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Roll No.

 SHAMBHUNATH INSTITUTE OF ENGINEERING AND TECHNOLOGY

FIRST SESSIONAL EXAM.(2019-20)

SEMESTER-VII

Sub: ENERGY EFFICIENCY AND CONSERVATION Sub Code:REE-076

Time: 90 Min. Max. Marks: 30

Q1.Attempt all (1x5)

A) What is the principle of energy conservation?

b) What you mean by energy efficient equipment?

c) What is energy Audit?

d) Show clearly through diagram energy management cycle.

e) What you mean by Demand Side Management?

Q.2. Attempt any two: (5x2)

a) Discuss the various steps involved in energy conservation in your home or any organization.

or

A motor 82% ƞcy runs 16 hours in a day for 365 days consumes 750 watts. If the ƞcy is increased to 92% of the motor by replacing it with new motor and the new motor cost Rs1200/- more. What will be the pay back time for the same O/P. The electricity charge is Rs5/ unit and the energy conservation in a year in KWH

b) What are included in energy audit system, explain in details.

c) Discuss the social and economy effects of energy crisis.

Q.3. Attempt only one: (5x1)

a) Discuss in details the energy conservation planning.

b) What is energy conservation legislation ACT 2001 and its salient feature?

Q.4. Attempt only one: (5x1)

a) Describe the energy audit team consideration in implementing energy conservation plan.

b) What are the various instruments used for energy audit?

Q.5. Attempt only one: (5x1)

a) Describe the concept and scope of Demand Side Management.

b) What are DSM Strategy planning and implementation?

**SOLUTIONS**

**Q1 a)The principle of energy conservation is input energy= output energy + unavoidable energy +avoidable energy. To conserve energy eliminate avoidable energy.**

**b) Energy efficient equipments are those which have less losses and are star graded related to energy consumption.**

**c)** As per Indian Energy Conservation Act 2001, Energy Audit is defined as: “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 “

d) Below is shown the cycle of Energy Management.

e) The demand side management (DSM) comprises techniques and policies which aim at equalizing energy consumption levels over the day. As opposed to the supply side management involving the addition of new generation units and total installed capacity, the idea here is not only to increase the energy to be supplied, but also to control the shape of consumption by applying energy management techniques.

Q2.

a)

 In order to enable .small scale enterprises adopt more efficient energy use patterns, it

is essential to demonstrate positive impacts of reduced energy use to the entrepreneurs in

tenns ofincreased productivity and higher profitability.. Thus an effective strategy to promote

energy efficiency small scale industry is to use a cluster based approach wherein energy

efficient technologies and practices can be demonstrated to a group of companies located in

close geographic proximity.. In India, a large portion of the. SSI activity is geographically

clustered. Within a uster, there exists a great deal of similarity in the level of technology,

the operating practices and even the trade practices among the individual units which means

that potential to develop and implement standard solutions for improving energy

efficiency is large..

 or

 INPUT=750 watts, efficiency =82%, Therefore OUTPUT=615 watts

 New motor efficiency= 92%.

Hence for the same OUTPUT INPUT by New Motor= 615/0.92=668 watts

Therefore net watt saving=750-668=82 watts. New motor cost Rs1200 more. Cost of one unit= Rs5/-

Therefore1200=(82\*5\*(H) hours)**/**1000. Hence H=(1000\*1200)/(5\*82)= 4528 hours =182days (As the motor is running only 16hrs daily. There pay back period will be 182 days

Energy conservation in a year= 82\*16\*365 watts hours= app 479KWH.

**b)**

1. Detailed Energy Audit is carried out in 3 phases – The Pre-audit Phase – The Audit Phase – The Post-Audit Phase
2. Organize Instruments • Resource planning, Establish/organize a Energy audit team • Conduct of brief meeting / awareness programme with all divisional heads and persons concerned (2-3 hrs.) • Informal Interview with Energy Manager, Production / Plant Manager • Walk through Audit • Plan and organize •The Ten Steps for Detailed Audit Step No PLAN OF ACTION PURPOSE / RESULTS –Pre Audit Phase & First hand observation • Familiarization of process/plant activities • Macro Data collection (suitable to type of industry.) •time frame & Orientation, awareness creation • Issue questionnaire for each department • Building up cooperation •Assessment of current level operation and practices

Historic data analysis, Baseline data collection • Conduct survey and monitoring •Energy Utility Diagram All service utilities system diagram (Example: Single line power distribution diagram, water, compressed air •Prepare process flow charts & Measurements : Motor survey, Insulation, and Lighting survey with portable instruments for collection of more and accurate data. Confirm and compare operating data with design data. • Annual Energy Bill and energy consumption pattern (Refer manual, log sheet, name plate, interview) • Design, operating data and schedule of operation

c)

Social and economy effects of energy crisis are tabulated as follows:

|  |  |  |
| --- | --- | --- |
| **Customer benefits** | **Social benefits** | **Utility benefits** |
| **Electric demand fulfilled** | **Reduce environment degradation** | **Lower cost of service** |
| **Reduce / stabilized cost** | **Conserve resource** | **Improve operating efficiency flexibility** |
| **Improve values of service** | **Protect global environment** | **Reduce capital need** |
| **Maintain / improve life style and productivity** | **Maxixise customer welfare** | **Improve customer services** |

**Q3.**

**a)**

**The easiest way to earn money is to waste less energy.**

 **Energy management is the process of monitoring, controlling, and conserving energy in a building or organization**

**Reduce the damage that we're doing to our planet, Earth. As a human race we would probably find things rather difficult without the Earth, so it makes good sense to try to make it last. Reduce our dependence on the fossil fuels that are**

**becoming increasingly limited in supply.**

***1. Metering your energy consumption and collecting the data***

***2. Finding and quantifying opportunities to save energy***

***3. Targeting the opportunities to save energy***

***4. Tracking your progress at saving energy***

**Replace incandescent lighting with compact fluorescent lighting indoors and**

**outdoors. CFL is almost four times as efficient as incandescent bulbs and lasts**

**about 12 times longer**

**For outdoor lights, use a timer or photocell so they turn off automatically during**

**the daylight hours**

**For indoor lights, adjust lighting levels to your needs with three-way lamps,**

**dimmer switches for overhead lights, and task lighting**

**Use 4-foot fluorescent fixtures with T5 or T8 lights with reflective backing on the**

**fixture and electronic ballasts**

**Take advantage of natural light by placing work areas near windows**

**Install occupancy sensors, so lights go off automatically in unoccupied rooms**

**When purchasing a new motor choose the most energy efficient one you can afford. Premium efficiency motors cost about 20 percent more, but can have a relatively short payback to off-set these costs.**

**Motors are oversized when they power end uses that require less horsepower than the motor is capable of producing. Select a lower power motor and operate it at a higher load factor near optimal efficiency to help justify the motor replacement. Motors operated at low load factors have lower power factors, thus having less efficiency.**

**Optimize transmission efficiency by using synchronous belts instead of v belts.V-belts can slip and deteriorate reducing efficiency at higher loads.**

**Consider using a variable speed drive motor system instead of traditional motors when loads vary significantly over the course of daily use.**

**b)**

**An Act to provide for efficient use of energy and its conservation and for matters connected therewith or incidental there to.(1) This Act may be called the Energy Conservation Act, 2001. (2) It extends to the whole of India except the State of Jammu and KashmirSalient features of the Energy Conservation Act 2001**

**Salient Features of Energy Conservation Act 2001**

* **specify energy consumption standards for notified equipment and appliances;**
* **direct mandatory display of label on notified equipment and appliances;**
* **prohibit manufacture, sale, purchase and import of notified equipment and appliances not conforming to energy consumption standards;**
* **notify energy intensive industries, other establishments, and commercial buildings as designated consumers;**
* **establish and prescribe energy consumption norms and standards for designated consumers;**
* **prescribe energy conservation building codes for efficient use of energy and its conservation in new commercial buildings having a connected load of 500 kW or a contract demand of 600 kVA and above;**

**Q4.**

1. **a)**

**1** DETAILED ENERGY AUDIT A TYPICAL INDUSTRIAL FORMAT OF REPORT Energy Audit Team Executive Summary –Scope & Purpose Energy Audit Options & Recommendations 1.0 Introduction about the plant 1.1 General Plant details and descriptions 1.2 Component of production cost (Raw materials, energy, chemicals, manpower, overhead, others) 1.3 Major Energy use and Areas

 2.0 Production Process Description 2.1 Brief description of manufacturing process 2.2 Process flow diagram and Major Unit operations 2.3 Major Raw material Inputs, Quantity and Costs

3.0 Energy and Utility System Description 3.1 List of Utilities 3.2 Brief Description of each utility 3.2.1 Electricity 3.2.2 Steam 3.2.3 Water 3.2.4 Compressed air 3.2.5 Chilled water 3.2.6 Cooling water

4.0 Detailed Process flow diagram and Energy& Material balance 4.1 Flow chart showing flow rate, temperature, pressures of all input- Output streams 4Water balance for entire industry

 5.0 Energy efficiency in utility and process systems 5.1 Specific Energy consumption 5.2 Boiler efficiency assessment 5.3 Thermic Fluid Heater performance assessments 5.4 Furnace efficiency Analysis 5.5 Cooling water system performance assessment 5.6 DG set performance assessment 5.7 Refrigeration system performance 5.8 Compressed air system performance 5.9 Electric motor load analysis 5.10 Lighting system

 6.0 Energy Conservation Options & Recommendations 6.1 List of options in terms of no cost, low cost, medium cost and high cost, annual energy savings and payback 6.2 Implementation plan for energy saving measures/Projects ANNEXURE Al. List of instruments A2. List of Vendors and Other Technical details

 **b)**

 **Following are the instruments used for audit:**

**1. Power analyzer: KVA, KW, PF and frequency meters.**

**2. Flue Gas analyzer: Combustion analyzer, Fuel efficiency monitor, Fyrite: A hand bellow pumpdraw the flue gas sample.**

**3. Temperature measurements: Contact thermometer, Infra red pyrometer.**

**4. Speed Measurement: Tachometer, stroboscope.**

**5 Illumination meter: LUX meter.**

**6. Flow meter: Air velocity(pilot tube and manometer air velocity in ducts), Water flow Ultrasonic flow meter: A non contact floe measure device using Doppler effect principle (transmission and receiver in opposite side.)**

**Q5.**

 **a)**

 The demand side management (DSM) comprises techniques and policies which aim at equalizing energy consumption levels over the day. As opposed to the supply side management involving the addition of new generation units and total installed capacity, the idea here is not only to increase the energy to be supplied, but also to control the shape of consumption by applying energy management techniques. The main challenge in the implementation of a DSM program is the quest for knowledge of the daily behavior of loads in the electrical system, which is generally not available from the systems based on conventional electromechanical meters. In such a scenario, the emergence of novel technologies like Smart Grid technology, creates an environment for convergence between the infrastructures of generation, transmission, distribution, information technology and digital communication infrastructure which enables the exchange of information and control actions among the various segments of the power grid. The research trends within the area of demand side management in a smart grid environment and proposes a scheduling scheme using genetic algorithm for load management. Simulation results confirm that the proposed algorithm efficiently reduces the PAR and electricity consumption cost.

Demand Side Management (DSM) has come a long way from simply building new power plants as energy demand grows. Over time, more and more emphasis has been placed on increasing energy efficiency for both economical and environmental reasons.

While navigating ever-evolving legislation, energy providers have successfully balanced demand with a consistently reliable grid - and at the same time protecting energy consumers from extremely high energy costs. But as grid-edge technology such as DERs, EVs and smart devices become more pervasive and energy efficiency legislation increases, energy providers’ ability to maintain a reliable, efficient and affordable grid will only become more challenging.

Join us as we explore the evolution of DSM as we know it today: where it began, how it has matured and what's next as utilities plan for the grid of the future.

b)

**DSM** There are three types of DSM based on the overall purpose of the DSM program:

􀂄**Environmentally-driven**–achieves environmental and/or social goals by reducing energy use, leading to increased energy efficiency and/or reduced greenhouse gas emissions

􀂄**Network-driven**–deals with problems in the electricity network by reducing demand in ways which maintain system reliability in the immediate term and over the longer term defer the need for network augmentation

􀂄**Market-driven**–provides short-term responses to electricity market conditions (‘demand response’), eg by reducing load during periods of high market pricescaused by reduced generation or network capacity

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**Timing**–DSM programs may be designed to achieve specific outcomes at particular times of day

**Pre-or post-contingency**–DSM programs may be designed to achieve specific outcomes either prior to a contingency or in

 response to a particular event

􀁺**Geographical locations**–DSM programs may be targeted to specific locations, eg (a)whole network (b) network regions

 (c)network elements

􀁺**Market segments**–DSM programs may be targeted to

 specific segments, eg residential, commercial or industrial customer classes