



केन्द्रीय प्रदूषण नियंत्रण बोर्ड
CENTRAL POLLUTION CONTROL BOARD
पर्यावरण, वन एवं जलवायु परिवर्तन मंत्रालय, भारत सरकार.
MINISTRY OF ENVIRONMENT, FOREST & CLIMATE CHANGE, GOVT. OF INDIA.

F.No. CP-22/1/2025-WM-III-HO-CPCB-HO

4th June, 2025

NOTICE

Subject: Inviting comments/Suggestions on the Guidelines for Storage and Handling of Waste Solar Photo-Voltaic Modules or Panels or Cells

As per the provisions under the E-Waste (Management) Rules, 2022, CPCB has prepared a draft guideline for storage and handling of waste solar photo-voltaic modules or panels or cells. The same is available on <https://cpcb.nic.in/comment-report1.php>.

It is requested that comments/suggestions if any, may please be communicated by 25th June, 2025 at wm3.cpcb@nic.in or youthika.cpcb@nic.in for finalization of the said guidelines.


(Youthika)

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Draft Guidelines for Storage and Handling of Waste Solar Photo-Voltaic Modules or Panels or Cells

under

E-Waste (Management) Rules, 2022

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1. Background:

The management of E-Waste in India is presently regulated under E-Waste (Management) Rules, 2022. The Ministry of Environment Forest & Climate Change, Government of India, has notified E-Waste (Management) Rules, 2022 for the effective management of the E-Waste in the country, and are effective from 01.04.2023. The overall objective of the E-Waste (Management) Rules, 2022 is to take all steps necessary to ensure that E-Waste is managed in a manner which shall protect health and environment against any adverse effects, which may result from such E-Waste.

The rules encompass the management of waste electrical and electronic equipment (EEE), including their components, consumables, parts and spares including solar photo-voltaic modules or panels or cells, whole or in part discarded as waste, as well as rejects from manufacturing, refurbishment and repair processes. Accordingly, the rule describes a total of 106 categories of electrical and electronic equipment including solar photovoltaic panels/cells/modules, (As described in Schedule-I of the rules) which has been categorized as CEEW 14 in terms of EEE Code.

The management of E-Waste is presently regulated through the principle of Extended Producer Responsibility (EPR), where all producers have given recycling targets as per Schedule-III and Schedule-IV of the rules, which can be met only through purchase of EPR certificates through registered recyclers of e-waste to ensure environmentally sound management of such waste. However, as per the provisions under the aforesaid rules, E-Waste recycling targets shall not be applicable for waste generated from solar photo-voltaic modules or panels or cells.

The management of solar photo-voltaic modules or panels or cells are covered under the Chapter V of the E-Waste (Management), Rules, 2022, where the manufacturers, producers and the recyclers of solar photo-voltaic modules or panels or cells have been assigned responsibilities to ensure the compliance with the said rules through registration, storing the waste solar photo-voltaic modules or panels or cells up to the year 2034-35, filing annual returns on the portal, and ensuring compliances with the guidelines and standard operating procedure (SOP) laid down by CPCB.

2. Objective and Scope of the Guidelines

These guidelines are intended to provide technical guidance to transport, handle and store the waste generated from Solar photo-voltaic panels or modules or cells including their components, consumables, parts and spares (hereinafter will be referred as Solar Waste) in an environmentally sound manner which shall protect the health and environment. The guidelines shall be applicable to the producers, manufacturers and recyclers of solar photo-voltaic panels or modules or cell.

3. Environmental Concerns of Improper disposal and benefits of Sustainable Solar Panel recycling

The exponential growth of solar energy installations is crucial for a sustainable future, however presents a significant challenge in management of end-of-life solar photovoltaic (PV) modules. Improper disposal of these panels may have following environmental risks, while sustainable recycling offers a multitude of benefits:

- Heavy metal contamination: Lead, Cadmium, Arsenic, etc. may contaminate soil/leach into water bodies.
- Air Pollution: Burning of such waste in unscientific manner can release toxic fumes into the environmental.
- Health concerns: Handling of such waste in an unscientific manner may cause adverse health impact.

However, scientific and proper recycling of such waste prevent from damage to environment and can generate substantial amount of recovered material which can be further used as raw material thus reducing the need to extract new raw material conserving the energy and earth's resources.

4. General Average Composition of the Solar Panels

Solar Waste refers end-of-life solar photo-voltaic modules or panels or cells, whole or in part discarded as waste, rejects and waste generated from manufacturing, refurbishment and repair process and solar panels damaged during their transportation, handling, storage and installation. Solar panels consist of recyclable and non-recyclable materials such as:

1. Glass
2. Aluminum frame
3. Silicon wafers
4. Metals (copper, silver, lead, cadmium, tellurium, gallium, arsenic and tin)
5. Plastics

5. Guidelines for Transportation, handling and Storage of Solar photo-voltaic modules, panels or cells waste:

The collection and transportation of solar waste is to be done in the following manner:

1. It shall be ensured that solar waste shall never be disposed of or dumped in open area, as it may release toxic chemicals into the environment, and it shall never be sold to unauthorized entities.

2. After assessing the requirement of storage, producers and manufacturers shall devise a collection mechanism from consumer/bulk consumer which may include take-back through different stakeholders.
3. Producers and manufacturers shall publicize their collection system which may include details of their collection points for the collection of waste solar waste, take-back schemes implemented through dealers, if any.
4. Producers and manufactures may provide consumer/ bulk consumer following details of their take-back system:
 - a. Link of their web site where information pertaining to take-back system is available.
 - b. Contact number of a designated person for handling queries regarding the take-back system and grievance support.
 - c. Details of their collection system including, collection points/pick up vans linked to collection centres for depositing solar waste.
 - d. Details of authorized recycling facilities who can take-back solar waste.
 - e. Producers may maintain a database of consumers/bulk consumers and their site details while selling solar panels or modules or cells so that consumers/ bulk consumers can be approached for collection of solar waste.
5. Transportation of solar waste should be done in covered trucks, preferably in trucks authorized for transportation of hazardous wastes.
6. While transporting solar waste destined for final disposal the sender should follow the provisions under Hazardous and Other Wastes (Management and Transboundary Movement) Rules, 2016.

The storage and handling of waste solar panels, cells or modules is to be done in the following manner:

1. Storage of solar waste may be done in a manner which does not lead to breakage of the waste collected and is safe to workers handling such products.
2. Avoid sharp objects contact or collision with solar waste so as not to damage the internal module.
3. Storage of waste solar photo-voltaic modules, panels or cells should be carried out in such a way that its end use such as re-use after refurbishing or recycling/recovery is unaffected and there should not be any damage to health, environment and to the product itself.
4. Covered shed/spaces have to be used for storage of solar waste. The solar waste should be placed in a dry environment and a well ventilated area.
5. Considering the leaching potential of metals such as antimony, cadmium, arsenic, lead, selenium, among others, the floor used for storage of waste solar photo-voltaic modules,

panels or cells should be non-leachable, impervious to prevent contamination to the ground water and soil.

6. The panels should be stocked in not more than 20 layers or to a maximum height of 2 meters above the ground, whichever is less.
7. The storage area should have fire protection system with adequate firefighting arrangement, escape route for emergency exit, ERP- Emergency response plan in place.
8. Storage racks or containers should be clearly labelled with the type of waste they contain to help in easy identification and sorting during recycling processes.
9. Inventorization should be done for the stored waste solar photo-voltaic modules, panels or cells from time to time to maintain the records.
10. The storage area should be periodically inspected and recorded to check for any damage.
11. Space needed for storage of Solar photo-voltaic modules, panels or cells (CEEW 14) category of e-waste should be at least 19.5 m³/tonne.

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