

BUILDING INTEGRATED PHOTOVOLTAICS: SCIENCE & TECHNOLOGY

NEWS: Building-Integrated Photovoltaics: converting buildings into solar assets

WHAT'S IN THE NEWS?

India has significant potential to scale up Building-Integrated Photovoltaics (BIPV), which integrate solar cells into building elements like façades and rooftops, aiding urban clean energy generation. However, challenges like high costs, policy gaps, and low awareness hinder its widespread adoption.

In News

- It has been recently observed that **India has strong potential** to scale up adoption of **Building-Integrated Photovoltaics (BIPV)** due to its robust manufacturing capabilities and growing commitment to sustainability.

What is BIPV?

- **Definition**
 - **Building-Integrated Photovoltaics (BIPV)** refers to the **integration of photovoltaic (solar) cells** directly into the **building envelope**.
 - These include:
 - **Glass panels**
 - **Rooftops**
 - **Railings**
 - **Façades**
 - **Cladding materials**
 - BIPV systems **replace conventional construction materials** and generate electricity, turning buildings into **power generators**.

Key Features

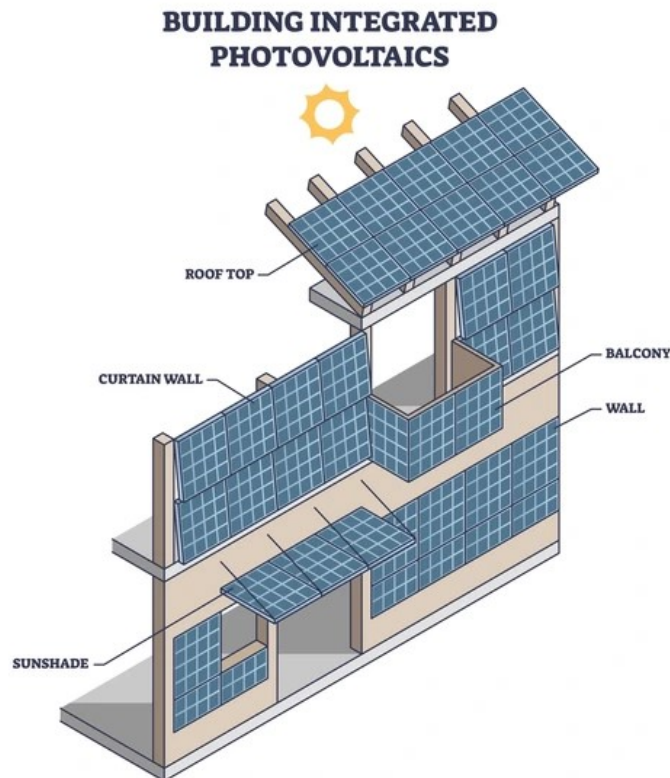
- **Aesthetic Flexibility**
 - BIPVs can be **customized** in color, shape, size, and transparency.
 - This allows **architectural harmony** with modern building designs.
- **Thermal Benefits**

- **Semi-transparent panels** reduce **solar heat gain**, enhancing **indoor energy efficiency**.
- Reduces demand for **air-conditioning** and improves occupant comfort.
- **Efficient Land Use**
 - Ideal for **residential, commercial, and public infrastructure**.
 - Enables **customizable, space-efficient, and visually discreet** integration.
 - Makes effective use of **vertical surfaces** and **non-rooftop elements**.
- **Photovoltaic Integration**
 - Solar cells are directly incorporated into:
 - **Glass panels**
 - **Roofing materials**
 - **Shading devices**
 - The building surface functions both as an **enclosure** and an **energy generator**.

Importance for India

- **Urban Relevance**
 - BIPVs address challenges of **limited rooftop space** in India's urban centres.
 - Suitable for densely populated areas and **high-rise buildings**.
- **Efficient Surface Use**
 - Surfaces like **façades** and **balconies** can be used for power generation.
 - A **south-facing façade** can generate **nearly 4 times** more power than a rooftop system.
- **Electricity Generation and Efficiency**
 - Sunlight is converted to electricity, feeding directly into the building's **power system**.
 - BIPV panels help reduce **heat ingress**, cutting air-conditioning demand.
- **Inclusivity**
 - BIPVs are suitable for homes **without rooftop access**.
 - Example: In Germany, **balcony solar panels** have helped reduce electricity bills.

- This makes BIPV an inclusive solution for **urban energy needs**.



Challenges

- **High Initial Costs**
 - BIPV installation costs remain **higher** than traditional PV systems.
- **Policy Gaps**
 - Lack of **dedicated incentives** for BIPV adoption.
 - **Low awareness** among architects, builders, and consumers.
- **Technical Capacity**
 - Insufficient **technical expertise** in BIPV design and implementation.
 - **Absence of clear standards** and guidelines for BIPV integration in building codes.
- **Reliance on Imports**
 - Heavy reliance on **imported BIPV components** limits domestic value addition.
 - Affects the overall **cost competitiveness** of BIPV solutions.

Suggestions and Way Forward

- **Huge Potential**
 - India has an estimated potential of **309 GW** from existing buildings alone.
 - With rapid **urban growth**, prioritizing BIPV is key to achieving India's **clean energy targets**.
- **Policy Support**
 - Increase **subsidies** — take cues from **Seoul's 80% cost support** model.
 - Expand **existing solar schemes** (such as rooftop solar) to include BIPV for **commercial** and **industrial sectors**.
- **Building Code Reforms**
 - Embed **BIPV requirements** in **national and state building codes**.
 - Promote BIPV as part of **green building** certifications and incentives.
- **Pilot Projects and PPPs**
 - Launch **pilot projects** in smart cities and government buildings.
 - Foster **public-private partnerships (PPPs)** for demonstration and scaling.
- **Boost Domestic Manufacturing**
 - Provide **incentives** for local manufacturing of BIPV components.
 - Support **research and development (R&D)** in **indigenous BIPV technologies**.
- **Financial Models**
 - Promote **Renewable Energy Service Companies (RESCOs)**.
 - Facilitate **long-term power purchase agreements (PPAs)** to improve financial viability.

Source: <https://www.thehindu.com/sci-tech/energy-and-environment/building-integrated-photovoltaics-converting-buildings-into-solar-assets/article69652891.ece>