Energy Efficiency in Construction Sector

For Prelims: India Cooling Action Plan, Eco-Niwas Samhita, Bureau of Energy Efficiency (BEE), **Energy Conservation Building Code,** Energy Conservation (Amendment) Act 2022

For Mains: Energy Efficiency in Construction Sector, Conservation, Government Policies & Interventions

Source: TH

Why in News?

India's unprecedented **construction sector** boom has brought forth **economic opportunities and improved living standards**, but it also poses significant **environmental challenges.** Addressing energy inefficiency in residential buildings becomes crucial amidst this scenario.

Why is Addressing Energy Inefficiency in India's Construction Sector Important?

- Addressing energy inefficiency in residential buildings is crucial, given India's rising energy and cooling demand due to economic growth, **urbanisation,** heat islands**, and climate change.**
- The construction sector in India is witnessing an unprecedented boom, with over **300,000 housing units erected annually.** This growth brings economic opportunities and improved living standards but **poses significant environmental challenges.**
    - The building sector accounts for **over 33% of India's electricity usage**, contributing to **environmental degradation and climate change.**
- The **India Cooling Action Plan** forecasts an **eightfold increase in cooling demand between 2017 and 2037**, emphasising the need for thermal comfort while reducing active cooling demand.
- Improving energy efficiency offers a significant opportunity to reduce energy consumption and associated **greenhouse gas (GHG) emissions.**
    - Well-designed, energy-efficient buildings offer better indoor air quality, thermal comfort, and natural lighting, enhancing occupant well-being.

Note:

- Globally, the Buildings sector contributes to **approximately 37% of energy-related** CO_2 emissions.
    - More than 34% of global energy demand is attributed to constructing, heating, cooling, and lighting homes and businesses.
- The **Intergovernmental Panel on Climate Change (IPCC)** suggests that efficiency policies in buildings can cut **GHG emissions** by up to 90% in developed countries and up to 80% in developing countries.
    - Implementation of such policies can help lift up to 2.8 billion people in developing nations out of energy poverty.

What are India's Initiatives Regarding the Energy Efficiency in the Construction Sector?

- **Eco-Niwas Samhita (ENS):**
  - **ECO Niwas Samhita** is an **Energy Conservation Building Code for Residential Buildings (ECBC-R)** launched by the Ministry of Power in December 2018.
    - The code aims to promote energy efficiency in the design and construction of homes, apartments, and townships for the benefit of occupants and the environment.
  - The **Bureau of Energy Efficiency (BEE)** is the statutory body responsible for implementing policies and programs in energy efficiency and conservation.
  - The ENS introduced the **Residential Envelope Transmittance Value (RETV),** a metric measuring heat transfer through a building's envelope (walls, roof, and windows).
    - **Lower RETV values lead to cooler indoor environments** and decreased energy usage for cooling.
  - The ENS recommends maintaining an RETV of 15W/m^2 or less for optimal efficiency, improved occupant comfort, and lower utility expenses.
- **Energy Conservation Building Code (ECBC):**
  - The Energy Conservation Building Code (ECBC), initiated by the **Bureau of Energy Efficiency (BEE)** in 2007 and updated in 2017, sets minimum energy standards for commercial buildings.
    - It aims to achieve energy savings of 25 to 50% in compliant buildings and applies to commercial buildings with a significant connected load.
  - ECBC primarily focuses on six components of building design, including **envelope, lighting systems, Heating, Ventilation, and Air Conditioning. (HVAC) systems, and electrical power systems.**
  - The updated 2017 code prioritises renewable energy integration, ease of compliance, inclusion of passive building design strategies, and flexibility for designers.
    - It **offers tags of efficiency ranging from ECBC to Super ECBC** based on compliance levels.
- **Energy Conservation (Amendment) Act, 2022:**
  - **Energy Conservation (Amendment) Act, 2022** provides for the transitioning of ECBC into the Energy Conservation and Sustainability Building Code by incorporating measures relating to **embedded carbon,** net zero emissions**, materials and resource efficiency,** deployment of clean energy, and circularity.
  - Energy Conservation (Amendment) Act, 2022 also makes **ECO Niwas Samhita, the residential building energy code, mandatory.**
- **NEERMAN Awards:**
  - **National Energy Efficiency Roadmap for Movement towards Affordable & Natural Habitat(NEERMAN) Awards,** recognized and encouraged buildings that comply with the Energy Conservation Building Code 2017 (ECBC 2017).
    - The awards were a part of the 'Azadi Ka Amrit Mahotsav' initiative.
- **BEE Star Rating for Buildings:**
  - BEE Star Rating for Buildings is a unique tool, which is developed to **assess the status of Energy Efficiency in Commercial Buildings.**
    - This rating system is applicable to buildings with the connected load of 100 kW or greater.
    - Under this system of evaluation, 1-5 stars are awarded based on the building's energy usage.
  - The rating is based upon different criteria such as built-up area, conditioned and unconditioned areas, type of building, hours of operation of building in a day, climatic zone and other miscellaneous information related to facility.
- **Green Rating for Integrated Habitat Assessment (GRIHA):**
  - GRIHA is a national rating system for green buildings that is adopted while designing and evaluating new buildings. This tool has been adopted by the **Ministry of New and Renewable Energy.**
- **Indian Green Building Council (IGBC):**

- The IGBC, part of the **Confederation of Indian Industry (CII)** was formed in the year 2001. The vision of the council is, “To enable a **sustainable built environment for all** and facilitate India to be one of the global leaders in the sustainable built environment by 2025”.

How can the Construction Sector Become Energy Efficient?

- **Utilisation of Autoclaved Aerated Concrete (AAC) Blocks:**
  - An analysis across four warmer climate cities in India compared the popularity of materials like **Autoclaved Aerated Concrete (AAC) blocks**, red bricks, **fly ash**, and monolithic concrete (Mivan).
    - ACC is concrete that has been manufactured to contain closed air pockets**. AAC is one-fifth the weight of concrete.**
  - AAC blocks exhibit **superior thermal efficiency** across various climatic conditions.
    - They have the lowest RETV compared to other materials, indicating their potential for energy efficiency.
  - AAC blocks offer a better balance between embodied energy and construction time compared to red bricks and monolithic concrete.
- **Exploring Innovative Building Materials:**
  - India possesses untapped potential for innovative building materials.
  - **Interdisciplinary collaborations** with sustainability experts can optimise strategies for energy-efficient building design.
- **Addressing Sustainability Concerns:**
  - The construction industry's preference for **materials like monolithic concrete** raises concerns due to high embodied carbon and thermal discomfort.
    - Monolithic construction is a method by which walls and slabs are constructed together.
  - Sustainable construction requires innovation from manufacturers to develop cost-effective and resilient solutions.
- **Promoting Sustainable Practices:**
  - Re-imagining construction practices and fostering a culture of sustainability can significantly enhance energy efficiency and environmental sustainability.
  - Cost-effective, durable, and climate-resilient building materials can contribute to improved quality of life and align with environmental goals.
- **Adoption of Smart Building Systems:**
  - Smart building systems, **Artificial Intelligence**, **3D Printing** and the **Internet of Things (IoT)** should be integrated into construction projects to optimise energy consumption.
    - Deploy intelligent **HVAC systems that adjust based on occupancy** to minimise energy consumption while ensuring occupant comfort.
  - Embrace 3D printing for creating energy-efficient building components with minimal material waste.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims:

Q1. With reference to ‘fly ash’ produced by the power plants using coal as fuel, which of the following statements is/are correct? (2015)

1. Fly ash can be used in the production of bricks for building construction.
2. Fly ash can be used as a replacement for some of the Portland cement contents of concrete.
3. Fly ash is made up of silicon dioxide and calcium oxide only, and does not contain any toxic elements.

Select the correct answer using the code given below:

(a) 1 and 2
(b) 2 only
(c) 1 and 3

(d) 3 only

Ans: (a)

***Mains*:**

Q. “Investment in infrastructure is essential for more rapid and inclusive economic growth.” Discuss in the light of India’s experience. **(2021)**