



## 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<sub>2</sub> 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<sup>2</sup> 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)**

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