

## Programme out line

### Lecture Programme

**Date: Day 1**

Time: 0900 to 1730

0830 to 0900:	Inauguration
0900 to 0945:	Present Energy scenario – National and tea industry, Introduction to Energy, Energy cost and Energy Accounting
0945 to 1030:	Energy conservation Approach and practical ways of energy conservation
1030 to 1100	Tea Break
1100 to 1300	Energy saving opportunities – in respect to electrical energy
1300 to 1345	Lunch Break
1345 to 1515	Energy saving opportunities – in respect to Thermal energy
1515 to 1545	Energy options for tea industry
1545 to 1600	Tea Break
1600 to 1730	Energy Auditing and Implementation of an Energy Management programme

### Lecture Resource persons

NAME	PROFESSIONAL QUALIFICATIONS
Mr.M.M.R.Pathmasiri	B.Sc. Eng.(Hons), M.Eng,C.Eng.,MIE(SL)
Mr.Ananda Namal	B.Sc. Eng.(Hons), M.Eng,C.Eng.,MIE(SL)
Mr.Ronald Comestor	B.Sc. Eng. MBA,C.Eng.,MIE(SL)
Mr.Gamini Senanayake	B.Sc. Eng.(Hons), MBA,C.Eng.,MIE(SL)
Mr.Chamila Jayasekara	B.Sc. Eng, M.Eng.,,AMIE(SL)
Mr.Sanath Kithsiri	B.Sc. Eng.(Hons), MSc.,AMIE(SL)

### Lecture Contents and Coverage

The contents of the lectures are mainly focused on tea manufacturing and brief description of each lecture is given below.

**Lecture 1: Present Energy scenario – National and tea industry (Time  $\frac{1}{2}$  hr)**

The national energy scenario will be discussed emphasizing the energy shortage and importance of the energy conservation. Energy scenario of tea industries will be presented including energy share of tea industry to the national electrical and thermal energy balance, variation of specific energy consumption and energy saving potential in tea industries

***At the end of this lecture participants will feel importance of energy conservation and their responsibilities towards energy usage and conservation***

**Lecture 2: Introduction to Energy, Energy cost and Energy Accounting (Time  $\frac{3}{4}$  hr)**

The basic energy units and energy control factors –Capacity (kW) and Time (hr) relationship- will be introduced. Tariff options and cost of energy will be discussed. Specific energy consumption and important of establishing, comparing and monitoring of SEC will be emphasized. Method of energy accounting and its importance will be discussed.

***At the end of this lecture participants will understand basis of energy and its cost and they realize how importance is the energy accounting in controlling energy cost.***

**Lecture 3: Energy conservation Approach and practical ways of energy conservation (Time  $\frac{3}{4}$  hr)**

The practical ways of energy conservation approach with simple and generic measures will be discussed starting from the energy flow diagram. This introduces non technical methods and simple house keeping practices. Importance of life cycle approach and giving due consideration for energy ratings and efficiency ratings of energy consuming equipment in purchasing will be emphasized. Un attended energy losses such as idling operations, leaks, misuse etc. will be discussed.

***At the end of this lecture participants will understand the approach and practical ways of energy conservation. Further they will realize the importance of non technical matters and simple house keeping towards energy conservation.***

**Lecture 4: Energy saving opportunities – in respect to electrical energy  
(Time 2 hr)**

This lecture covers power factor improvement and demand management, motors and drive system, blowers and variable speed drives, and lightings.

***At the end of this lecture participants will gain knowledge on electrical energy conservation opportunities in tea manufacturing.***

**Lecture 5: Energy saving opportunities – in respect to thermal energy (Time 1 ½ hr)**

This lecture covers combustion of fire wood and liquid fuels, furnace and boiler energy efficiency, and tea drying.

***At the end of this lecture participants will gain knowledge on thermal energy conservation opportunities in tea manufacturing.***

**Lecture 6: Energy options for tea industry (Time ½ hr)**

Other energy options (other than conventional options) that can be used for tea manufacturing will be discussed. Use of gasifiers, automated chipped wood combustion system, solar energy for air pre heating, use of waste material such as saw dust will be discussed.

***At the end of this lecture participants will gain knowledge on other possible energy options for tea manufacturing.***

**Lecture 7: Energy Auditing and Implementation of an Energy Management programme (Time 1 ½ hr)**

The steps in an energy audit and contents of an energy audit report will be discussed. Then steps involve in implementation of an energy management programme in a tea factory will be discussed.

***At the end of this lecture participants will educate on involvement in an energy audit and it will greatly help to the rest of the exercise of this five day programme. The knowledge gain in implementation of an energy management programme will facilitate participants to practice the energy conservation in their respective organizations after the programme.***

### **1.1 Practical Sessions**

Practical sessions will be conducted with the guidance of well experienced instructors. Participants will be divided into four groups. During this session participants will do an energy survey in a tea factory, analyze data and measurement to established present energy scenario and to draw up some recommendation for energy conservation and prepare the energy audit report.

#### **1.1.1 Energy Survey**

Energy survey will be conducted by the participants with the guidance of instructors during Day 2 and Day 3. All necessary data will be collected, measurements will be taken and energy conservation opportunities will be identified by each group during the energy survey. A walk through energy survey will not be conducted since all the participants are very well familiar with operation of a tea factory, however if it feel a walk through survey is necessary, a two hour walk through survey will be conducted during start of the Day 2.

Main task of each group is given below

Group 1: Electricity supply and tea weathering

Group 2: Rolling, roller braking and fermentation

Group 3: Furnace and drying

Group 4: Sorting, grading and packing

Each group will study their main task during Day 2 and First half of the Day 3. In the second half of the Day 3, the group 1,2 and 4 will study the thermal energy area and group 3 will study the electricity supply to obtain experience in overall aspects. Historical data collection will also be allocated to all groups in order to train all the groups in data collecting. Main activities of each group during the energy survey (as their main task) are shown below.

## **Group 1: Electricity supply and tea weathering**

### ***Measurements***

- Logging of main electrical parameters in main feeder points
- Checking of the status of capacitor banks if available
- Generator test ( if a generator available)
- Measurements of electrical parameters of weathering blowers
- Measurements of thermal parameters (Dry bulb and wet bulb temperature, flow rates , pressure level)
- Weight and type of dhools
- Measurement in electrical usage in other equipments in the weathering section such as tea conveyor and ventilation fans
- Measurements of moisture contents of raw and weathered leaves
- Study of lightings in the weathering section

### ***Data Collection***

- Monthly electricity bills
- Name plate data of machineries at weathering section
- Process parameters to be practiced in weathering

### ***Thorough Inspection***

- Status of switch gears
- Air leaks air pockets
- Work practices

## **Group 2: Rolling, roller braking and fermentation**

### ***Measurements***

- Logging of electrical parameters in a full cycle of a rolling machine
- Measurements of electrical parameters in the machineries in the rolling section
- Study of rolling process – time for different pressure setting, weight
- Dry bulb and wet bulb temperature of fermentation area
- Study of lightings of the rolling section

### ***Data Collection***

- Monthly purchased tea leaves data
- Name plate data of machineries in rolling section

- Process parameters ( process time, ambient temperature and RH, roller programmes etc.) practiced in rolling and fermentation

#### ***Thorough Inspection***

- Status of switch gears
- Status of power transmission – belt drives
- Work practices

#### **Group 3: Furnace and drying**

##### ***Measurements***

- Flue gas analysis of furnace
- Fuel consumption rate
- Temperature logging of ambient air, dryer intake and outlet air
- Air flow rates
- Surface temperature
- Dry bulb and wet bulb temperature of air
- Moisture content of tea leaves, fired tea and fire wood
- Mass of fired tea/dhool input to drier
- Study of lightings of the firing section and outdoor lighting

##### ***Data Collection***

- Monthly fuel consumption data
- Name plate data of machineries in firing section
- Process parameters (process time, drier inlet/outlet temperature, moisture content of fired tea etc.) practiced in drying

#### ***Thorough Inspection***

- Status of switch gears
- Status of power transmission – belt drives
- Status of fire tubes in the furnace
- Firewood storage
- Dryer trays
- Work practices

#### **Group 4: Sorting, grading and packing**

##### ***Measurements***

- Measurements of electrical parameters in the machineries in the sorting, grinding and packing section
- Operating production capacities of each machines
- Moisture content of packed tea
- Study of lightings and ventilation in this section

#### ***Data Collection***

- Monthly made tea data
- Name plate data of machineries in this section
- Operating hours of each plant in this section

#### ***Thorough Inspection***

- Status of switch gears
- Status of power transmission – belt drives
- Work practices

***At the end of the energy survey participants will gain experience in handling measuring instruments, energy audit procedures, identification of energy saving options and energy lost streams.***

#### **1.1.2 Data Analysis and Calculation**

The all groups will do data analysis calculation and report writing during Day 4 and first half of the Day 4 with the guidance of instructors. Activities of each group are given below.

#### **Group 1**

- Analysis of recorded incoming electrical data and establishing daily electrical energy load curve
- Identification of demand management option based on this curve if any.
- Calculation of overall specific electrical energy consumption of the factory
- Calculation of specific energy consumption of weathering process
- Calculation of specific thermal energy consumption of weathering process if dedicated thermal energy is used for weathering
- Calculation of power factor improvement if any

- Calculation of energy saving and economics of identified energy conservation options
- Report preparation

### **Group 2**

- Calculation of specific electrical energy consumption of the rolling process and roller breaking
- Establishing of electrical energy balance of the factory
- Analysis of tariff options
- Calculation of energy saving and economics of identified energy conservation options
- Report preparation

### **Group 3**

- Calculation of specific thermal and electrical energy consumption of tea firing
- Establishing energy balances of furnace and dryers
- Establishing overall energy balance of the factory (share of thermal energy and electrical energy)
- Calculation of energy saving and economics of identified energy conservation options
- Report preparation

### **Group 4**

- Calculation of specific electrical energy consumption of sorting, grading and packing
- Establishing process flow diagram of tea manufacturing in respect to energy flow
- Calculation of energy saving and economics of identified energy conservation options
- Report preparation

## **1.2 Presentation**

Presentation will be done on the second half of the Day 5. Each group will present their findings and recommendations.