MODULE 5

SYLLABUS :Basic concept of sustainable habit ,Methods of increasing energy efficiency of building , green engineering, sustainable urbanization, sustainable transport, sustainable cities

Sustainable Habitat

A sustainable habitat is an ecosystem that produces food and shelter for people and other organisms, without resource depletion and in such a way that no external waste is produced. Thus the habitat can continue into future without massive depletion of resources. Such a sustainable habitat may evolve naturally or be produced under the influence of man. Man made sustainable habitats refers to green building or environmental planning. Main features of such habitats/houses are to:-

-Minimize resource use
-Maximize energy and water efficiency
-Protect the environmental resources.
-Eliminate exposure to toxic chemicals
-Preference to human health & safety

METHODS OF INCREASING ENERGY EFFICIENCYOF BUILDING

Energy efficiency is the first step toward achieving sustainability in any type of buildings. Energy efficiency helps control rising energy costs, reduce environmental footprints, and increase the value and competitiveness of buildings .

In the present world there are many methods to achieve energy efficiency of a building

SPACE CONDITIONING

Space conditioning (heating, cooling, ventilation, and humidity control) requires more energy than any other service in both residential and commercial buildings, accounting for more than half of total residential/commercial energy use. Method used for space conditioning are

There have been impressive advances in the efficiency of space-conditioning equipment in recent years. New residential gas furnaces, for example, are now available that are 97 percent efficient fold improvement over the single-pane windows still found in many buildings A very efficient furnace will still use a lot of energy to heat a poorly insulated, drafty building, while a well-insulated building in a moderate climate may need no additional energy for space conditioning. Natural gas fired warm-air furnaces, currently found in about41 percent of households,5 have made impressive gains in energy efficiency in recent years There are many commercially available gas furnaces, however, that are far more efficient-in the range of 95 to 97 percent

Light conditioning

Lighting is the single largest consumer of electricity in commercial buildings. About 41 percent of electricity, and 28 percent of total energy, consumed in the commercial sector is for lighting. In the residential sector, lighting energy use is small though not trivial, representing about 7 percent of residential energy use. These energy savings come largely from the use of new, efficient lighting technologies. Lamps, ballasts, reflectors, and lighting control technologies Incandescent lamps provide most lighting in the residential sector . There are several technologies available to improve incandescent lamp efficiency, although even the advanced incandescent lamps are still far less efficient than fluorescent lamps. Improved filaments and the use of krypton gas inside the bulb provide a modest efficiency improvement.

Fluorescent lamps are about four times more efficient than incandescent lamps, but their use in residences has been limited by their higher frost cost, unattractive light, and inability to fit in incandescent fixtures. In 1984, however, a lighting manufacturer introduced the compact fluorescent, a lamp providing reasonably attractive light and fitting regular incandescent fixtures yet using the efficient fluorescent technology.

Water heating

Water heating accounts for about 15 percent of residential use .The efficiency of residential-size water heaters has improved in recent years, due largely to increased tank insulation, smaller pilot lights, and improved heat transfer from combustion gases to the water in the tank. The most efficient commercially available water heaters sold today use thick polyurethane foam insulation, carefully designed heat transfer surfaces, and electronic ignition, but these features are found only in a few models. As was found for other residential appliances, there is a considerable efficiency difference between the average new water heater and the most efficient commercially available new water heater. Several new water heating technologies show considerable promise for improved efficiency. Heat pump electric water heaters, which pump heat from an external heat source (usually outside air) into a hot water tank, are commercially available from

Sustainable transport

Urban transportation is a complex system tied to land use planning and urban design. The provision of transportation systems has a large influence on the form of the built environment and people's quality of life. Our world is changing at an accelerating pace. As populations increase around the world, people are looking for more housing options, job opportunities and access to services, causing urban areas to grow rapidly. More than 50% of Canadians live in a medium to large sized city, with 55% of Manitobans living in the city of Winnipeg

Sustainable cities

A sustainable city, or eco-city (also "ecocity") is a city designed with consideration of environmental impact, inhabited by people dedicated to minimization of required inputs of energy, water and food, and waste output of heat, air pollution - CO2, methane, and water pollution. Cities are responsible for 75% of the world's energy use and produce more than 80% of all greenhouse gas emissions, mostly CO2.

GREEN ENGINEERING

Green engineering approaches the design of products and processes by applying financially and technologically feasible processes and products in a manner that simultaneously decreases the amount of pollution that generated by a source, minimizes exposures to potential hazards (including reducing toxicity and improved uses of matter and energy throughout the life cycle of the product and processes). In so doing, the overall health and ecological stress and risk are reduced. As such, green engineering is not actually an engineering discipline in itself, but an overarching engineering framework for all design disciplines.

Green engineering adheres to nine guiding principles. A designer must strive to:

Engineer processes and products holistically, use systems analysis, and integrate environmental impact assessment tools.

2. Conserve and improve natural ecosystems while protecting human health and wellbeing.

3. Use life-cycle thinking in all engineering activities.

4. Ensure that all material and energy inputs and outputs are as inherently safe and benign as possible.

5. Minimize depletion of natural resources.

6. Strive to prevent waste.

7. Develop and apply engineering solutions, while being cognizant of local geography, aspirations, and cultures.

8. Create engineering solutions beyond current or dominant technologies; improve, innovate, and invent (technologies) to achieve sustainability

9. Actively engage communities and stakeholders in development of engineering solutions.

SUSTAINABLE URBANIZATION

Cities are at the forefront of global socio-economic change. Globalization and democratization are an important part of sustainable development. Half of the world's population now lives in urban areas and the other half increasingly depend upon cities for economic, social, cultural and political progress. In cities, education policies must typically serve highly diverse populations. Providing education for all – in particular girls, persons with disabilities, migrants, the poor and the marginalized – is a complex exercise requiring effective public services and the collaboration of numerous partners. Learning to live together sustainably in cities is one of the most important educational challenges of our time. This requires a focus on:

- Creating a quality learning and educational environment that promotes sustainability;
- Providing lifelong learning opportunities in cities;
- Teaching tolerance and mutual understanding in urban societies;
- Enabling children and youth to learn to live and participate in urban life;
- Enhancing learning to create inclusive societies in inclusive cities;
- Developing learning in all its diverse forms.

The school is a unique institution where connections are made between world problems and local life. It has the potential of serving as an enabler of change and of facilitating the acquisition of the knowledge and skills necessary to function as an active and responsible citizen. Local authorities have a strategic role to play in making these centres of learning, training and personal development available to all citizens. At the same time, the capacity to live together is generated through a wide range of non formal and informal modalities of learning. The challenge of sustainability requires learning how to change and nowhere is this more urgent or important than in urban settings.

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- Building sustainable cities require investments in :-
  - Renewable energy sources
  - Efficiency in use of water and electricity
  - Increase in green buildings and green areas
  - Sustainable public transport facilities
  - Improved waste management
- Sustainable cities can be developed by :-
  - Social development through:-

    -Education & health - Water & sanitation -Recreation areas

    -Food & nutrition -Green public transport

    -Green buildings -Renewable energy access
  - Economic development through:-

    -Green productive growth

    -Employment opportunities in green technology

    -Production & distribution of renewable energy
  - Environmental management through:-

    -Waste recycling -energy efficiency -water management

    -Air quality management -forest management -soil management

    -adaptation of climatic change
  - Urban governance through:-

    -Planning & decentralization -reduction of inequalities

    -Strengthening of civil and political rights

    -support of local, national and global links

Sustainable Transport

Sustainable Transport is sometimes known as Green Transport and it is any form of transport with low impact on the environment. It relies on renewable or regenerated energy rather than fossil fuels . For this reason it is said to have a low or a negative effect on the environment since it makes use of energy sources that are sustainable.

- Walking short distances instead of using vehicles also provides the same benefits.
- Cycling has also gained in popularity, both as a means of maintaining fitness and as a cheap and often swift form of transport.
- In many areas there have been moves to encourage people to use public transport networks rather than travelling by car. There have been moves to introduce cleaner and more fuel-efficient means of urban transport. There have been experiments using different types of fuel and there has been much effort and progress made in the development of so-called "green vehicles".
- Car pooling system (a group of people use same vehicle to reach a common destination) can be used.
- Hybrid electric vehicle (HEV) has been developed as an alternative to conventional cars. These are gaining in popularity. Generally they are of a hybrid design, combining an internal combustion engine with an electric engine.
  Eg: Maruti Suzuki Ciaz , Toyota Prius etc.
- Biofuel: Biofuels have also become very popular in some areas. In 2008 biofuels provided 1.8% of the world's transport fuel.
- Solar powered vehicles are another possible future option, but this will depend on a technical leap in the conversion rates of the photovoltaic (PV) cells that convert sunlight into electricity. Battery power would be required at nighttime or when there is no sun during daylight periods.

- Hydrogen can be used to power future transportation. Power can either be through the use of electric motors powered by fuel cell technology or by improved internal combustion engines. In both cases emissions would be zero. Hydrogen power is currently expensive, but progress is being made in the technology to achieve this. A big challenge is to source the hydrogen from renewable resources and to safely store them. Eg :- Toyota Mirai