

SUSTAINABLE ENGINEERING

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Module 5

Module V

SUSTAINABLE HABITAT

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 the future without external infusions of resources. Such a sustainable habitat may evolve naturally or be produced under the influence of man.

Man-made sustainable habitat refers to green buildings or environmental planning.

Main features of such habitat are:

- Minimize resource use
- Maximize energy and water efficiency
- Protect the environmental resources.
- Eliminate exposure to toxic chemicals.

Preference for human health and safety

METHODS OF INCREASING ENERGY EFFICIENCY OF 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 the energy efficiency of a building

Measure your energy consumption

Most businesses don't have the luxury of building a brand-new building or retrofitting from the ground up. However, whether you own or rent, you can boost your energy efficiency and the first step is to measure your consumption.

Benchmarking is a great way to start seeing where you can make the greatest improvements in energy efficiency. The Energy Star Portfolio Manager is a free web-based tool you can use to compare your buildings to other commercial buildings in North America.

Focus on insulation

The outside envelope of your building should be designed to lower heating and cooling needs. Your insulation should make your building as airtight as possible.

In new buildings, this can be achieved by using high-performance insulation and non-traditional wall systems that offer additional insulation. Replacing doors and windows to avoid air leaks in existing buildings can be a great investment.

Choose the right ventilation system

Because your building will be as airtight as you can possibly make it, you will want to use a ventilation system to maintain good air quality and prevent the buildup of moisture.

Heat recovery ventilators are systems that use the outgoing air from your building to heat incoming air. In the summer, air from your building can cool air coming from outside wall systems that offer additional insulation. Replacing doors and windows to avoid air leaks in existing buildings can be a great investment.

Buy certified equipment

Keep your eye on the market for high-performance, energy-efficient systems, and equipment.

Energy Star certified products, for example, will tend to be in the top 15 to 30% of their class for energy performance.

An Energy Star-certified computer, for example, will use 30% to 65% less energy than a typical non-certified model, depending on its use. These products evolve quickly, so it's important to stay informed about new developments.

Use LED lights

Upgrading to LED lighting can help you reduce your energy use by 75% compared to incandescent lighting.

You can also use sensors in infrequently used spaces such as conference rooms and restrooms to cut down on energy use.

Consider upgrading to LEED

Many buildings in Canada are now being built or retrofitted to the green standard known as LEED (Leadership in Energy and Environmental Design). It aims to improve the sustainability of buildings in such areas as site planning, water efficiency, energy use, materials selection, indoor air quality, and design features.

LEED buildings typically cost about 2% more to build than conventional buildings, but improved energy and water efficiency and a higher occupancy rate mean that this additional cost is typically recouped in just a few years.

Install Light Sensors

It's not enough to use energy-efficient bulbs; you need to have a lighting control mechanism in place. It's highly recommended that you encourage occupants to install sensors that turn lights on and off automatically. The reason for this is that light sensors are relatively cheap and highly reliable in controlling lighting and minimizing wastage. When you install and use switch plate, sensors in strategic locations, you can gain quick savings and improve the energy-efficient ratings on your building.

Consider Renewable Energy

You seriously need to think about how you power your building. The world is shifting from non-renewable to cleaner and sustainable renewable energy. Commercial non-renewable energy is not only costly but also less eco-friendly. Embracing renewable energy can help you lower energy costs and make your building more energy-efficient. Instead of using electric-powered hot water heaters, use solar heaters. Take advantage of state subsidies and incentives to transform your building into an energy-sufficient and efficient model.

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:

1. 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 the 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 centers 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 nonformal 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.

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.

Building sustainable cities require investments in:-

- Renewable energy sources
- Efficiency in the 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: •

(i) Social development

- through: -

(ii) Education & health

- Water & sanitationFood & nutrition
- Green public transport
- Green buildings
- Renewable energy
- accessRecreation areas

(iii)Economic development through:-

- Green productive growth
- Employment opportunities in green
- technologyProduction & distribution of renewable energy

(iv) Environmental management through:-

- Waste recycling -energy efficiency
- Air quality management -forest
- managementAdaptation of climatic change
- water
- managementSoil management

(v) Urban governance through:-

Planning & decentralization -reduction of

- inequalitiesStrengthening of civil and political
- rights
- support of local, national, and global
- linksreduction of inequalities

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 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 traveling 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".
- ▶ Carpooling system (a group of people who uses the 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 technology to achieve this. A big challenge is to source the hydrogen from renewable resources and to safely store them. Eg:- Toyota Mirai

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