# Online Preparatory Training Course For BEE Energy Managers /Energy Auditors Certification Exam 2020

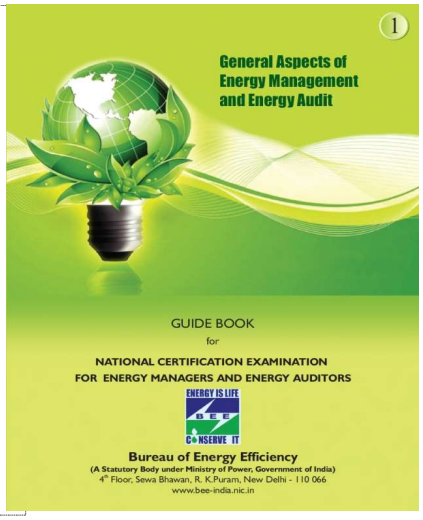
**Session- 1**
**29th June 2020**

**EnSave Consultancy and Training Pvt. Ltd.**
Chennai-600037, www.ensaveindia.com

## BOOK 1 – GENERAL ASPECTS OF ENERGY MANAGEMENT AND ENERGY AUDIT

### Brief Contents





# Chapter-1.2 ENERGY CONSERVATION ACT-2001 AND RELATED POLICIES




# Chapter 2 Energy Conservation Act,2001 and Related Policies

## Contents

# Chapter 2 Energy Conservation Act,2001 and Related Policies

## Learning Objectives

### In this chapter you will learn about

- ✓**Salient Features of the Energy Conservation Act,2001**
- ✓**State Designated Agencies**
- ✓**Scheme of Bureau of Energy Efficiency (BEE)- ECBC,S&L,DSM,BLY,SMEs**
- ✓ **Designated Consumers**
- ✓ **Electricity Act 2004**
- ✓ **National Action Plan on Climatic Change**



## Energy Conservation Act, 2001 & The Energy Conservation (Amendment) Act, 2010

## 2.1 Introduction

- ❖ **The Government of India** has enacted the **Energy Conservation Act in 2001**.
- ❖ The Act empowers the **Central and State Governments** to facilitate and enforce efficient use of energy and its conservation., **notify energy-intensive industries, establishments and commercial buildings** as designated consumers and **prescribe energy consumption norms** and standards for designated consumers
- ❖ This Act led to the creation of Bureau of Energy Efficiency (**BEE**) as the nodal agency at the center and State Designated Agencies **(SDAs**) at the State level to implement the provisions of the Act.
- ❖ Mission of BEE is to develop policy and strategies based on self-regulation and market principles with the goal of reducing energy intensity of the Indian economy.

## 2.2 Key Definitions as Outlined in the Act

- **Building:** "building" means any structure or erection or part of structure or erection after the rules relating to energy conservation building codes have been notified and includes any existing structure or erection or part of structure or erection, which is having a connected load of **100 Kilowatt (kW) or contract demand of 120 Kilo- volt Ampere (kVA)** and above and is used or intended to be used for commercial purposes.
- **Designated agency:** Designated agency means an agency which coordinates, regulates and enforce provisions of this act within a State.
- **Designated consumer:** Designated consumer means any user or class of users of energy in a energy intensive industries and other establishments specified in the Schedule as designated consumer.
- **Energy:** Energy means **any form of energy derived from** fossil fuels, nuclear substances or materials, hydro-electricity and includes electrical energy or electricity generated from renewable sources of energy or biomass connected to the grid.



- **Energy audit:** Energy audit means the verification, monitoring and analysis of use of energy including submission of technical report containing recommendations for improving energy efficiency with cost benefit analysis and an action plan to reduce energy consumption.
- **Energy conservation building codes:** It means the norms and standards of energy consumption expressed in terms of per square meter of the area and wherein energy is used and includes location of the building.
- **Energy consumption standards:** It means norms for process and energy consumption standards.
- **Energy savings certificate :** Energy savings certificate" means any energy savings certificate issued to the designated consumers.
- **Equipment or appliance :** It means any equipment or appliance which consumes, generates, transmits or supplies energy and includes any device that consumes any form of energy and produces a desired work.

## Role of State designated agencies

Designated Agencies will have the responsibility to implement the Act within the State.

### *Responsibilities*

- Spread awareness on EC Act . to promote energy conservation
- coordinate with BEE, State Government dealing with energy, industry, planning, regulators, consumer affairs, municipal bodies etc.
- Capacity building of staff employed
- maintain state website addressing the voluntary and mandatory provisions of EC Act
- Undertake energy conservation program for consumers, industrial, school , farmers
- Arrange meets between energy managers, energy auditors, designated consumers

### *Duties*

- Prepare a list of designated consumers ,Compile information received from designated consumers energy audit reports, action taken on energy audit
- Prepare a state and sectoral energy data base and provide the feed
- organize training for efficient use of energy and its conservation
- Take steps to encourage for use of energy efficient equipment or appliances
- Appoint or designate inspecting officer with specified powers as necessary for the purpose of ensuring compliance with energy consumption standards
- Establish Energy Conservation Fund within the State.



## 2.3 Schemes of BEE under the Energy Conservation Act-2001

1. Energy Conservation Building Codes (ECBC)
2. Standards and Labeling (S & L)
3. Demand Side Management (DSM)
4. Bachat Lamp Yojana (BLY)
5. Promoting Energy Efficiency in Small and Medium Enterprises (SMEs)
6. Designated Consumers
7. Certification of energy auditors and energy managers

## 2.3.1 Energy Conservation Building Code (ECBC)

- Energy Conservation Building Codes (ECBC) was developed to deal with increasing energy consumption in commercial buildings
- ECBC sets ***minimum energy efficiency standards for design and construction of commercial buildings***
- .ECBC defines the norms of **energy requirement per sq.metre of area** and takes into consideration the climatic region of the country, where the building is located


Central Government can prescribe energy conservation building codes and direct owners/ occupiers to comply. State Governments can modify the codes to suit regional and local climatic conditions.

Ministry of Power, Bureau of Energy Efficiency launched the '**Energy Conservation Building Code (ECBC)**' code in 2007 and code was revised in 2017

ECBC is being adapted with minor additions in different States and ECBC compliance is now mandatory.

ECBC is also being incorporated into local bye-laws, Urban Local Bodies (ULBs) building approval



## 2.3.2 Standards and Labelling (S&L)

**The objectives of Standards & Labeling** Program is to provide the consumer an informed choice about the energy saving and thereby the cost saving potential of the marketed household and other equipment.

**Standard:** Energy-efficiency standards are procedures and regulations prescribing the energy performance of manufactured/commercially sold products sometimes prohibiting the sale of products that are less efficient than a minimum level.

The term "standards" meanings:

**a)** well-defined test protocols (or test procedures) to obtain a sufficiently accurate estimate of the energy performance of a product, or at least a relative ranking of its energy performance compared to that of other models; and

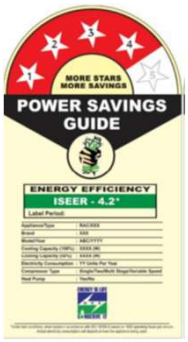
**b)** target limits on energy performance (usually maximum use or minimum efficiency) based on a specified test protocol.

# Labels

❑ Labels are **informative labels affixed to manufactured products** to describe the product's energy performance (usually in the form of energy use, efficiency). These labels give consumers the data necessary to make informed purchases.

**There are two types of labels**

•**Comparative label:** allow consumers to compare efficiency of all the models of a product in order to make an informed choice. It shows the relative energy use of a product compared to other models available in the market. Examples: comparative labels for air-conditioners, and colour television




•**Endorsement label:** define a group of products as efficient when they meet minimum energy performance criteria specified in the respective product schedule/regulation/statutory order.

❑**Minimum Energy Performance Standards (MEPS):** MEPS prescribe minimum efficiencies (or maximum energy consumption) that manufacturers must achieve in each product, specifying the energy performance(or output) but not the technology or design details of the product. . The MEPS will be reviewed and upgraded periodically to enhance & ensure the availability of energy efficiency product in the market.

❑, Star 1 is the least energy efficient (and hence the least money saved) and star 5 is the most energy efficient (and hence more money saved ).



# Products notified under mandatory labelling / under voluntary labelling

Products notified under **mandatory labelling** As of September 2018,

1. Frost Free (no-Frost) Refrigerators
2. Tubular Fluorescent Lamps
3. Room Air Conditioners
4. Distribution Transformers
5. Room Air Conditioners (Cassette, Floor Standing Tower, Ceiling, Corner AC)
6. Direct Cool Refrigerators
7. Electric Geysers
8. Color TV
9. Room Air Conditioners (Inverter type)
10. LED lamps

- The BEE S&L scheme is invoked for 22equipment/appliances including 10 for which it is mandatory (sep 2018)

Products under **voluntary labelling** As on September 2018,

**1. Induction Motors**
**2. Agricultural pump sets**
**3. Ceiling fans**
**4. Domestic Liquefied Petroleum Gas Stoves**
**5. Washing machine (Presently process of revising)**
**6. Computer (Notebook/Laptops)**
**7. Ballast (Electronic/Magnetic)**
**8. Office equipment's (Printer, Copier,Scanner)**
**9. Diesel Engine Driven Monoset Pumps forAgricultural**
**10. Solid State Inventor**
**11. Diesel Generator**
**12. Chiller**

# Example: Energy & Cost Savings estimation for Star rated appliance

| S No | Parameter | Star Rated Refrigerator | Non Star Rated Refrigerator |
|---|---|---|---|
| 1. | Cost | Rs 17,000/- | Rs 10,000/- |
| 2. | Star level | 5 star | No star |
| 3. | Annual Electricity consumption | 204 Units | 520 Units |
| 4. | Annual Electricity savings | 316 Units | |
| 5. | Annual Electricity Cost (@Rs 5/Unit) | Rs 1020/- | Rs 2600/- |
| 6. | Annual Money Savings | Rs 1580/- | |
| 7. | **Payback Period** | **1-1.5Years** | |

**Comparison of Star Rated Refrigerator with Non Star rated Refrigerator (220 Liters)**

Note: The cost of refrigerators & electricity consumption non star refrigerator is an assumption for savings estimation. The actual value may vary



# Who is Designated Consumers (DC)

- The Central Government has notified the following **9 energy intensive industries** as designated consumers under The EC Act 2001.

| No. | Industry | Energy consumption |
|---|---|---|
| 1. | Thermal Power Stations | 30,000 metric tonne of oil equivalent (MTOE) per year and above |
| 2. | Fertilizer | 30,000 metric tonne of oil equivalent (MTOE) per year and above |
| 3. | Cement | 30,000 metric tonne of oil equivalent (MTOE) per year and above |
| 4. | Iron & Steel | 30,000 metric tonne of oil equivalent (MTOE) per year and above |
| 5. | Chlor-Alkali | 12,000 metric tonne of oil equivalent (MTOE) per year and above |
| 6. | Aluminium | 7,500 metric tonne of oil equivalent (MTOE) per year and above |
| 7. | Railways | Electric traction Sub-Section (TSS), diesel loco shed, Production units and Workshops of Indian Railways having total annual energy consumption of 30,000 MTOE or more under Ministry of Railways |
| 8. | Textile | 3,000 metric tonne of oil equivalent (MTOE) per year and above |
| 9. | Pulp & Paper | 30,000 metric tonne of oil equivalent (MTOE) per year and above |

- As per the Act, **Designated consumers have to fulfill** the following criteria:
  1. Designated consumers have to **appoint Energy managers** with prescribed qualifications.
  2. The designated consumer has **to get an energy audit conducted by an accredited energy auditor.** Designated consumers would **comply with prescribed norms and standards of energy consumption** for the industrial sectors.
  3. Designated Consumers are required to adhere to energy efficient consumption norms stipulated.
  4. Designated Consumers are required **to submit the status of energy consumption information every financial year as prescribed.**



**Perform, Achieve and Trade (PAT) Scheme** is a **market based mechanism** to enhance cost effectiveness of improvements in energy efficiency in energy-intensive large industries and facilities, **through certification of energy savings** that could be traded.

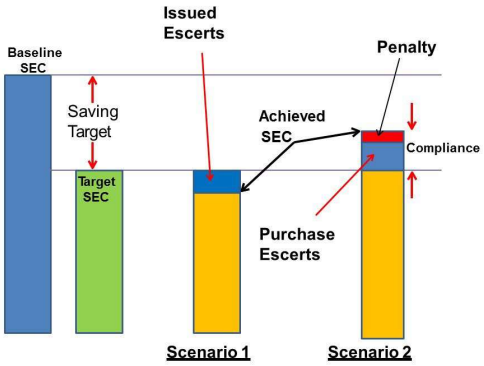
The genesis of the PAT mechanism flows out of the provision of the Energy Conservation Act, 2001 (**amended in 2010**).

The key goal of PAT scheme is to mandate specific energy efficiency improvements for the most energy intensive industries. Sector wise breakup of 478 Designated Consumers, which have been notified under the Energy Conservation Act, 2001, and covered under PAT Scheme, is as given below:

| Sector | Minimum annual energy consumption for the DC (tons of oil equivalent) | No. of DCs |
|---|---|---|
| Aluminium | 7500 | 10 |
| Cement | 30000 | 85 |
| Chlor-Alkali | 12000 | 22 |
| Fertilizer | 30000 | 29 |
| Iron and Steel | 30000 | 67 |
| Pulp and Paper | 30000 | 31 |
| Textile | 3000 | 90 |
| Thermal Power Plant | 30000 | 144 |
| **Total** | | **478** |

# Overview of PAT

- **PAT mandates** specific energy efficiency improvements
- Units in terms of SECs range from among the best in the world to some of the most inefficient units.
- more efficient unit will have a lower reduction target than less efficient unit in the same sector.
- First cycle of PAT (PAT-I) was completed inMar2015.
- For units surpassing their targets **awarded of Energy Saving Certificate**
- Certificates (**1 ESCerts = 1 MTOE (Metric Tonne of Oil Equivalent)**
- **Penalty** for not meeting the target. .
- **ESCert can be traded** in two exchanges namely Indian Energy Exchange (IEX) and Power Exchange of India (PXIL).






**Energy Savings Certificates (ESCerts)** so issued will be **tradable at Power Exchanges.** The scheme also allows units which gain ESCerts to bank them for the next cycle of PAT, following the cycle in which they have been issued. The number of ESCerts which would be issued would depend on the quantum of energy saved over and above the target energy savings in the assessment year (for 1$^{st}$Cycle of PAT, assessment year is 2014-15).

After completion of baseline audits, targets varying from unit to unit ranging from about **3 to 7% have** been set and need to be accomplished by 2014-15 and after which new cycle with new targets will be proposed. Failing to achieve the specific energy consumption targets in the time frame would **attract penalty** for the **non-compliance** under Section 26 (1A) of the Energy Conservation Act, 2001 (amended in 2010).

For ensuring the compliance with the set targets, system of **verification and check-verification** will be carried out by empanelment criteria of accredited energy auditors.

## Empanelment Criteria of Accredited Energy Auditor's Firm for Verification and Check-Verification under PAT Scheme

Accredited Energy Auditor can apply for Empanelment of Accredited Energy Auditor Firm for Verification and Check Verification under PAT Scheme and meet the following criteria for Firm empanelment:

a) has **at least one Accredited Energy Auditor** whose name is included in the list of the Accredited Energy Auditors
(b) has **at least three energy auditors**
(c) has **adequate expertise of field studies** including observations, probing skills, collection and generation of data, depth of technical knowledge and analytical abilities for undertaking verification and check-verification;
(d) has a minimum turnover of ten lakhs rupees per annum in at least one of the previous three years or in case of a newly formed organisation, a net worth of ten lakhs rupees

**Qualification for Accredited Energy Auditors**

An Energy auditor shall be qualified to become an accredited energy auditor if he / she-

- is a certified energy manager and has **passed the examination in "Energy Performance for Equipment and Utility Systems"**
- has an experience of **five years in energy audit** out of which atleast three years shall be in any of **energy intensive industries**
- has been granted a certificate of accreditation by the Bureau of Energy Efficiency.



- **Demand Side Management (DSM)** means managing of the demand for power, by utilities / Distribution companies, among some or all its customers to meet current or future needs.
- **Bachat Lamp Yojana**, which literally means "Save Lamp Scheme", aims at the large scale replacement of inefficient incandescent bulbs in households by Compact Fluorescent Lamps (CFLs).
- **BEE's SME Program** is implemented to improve the energy performance in selected SME clusters. The objective of the program is to accelerate the adoption of energy efficient technologies and practices in the chosen SME clusters through knowledge sharing, capacity building and development of innovative financing mechanisms.
- **Certification of Energy Managers and Auditors,** A cadre of professionally qualified energy managers and auditors with expertise in policy analysis, project management, financing and implementation of energy efficiency projects would be developed

## 2.4 Electricity Act, 2003

Government has enacted Electricity Act, 2003

The **objectives of the Act are**

- To consolidate the laws relating to generation, transmission, distribution, trading and use of electricity
- To take measures suitable for development of electricity industry
- To promote competition
- To protect interest of consumers and supply of electricity to all areas,
- To ensure transparent policies regarding subsidies
- To promote efficient and environmentally benign policies
- To constitute Central Electricity Authority (CEA), Regulatory Commissions



## Main features of Electricity Act 2003

- Generation free from licensing
- Captive generation free from control
- Re-structuring of State Electricity Boards
- Mandatory establishment of Regulatory Commissions
- Open access in transmission
- Open access in distribution to be allowed by State Regulators in phased manner
- Recognition of electricity trading as a distinct activity
- Stringent provisions for violation of grid discipline and theft of power
- Supply of electricity to all areas and specific provisions for supply in rural areas
- Rationalization of electricity tariff``

**The main features of the Policy can be summed up as follows:**

- Reducing Energy Requirements through Energy Efficiency and Conservation.
- Ensuring Adequate Supply of Coal with Consistent Quality
- Ensuring Availability of Gas for Power Generation
- Rationalization of Fuel Prices for Efficient Fuel Choice and Substitution
- Accelerating Power Sector Reforms
- Reduction in Cost of Power
- Role for Renewable Energy
- Ensuring Energy Security
- Using Energy Abroad
- Role of Nuclear and Hydro Power
- Promoting and focusing energy related R&D
- Climate Change Concerns



# Renewable Purchase Obligation ('RPO')

- **Renewable Purchase Obligation** (RPO) is the requirement set by the Central Electricity Regulatory Commission (CERC) for an **obligated entity** **to purchase electricity from renewable energy sources** or buy Renewable Energy Certificates.
- **each State has to meet 3% of its energy demand** from solar sources
- MNRE is planning to raise the mandatory RPO requirement to 10.5%.

**Renewable Energy Certificate (REC)**

- It is a market based instrument to promote renewable energy and facilitate renewable purchase obligation (RPO).
- **1 REC = 1 MWh of renewable electricity generated and injected into the grid.**
- REC can be traded only in the CERC approved power exchanges namely Indian Energy Exchange and Power Exchange of India

**Power Purchase Agreement (PPA)**

- ✓ power purchaser agrees to off-take the power generated by generator for a specified number of years (usually >10 years). The generator is thereby assured of getting the money back within the PPA period
- ✓ Solar Developers are able to competitively price solar power for both public as well as private customers under the terms of the PPA

# 2.5 Integrated Energy Policy

India needs to sustain 8% to 10% economic growth rate, over the next 25 years, if it is to eradicate poverty and meet its human development goals.
For sustained growth rate ,India needs to increase its primary energy supply by 3 to 4 times

By 2031-32, power generation capacity must increase to nearly 8,00,000 MW from the current capacity of around 1,60,000 MW. Similarly requirement of coal will need to increase to over 2 billion tonnes/annum based on domestic quality of coal

**Need for Integrated Energy Policy**

- Policies affecting energy are determined by different Ministries: Petroleum & Natural Gas, Coal, Power, Water Resources, Atomic Energy, New and Renewable Energy and Finance Ministry for tax purposes
- Policies in each sector have evolved independently across sectors and they do not take into account responses arising from climate change.
- Globally energy prices are rising and domestic energy prices have to reflect these changes to encourage energy efficiency, and to encourage domestic investment in expanding energy supply.



# 2.6 National Action Plan on Climate Change (NAPCC)`

- India is faced with the challenge of sustaining its rapid economic growth while dealing with the global threat of climate change.
- This threat comes from accumulated man-made greenhouse gas emission in the atmosphere generated through long term, intensive industrial growth and high consumption lifestyle.
- India is very vulnerable to climate: floods, droughts, vector borne disease, cyclones, ocean storm surges, etc.
- NAPCC document was released in 2008 and it identifies measures to advance India's development without affecting climate change related adaptation and mitigation.

## The 8 National Missions of the National Action Plan are:

1. **National Solar Mission** *is being launched to significantly increase the share of solar energy in the total energy mix as well to increase the use of other renewable and non-fossil fuel options such as nuclear energy, wind energy and biomass.*
2. **National Mission for Enhanced Energy Efficiency** *The Energy Conservation Act of 2001 provides a legal mandate for the implementation of the energy efficiency measures through the institutional mechanism of Bureau of Energy Efficiency (BEE)*
3. **National Mission on Sustainable Habitat** *is planned to make habitat sustainable through improvements in energy efficiency of buildings, management of solid waste and shift to public transport.*
4. **National Water Mission** *focuses on ensuring integrated water resource management to conserve water, minimize wastages and ensuring equitable distribution across and within States.*



5. **National Mission for Sustaining the Himalayan Ecosystem** *This mission focuses on sustaining and safeguarding the Himalayan glacier and mountain ecosystem.*
6. **National Mission for Green India** *will focus on enhancement of ecosystem services including carbon sinks. Green India campaign is already being launched for afforestation of 6 million hectares.*
7. **National Mission for Sustainable Agriculture** *The Mission aims to make Indian agriculture more resilient to climate change.*
8. **National Mission for Strategic Knowledge on Climatic Change** *Mission would identify challenges and responses to climatic change through enlisting global community in research, technology development and collaboration.*

# National Mission on Enhanced Energy Efficiency-NMEEE

1. **Perform Achieve and Trade Scheme (PAT),** a market based mechanism to enhance the cost effectiveness in improving the Energy Efficiency in Energy Intensive industries through certification of energy saving which can be traded.
2. **Market Transformation for Energy Efficiency (MTEE)**, for accelerating the shift to energy efficient appliances in designated sectors through innovative measures to make the products more affordable.
3. **Energy Efficiency Financing Platform (EEFP)**, for creation of mechanisms that would help finance demand side management programmes in all sectors by capturing future energy savings.
4. **Framework for Energy Efficient Economic Development (FEEED)**, for development of fiscal instruments to promote energy efficiency.



**Solved Example**: In a textile plant the average monthly energy consumption is 7,00,000 kWh of purchased electricity from grid, 40 kL of furnace oil (specific gravity =0.92) for thermic fluid heater, 60 tonne of coal for steam boiler, and 10 kL of HSD ( sp.gravity = 0.885) for material handling equipment.

**Given data:**
(1 kWh = 860 kcal, GCV of coal= 3450 kcal/kg, GCV of furnace oil= 10,000 kcal/kg, GCV of HSD= 10,500 kcal/kg, 1kg oil equivalent = 10,000 kcal)
a) Calculate the energy consumption in terms of Metric Tonne of Oil Equivalent (MTOE) for the plant.
b) Calculate the percentage share of energy sources used based on consumption in MTOE basis.
c) Comment whether this textile plant qualifies as a notified designated consumer under the Energy Conservation Act?

**Ans:**

$$= (40000 \times 0.92 \times 10000) + (60000 \times 3450) + (7{,}00{,}000 \times 860) + (10{,}000 \times 0.885 \times 10{,}500)$$

a) MTOE $= \dfrac{(36.8 \times 10^7) + (20.7 \times 10^7) + (60.2 \times 10^7) + (9.2925 \times 10^7)}{10^7}$

= **127** Metric Tonnes of Oil Equivalent per month

b) Electricity % = 47.4
Furnace oil% = 29.0
Coal % = 16.3
HSD% = 7.3

c) Annual energy consumption of the textile plant = 127 x 12 = 1524 MTOE which is less than 3000 MTOE cut off limit as notified under the EC act. Therefore this textile plant is not a designated consumer for the present energy consumption levels.

## Objective Type Question

1 **The legal framework for energy efficiency in India is given by**

a) Electricity Act 2003 b) Energy Conservation Act 2001

c) Electricity (supply) Act 1958 d) Indian Electricity Act 1910

2 **The first amendment to the Energy Conservation Act was made in**

a) 1948 b) 2003 c) 2007 d)2010

3 **The nodal agency at the centre for implementing the EC act is**

a) CEA b) SDA c) BEE d) Ministry of Power

4 **The minimum connected load for a building as defined in the amended EC act is**

a) 100 kW b) 100 kVA c) 500 kW d) 500 kVA

5 **As per EC act, the definition of energy audit does not consider**

a) monitoring b) verification c) analysis d) duration of audit



## Objective Type Question

6 **Star rating is a part of _____ programme of BEE**

a) DSM b) BLY c) S&L d) none of the above

7 **For the purpose calculating MTOE for a designated consumer the calorific value of oil is taken as**

a) 10,500 kcal/kg b) 10,000 kcal/kg c) 10,400 kcal/kg d) 9,800 kcal/kg

8 **The norms for energy consumption in ECBC is defined as energy consumption per____**

a) day b) hour c) square foot d) square meter

9 **DSM is of benefit to**

a) Government b) DISCOM c) user d) all of the above

10 **The major portion of subsidy under BLY is met be revenues from**

a) electricity boards b) CDM c) DISCOMS d) central budget

## Short Type Questions

S-1 Explain what is meant by Renewable Purchase Obligation (RPO)

S-2 Explain the reforms in the distribution brought about by Electricity Act 2003

S-3 Explain the difference between Standards and Labelling?

S-4 List at least five national missions under the National Action Plan for Climatic Change

S-5 Distinguish between designated agency and designated consumer

## Long Type Questions

L-1 Explain the 'Bachat Lamp Yojana' scheme

L-2 Explain five important features of the energy conservation act, 2001?



# Thank You

**Dr.P.Dharmalingam**
**Accredited Energy Auditor**
**pdlingam@gmail.com**
**9444177914**
**www.ensaveindia.com**
**EnSave Consultancy & Training Pvt Ltd, Chennai**

***Save energy and water for Sustainable Life***