08 \text{$} \]

Calculation of Money Made

<table>
<thead>
<tr>
<th>Person</th>
<th>Wage Rate (power)</th>
<th>Hours Worked (time)</th>
<th>Total Amount (Energy)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$7/h</td>
<td>10</td>
<td>$70</td>
</tr>
<tr>
<td>B</td>
<td>$20/h</td>
<td>10</td>
<td>$200</td>
</tr>
<tr>
<td>C</td>
<td>$50/h</td>
<td>20</td>
<td>$</td>
</tr>
</tbody>
</table>
Calculation of Your Energy Consumption

- List the appliances that you use at home. Note down their power consumption and estimating the time of usage, calculate approximate energy consumption for a month.
  - Electric bulbs (number of bulbs)
  - Refrigerator
  - Washer
  - Dryer
  - Dishwasher etc.