

31B. ENERGY CONSERVATION

- Excessive energy use and growing exploitation of natural resources have adversely affected our environment.
- **Impact of Energy Use on Environment**
 - Energy use and supply is of fundamental importance to society which has made the greatest impact on the environment of any human activity.
 - Apart from depletion of energy resources, use of energy especially burning of fossil fuels cause environmental pollution. Burning of fossil fuels emit green house gases that cause global warming. The changing weather patterns due to global warming are now a reality. We should better be cautious and aware to this to save our planet earth.
- The impact of energy use on the environment has been twofold:
 - i. Depletion of energy resources.
 - ii. Pollution of environment from emission of green house gases from burning of fossil fuels.
- **Importance of Energy in Daily Life**
 - In an average home for almost all types of activities like lighting, cooling and heating the house, for cooking, for running televisions, computers and other electrical gadgets energy is used.
 - If you walked to go outside, you used the energy your body made from converting calories from food to energy.
 - You might turn on lights in your house, when it gets dark. Electricity allows you to light up the room and makes it bright.
 - **In the transport sector**, buses, trucks, trains, aeroplanes, ships, automobiles are powered by fossil fuels and their over exploitation is causing scarcity.
 - **In the agricultural sectors**, Tractors, threshers, combined harvesters, pumps for irrigation etc. run on diesel (a fossil fuel) or electricity.
 - **In the industrial sectors**, energy is required in huge amount at various stages in the manufacturing of goods.
 - Energy has been universally recognized as one of the most important inputs for economic growth and human development. The energy sector in India has been receiving high priority in the planning process.
- **Energy and Economic Development**
 - Economically developed countries use more energy per unit of economic output and have much more per capita energy consumption as compared to developing countries.
 - Energy has been universally recognized as one of the most important inputs for economic growth and human development.
 - Growth of economy will stand global competitiveness withstand only when it will depend on cost effective or cheaper and environment friendly energy sources.
 - Government of India has recognized the fact that the energy sector can become a major constraint or hurdle in the achievement of a high growth rate or Gross Domestic Product (GDP).
- **ENERGY CONSERVATION**

It is necessary to prevent wastage of energy and make all our efforts for energy conservation. We shall fail in our duty, if energy sources are exhausted.

 - Sincere efforts are needed at individual, community and at government level for energy conservation.

(A) Energy conservation at household level

The steps in developing an energy conservation plan for our home are:

 - (1) Identify the problem areas where energy is being lost or inefficiently used.
 - (2) To prioritize the problem areas according to how much energy is being lost or inefficiently used and
 - (3) Systematically correct the prioritized problems according to the limits of our household energy improvement budget.
- **(i) Major appliances for domestic use**

Large appliances are the major consumers of energy and improving the operating efficiency of such household appliances will significantly reduce the overall consumption of electricity.

(ii) Lighting

- Light should be turned off when not in use. Maximum sunlight should be used during the day. Bulbs and tube lights should not be used during day.
- Use task lighting whenever possible instead of brightly lighting an entire area or room.



- Use compact fluorescent lamps (CFL) in place of incandescent bulbs.
- Use dim light in galleries, lobbies; balconies etc.
- Do not keep computer, TV, tape recorder, music system in standby mode.
- Geysers consume the maximum amount of electricity.
- Thermostat can be set to a lower temperature 45°C to 50°C.

(iii) Electricity conservation

- Use ISI marked appliances and equipments.
- Substitute bulbs with tungsten filaments lamps (TLP) tubes.
- CFL (compact fluorescent lamps) and LED (Light Emitting Diode) should be used as they use comparatively less electricity and last longer.
- Electric geyser can be replaced by gas geyser to save electricity.

(iv) Cooling

A huge amount of energy is wasted in cooling.

- We should open windows at night, to bring cool air inside.
- Windows should be closed during daytime.
- West facing windows should be shaded.
- An evaporative cooler should be installed.
- Use room air conditioning only where needed and install energy efficient models.
- Cooling in air conditioned houses should be maintained at 25°F.

Refrigerator:

- Condenser is found either behind the fridge or underneath the fridge and helps in maintaining its lower temperature. Keep the fridge as full as possible.
- Close door of the fridge properly.
- Door of the fridge should not be opened several times.

Oven/ Microwave oven

- Use microwaves as they consume 50% less energy than conventional ovens.
- Door should not have any cracks or tears in it.
- Rearrange oven shelves before turning your oven on and do not peep in oven
- One should cook as much of the meal in the oven at one time as possible.

Ironing

- We can save energy by ironing clothing in bulk and not just one or two at a time.
- Ensure that the thermostat on the iron is working and set the right temperature for the clothing being ironed.

Cooking

- Use a cooking pan that is slightly bigger than your cooker plate, coil or burner.
- Keep saucepan lids on.
- Turn down the heat once food starts boiling.

Washing machines

- We should try to use cold water while working and rinsing as almost 90% of the energy consumed by washing machine is used to heat the water.
- Follow detergent instructions carefully
- Soak or prewash the clothes for effective cleaning as well as to reduce energy consumption.

(B) Energy Conservation at community level

- All unnecessary lights should be turned off especially when conference rooms are not in use.
- Energy uses should be minimized during peak demand hours.
- Set computers, monitors, photocopiers and other business equipments to their energy saving mode. Turn them off during long idle hours such as lunch breaks.
- Skylights should be used for warehouses.
- Ensure that offices having air conditions have proper windows and all doors are closed when the air conditioner is in use.

(i) **Use of renewable energy resources**

- Demonstration of renewable solar technologies at the community level like solar pumps for water purification and irrigation of lawns, play grounds, gardens, community centres, as well as solar energy for cooking and heating should be promoted.
- Demonstration of biogas programmes is also required to tell people for the efficient use of it.
- Collaborative community/ academic research and development in order to produce low cost, sustainable energy options should be given priority.

(ii) **Energy conservation at community level for housing complexes**

At the community level following measures can be used:

- Installation of photoelectric controls or timers should be used to make sure that outdoor lighting is sufficient during the day.
- Open area or yard area lightings should be switched off after sunrise and again switched on only after sun sets.
- Tube lights in common area and staircase landings should be reduced and twin tubelight should be replaced by one tube light.
- Elevators/lifts should be used for going up beyond three floors and for coming down the usage of lifts may be reduced.
- Environmentally sustainable transport will promote more mileage less pollution by GHG gases.

(C) **Energy conservation in industry and other places** Energy conservation may be achieved through efficient energy use. At different places such as factories, business centres, transportation sector and construction activities, it can be saved in the following ways:

(i) **At factories and business centres including shops**

(a) **Auditing**

Regular monitoring and audit of energy consumption results in energy conservation.

(b) **Process modification**

It means replacement of old and more energy consuming processes by the new energy efficient processes. Old factories should now employ process modification.

(c) **Improved measuring instruments**

We can use new technologies and energy efficient instruments and processes to conserve energy.

(d) **Light load reduction**

- CFLs and LEDs have proved very helpful in reducing energy needs for lighting purposes.
- We can use new technologies and energy efficient instruments and processes to conserve energy.

(e) **Energy loss reduction**

- We can reduce energy loss by using following measures, for example: thermal insulation of fuel tanks can be done, Ceramic fiber sealing of furnaces, electrical tracing of liquid fuel lines instead of conventional steam heating
- Transportation includes all vehicles used for personal or freight transportation.

• (f) **Energy conservation in transportation sector**

- Energy can be conserved in transportation by the following ways:

(i) **Reduction of fuel consumption**

- Use public transportation as much as possible instead of using own vehicles.
- Car speed should be maintained as far as possible 50 to 60 km/hr.
- Avoid free frequent starts and stops to reduce fuel consumption. Release clutch pedal gradually and simultaneously press accelerator to racing and or jerking.
- Never race engine when declutched. brake and preferably install a warning light device. Apply brakes gradually as far as possible. Anticipate need for braking. to lower gears on gradients (up/down) at the right time. All these will be helpful in reducing fuel consumption

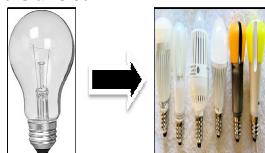
• (ii) **Fuel economy- maximizing behaviour .**

Fuel economy maximizing behaviour describes techniques that drivers can use to optimize their automobile fuel economy.

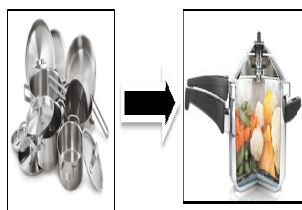
They include various measures-

- moderate driving
- driving at lower speeds
- by using cruise control (speed control or auto cruise controls speed and maintains steady speed by the driver).
- turning off a vehicles engine at stops rather than idling;

- It is important to improve energy use efficiency and switch to environment friendly energy sources.
- **CONCEPT OF ENERGY EFFICIENT BUILDINGS**
- **Energy efficient devices**
- It is very necessary to develop energy efficient devices to save energy.
- Compact Fluorescent Lamps (CFL) replaced incandescent bulbs.

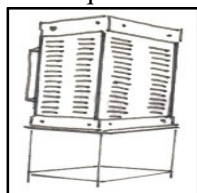


- Open utensils cooking have been replaced with pressurized steam cooking and of course solar cooking.



Many energy efficient devices can be manufactured and many technologies can be used for energy conservation.

- Other energy efficient devices which can be used for energy conservation are diamond hot plate, PRP bullock cart, tube light with electronic ballast device which helps in reducing energy consumption by limiting amount of electric current in an electric circuit. Diamond mono-block lathe, improved crematoria, natural water cooler etc
- Natural water cooler is a safe drinking water device which works on the principle of “cooling by evaporation”. No external source of energy such as electricity or ice is required.



- Promoted by government of Gujarat, India, improved crematoria are prefabricated cradle like iron structures designed for proper acration for proper combustion.
- Consumption of wood for cremation is much reduced and consequently trees prevented from being axed.



b. **Energy Efficient Buildings**

Many energy efficient houses were made to save energy. Different types of new technologies were used to make them energy efficient. Some examples of such energy efficient buildings are:

- Eco house
- The Auroville visitors centre
- Solar kitchen
- Inhoff Tanks
- Oscillatory baffled reactors

• **CONCEPT OF ENERGY EFFICIENT NEW TOWNS**

- Energy conservation should be considered in any comprehensive land use planning process.
 - A variety of heating sources like fuel oil, gas, wood, electricity, the sun and coal etc. are used in homes and business houses. This energy consumption and conservation of energy resources is the hot topic these days.
 - Substantial economic savings can be realized through energy conservation.
 - Effective use of land could prove to be a good way of energy conservation.
 - A township can be oriented towards becoming eco-friendly only with the cooperation of the inhabitants.
 - It may have structures of echo-friendly architecture but unless the inhabitants resolve and practice energy conservation and eco-friendly way of life, the purpose of energy efficient town would be defeated.
 - Education, eco-friendly behaviour and ecologically sound infrastructure can truly create energy efficient green towns
- (i) **Education**
- Education is the best way of creating awareness for energy conservation. Energy conservation information should be present on the websites, local cable access station.
- (ii) **Changing behaviour**
- A best way to conserve energy is to switch off the lights while leaving the room, shut down the

computers when not in use. When appliances are not in use they should be unplugged.

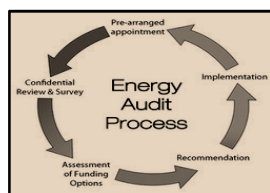
- Lower the thermostats in the winter and raise them in the summer.
- Household and business wastes should be recycled. It will positively result in energy conservation.

(iii) Greening our infrastructures

- Light bulb should be replaced with the energy efficient compact fluorescent bulbs as they use 75% less energy and last up to ten times longer than standard incandescent bulbs.
- Appliances and office equipments should be replaced with energy star rated units. It will lower energy usage and costs.
- **Green buildings**
- Proper design, building orientation, construction, and landscaping provide opportunities for energy conservation measures .
 - (i) Building designs and construction practices should promote energy conservation.
 - (ii) Use of renewable energy sources should be encouraged.

CONCEPT OF ENERGY AUDITING

- Energy auditing is a systematic approach to monitor industrial energy consumption and to find out the sources of energy wastage. It consists of activities that seek to identify conservation opportunities before conducting or developing any energy saving program.



- These audit programs are helpful in understanding and analyzing the energy utilization of any organization.
- The audit programmes help to identify and reduce energy wastage.
- **The Role of an Energy Audit**
 - The first and most important role of energy auditing is to identify the areas of energy consumption and to find the overuse for accessing the opportunity of saving energy. .
 - Also they would be made aware of the need for energy conservation. So there is an attitudinal change for reducing energy use and energy wastage.

(iii) Facilitate energy conservation as related to local transportation needs.

(iv) Awareness should be raised among people for conservation of energy sources.

(v) Promote community self-sufficiency and independence with respect to energy levels and encourage the use of the least environmentally damaging sources of energy.

(vi) Town should minimize its energy consumption.

- **Limitations of alternate source of energy**

- Once humans became aware about the limited stocks of fossil fuels, use of renewable sources of energy began. Currently the sources of energy in global use are:

(1) Fossil fuels (coal, oil and natural gas) – 88%

(2) Nuclear energy (Fission and fusion of atoms) 05%

(3) Other sources (hydel, tidal, wind, geothermal, solar, fuel wood, solid waste and biomass conversion energy) – 07%

- **Analysis of energy use**

- Can be used in the review of management structures and procedures for controlling energy use.
- Sub meters can be installed in different plant locations to pinpoint the actual energy consumption per area. This data could be helpful in allocating energy use.
- With the help of this plant manager can list all the equipment used and the corresponding operating hours.

- **Energy Conservations Initiative has taken by Government**

- The Petroleum Conservation Research Association (PCRA) is created in 1978 that engages in promoting energy efficiency and conservation in every walk of life.
- PCRA has done mass-media campaigns in television, radio, and print media.
- The Bureau of Energy Efficiency (BEE) is established in 2001 that is responsible for promoting energy efficiency and conservation.
- Protection and Conservation of Natural Resources is done by CNRM (Community Natural Resources Management) .



Check Yourself

1. Energy conservation is necessary because:
 - a. Energy is needed to our body to all functions.
 - b. Burning of fossil fuels cause pollution
 - c. Accumulation of CO₂ from burning coal has caused global warming and climate change'
 - d. Energy resources like fossil fuels are fast depletion
2. Which kind of bulbs help to save electricity by reducing light load?
 - a. CFL
 - b. LED
 - c. Tungsten filament bulb
 - d. Both a and b
3. Out of the following which are energy efficient buildings?
 - a. Eco house
 - b. Auroville Visitors centre
 - c. Only a
 - d. a and b both
4. Green building means:
 - a. Ecofriendly
 - b. Least use of environment damaging energy
 - c. Building designed and instructed such as to promote energy conservation
 - d. Building using non-conventional energy resources
5. Energy conservation at house hold level:
 - a. By using good quality electrical appliances.
 - b. Light and fans should be switched off when not in use.
 - c. Many washed clothes should be ironed after heating iron not one or two clothes.
 - d. All the above

Ans: 1.d 2.e 3.d 4.c 5.d



Stretch Yourself

1. Define energy auditing
2. What is car pool
3. Give four examples of energy efficient devices.
4. Why should you replace tungsten bulb by CFL or LED bulbs?



Test Yourself

1. Mention the characteristics of eco-house.
2. Suggest any four ways to save electricity while using washing machine.
3. Explain the concept of energy efficient town?
4. Mention the steps which are being used at factories and business centres for energy conservation.
5. Mention the advantage and of using nuclear energy.