

NGOs, interest groups and individuals become increasingly involved in addressing this global challenge and as Earth became witness to its hottest months ever recorded in 2016, a small village named Meenangadi in Wayanad District in Kerala quietly became the 1st carbon neutral village in India. Meenangadi Panchayat, which resides in a unique ecosystem in the Western Ghats towards northern Kerala, initiated an ambitious project to become carbon neutral by 2020. The project was initiated on June 5, 2016, as part of World Environment Day and in the past one year with a committed, innovative and strategic method, the panchayat and all its inhabitants have been able to achieve considerable progress towards one of the most enduring missions in the country.

Module II

- 10 a) What is the concept of carbon footprint? Write two methods to reduce the Carbon footprint. (3)
- b) What is carbon neutrality? (3)
- c) Write about the different lifestyle changes and measures to be adopted by this village in the future towards carbon neutrality. (4)

Stories/Cases/Data set - 3

(Stories/Cases/Data set)

Gypsum is one of the major industrial wastes of Fertilisers and Chemicals, Travancore (FACT). They produce Glass Fibre Reinforced Gypsum (GFRG) panels 124mm thick using this. These panels are 3m x 12m in size with longitudinal cavities inside which can be filled with concrete as required and suitable to use as walls or roof slabs of buildings. Researches done in IIT Madras argue that these panels can be used for buildings upto 10 stories with adequate strength and earthquake resistance. Hence, they propose it for mass housing requirements. These prefabricated elements make the building construction fast and cost-effective. This is an innovative technology from environmental, economic, and social point of views.

Module III

- 11 a) Do Life Cycle Impact Assessment for a building using traditional construction material. (3)
- b) Identify two benefits of GFRG approach. (3)
- c) Do Life Cycle Impact Assessment for a GFRG building. (4)

Stories/Cases/Data set - 4

(Stories/Cases/Data set)

Buildings account for a significant proportion of the total energy and carbon emissions worldwide, and play an important role in formulating sustainable development strategies. There is a growing interest in ZEBs (zero energy buildings) in recent years. Several countries have adopted or considering establishing ZEBs as their future building energy targets to help alleviate the problems concerning the depletion of energy resources and the deterioration of the environment. Broadly speaking, ZEBs involve two design strategies – minimizing the need for energy use in buildings (especially for heating and cooling) through EEMs (energy-efficient measures) and adopting RETs (renewable energy and other technologies) to meet the remaining energy needs. This paper reviews the works related to these two strategies. EEMs include building envelopes, internal conditions, and building services systems; RETs cover photovoltaic/building-integrated photovoltaic, wind turbines, solar thermal (solar water heaters), heat pumps, and district heating and cooling. Issues pertaining to sustainable development implications and further research work required are also highlighted. These include life-cycle

cost and environmental impacts, climate change and social policy issues.

Module IV

- 12 a) Explain briefly the concept of Zero Energy Buildings. (3)
b) Explain the measure that can be adopted to achieve ZEB through renewable energy and other technologies. (3)
c) Mention some ways to improve energy efficiency of buildings. (4)

Stories/Cases/Data set - 5

(Stories/Cases/Data set)

India has a huge potential to move into a fully renewable electricity system by 2050, owing to an abundance of renewable resources. If only we can optimally leverage sophisticated technologies to harness proactive collaboration with the industry, academia and energy innovation ecosystem, the region can move straight to affordable renewable systems. Such renewable energy systems can work mainly on clean energy, solar energy, wind energy and other new age storage solutions. Solar photovoltaics is the most economical electricity source and batteries satisfy the night-time electricity demand. In addition to covering India's electricity demand for power, such system simulation can also cover for seawater desalination and synthetic natural gas beyond other measures.

Module V

- 13 a) List out five reasons which hinder the development of renewable energy in India. (5)
b) Is it possible to generate electricity in India from oceans? Justify. (5)

Stories/Cases/Data set - 6

(Stories/Cases/Data set)

Industrial symbiosis thought emerged two decades ago, when researchers observed that waste and energy usage from industrial operations drastically could be decreased by using the waste of one firm as the input of another, and sharing infrastructure such as steam or water processes. Industrial symbiosis takes biological symbiosis as its guiding metaphor, mimicking the symbiotic relationships found in nature, such as the clownfish cleaning the sea anemone in return for protection from predators.

Module VI

- 14 a) Can the concept of industrial symbiosis be adopted in Kerala? Explain. (5)
b) List out the advantages and disadvantages of industrial symbiosis. (5)
