

CPCB's Draft Guidelines for Safe Management of Solar PV Waste: Towards Sustainable Solar

What is Solar Waste?

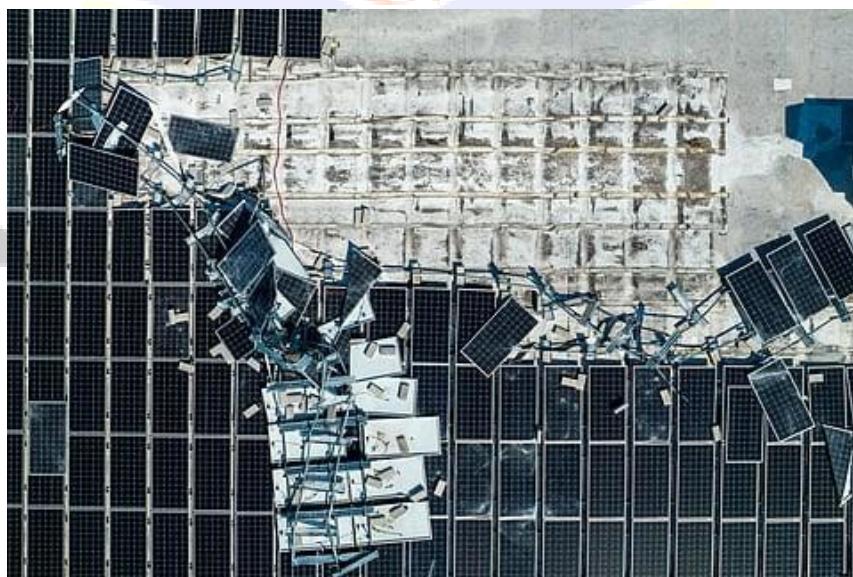
Solar waste, also known as **photovoltaic (PV) waste**, refers to the **discarded materials from solar energy systems**, particularly **solar panels**, once they reach the **end of their useful life** (typically 20–30 years) or are damaged or defective.

Types of Solar Waste

1. **End-of-Life Panels**: Panels that have completed their expected lifespan.
2. **Manufacturing Scrap**: Defective or surplus components from the production process.
3. **Damaged Panels**: Broken due to mishandling, weather events, or transport.
4. **Replaced Panels**: Panels swapped out for newer or more efficient versions.

Components of Solar Panels That Become Waste

- **Glass** (up to 75% of a panel's weight)
- **Silicon** (from the semiconductor cells)
- **Metals**: such as **aluminum, copper, silver, and lead**
- **Plastic backsheets and polymeric encapsulants**
- **Hazardous materials** in some panels (e.g., **cadmium, selenium**)



Introduction: Rising Solar Waste in India

India's renewable energy push, with **110 GW installed solar capacity**, has created a new environmental challenge—**solar PV waste management**. On June 4, 2025, the **Central Pollution Control Board (CPCB)** released **draft guidelines** for the **safe handling, storage, and transportation** of discarded **solar photovoltaic (PV) modules, panels, and cells** under the **E-Waste (Management) Rules, 2022**.

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Need for Regulation

- **Mega solar parks** exceeding 500 MW are increasing.
- Solar panels contain **toxic heavy metals** (e.g., cadmium, lead, arsenic).
- **Improper disposal** risks **air, water, and soil contamination**.
- There's an urgent need for **end-of-life (EoL) planning** to avoid health and environmental damage.

Legal and Regulatory Framework

- Solar PV waste is classified under '**CEEW 14**' in the **EEE Code**.
- Exempted from **Extended Producer Responsibility (EPR)** recycling targets, but:
 - Requires **mandatory registration, annual filings, and storage permissions** until **2034–35**.
 - Must follow **CPCB's Standard Operating Procedures (SOPs)**.

Key Guidelines Highlights

A. Collection and Take-Back Systems

- Producers must set up **collection mechanisms, helplines, web portals, and pickup services**.
- Maintain **consumer databases** to facilitate EoL collection.

B. Storage Protocols

- **Covered, ventilated, and dry spaces** to avoid damage.
- Max stacking: **20 layers or 2 meters**, whichever is lower.
- **Impervious floors** to prevent leaching.
- Safety features: **Fire systems, labelled containers, emergency exits**.
- Space requirement: **19.5 m³ per tonne**.

C. Transportation Standards

- Use **covered trucks**, preferably **hazardous-waste authorized**.
- Must comply with **Hazardous and Other Wastes Rules, 2016** during final disposal.

Environmental and Health Risks

- PV modules contain **hazardous substances**: cadmium, selenium, antimony, etc.

- **Unscientific dumping or burning** releases toxic fumes.
- Risks include **health hazards to workers** and **long-term ecological damage**.

Recycling and Circular Economy Opportunities

- Panels contain **glass, aluminum, silicon, silver, plastics**, etc.
- **Scientific recycling** recovers valuable materials.
- Reduces **resource extraction**, conserves **energy**, and supports **manufacturing**.

Way Ahead

- Ensure **public participation** in finalizing guidelines (comments invited).
- Build **infrastructure and capacity** for collection, storage, and recycling.
- Implement **producer responsibility frameworks**, even if exempt from targets.
- **Monitor compliance** with periodic audits and performance reviews.

Conclusion

The CPCB's draft guidelines mark a **proactive step** toward **sustainable solar energy** in India. By addressing the lifecycle of solar panels, India is laying the groundwork for a **circular economy** that aligns with its renewable goals. Proper implementation will be key to **preserving the green credentials** of solar power and ensuring **environmental and public health protection** as the country marches toward a **clean energy future**.

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