Solar Waste Management

Why in news?

As per the study by Ministry of New and Renewable Energy, the amount of solar waste produced by the country is expected to reach 600 kilo tonnes by 2030.

What is solar waste?

- It is the *electronic waste* generated by discarded solar panels which is sold as scrap in the country.
- Solar waste refers to the waste generated during the manufacturing of solar modules and waste from the field (project lifetime).
- **Manufacturing waste**- It includes scrap produced during production and waste from photovoltaic (PV) modules failing quality tests.
- **Field waste-** It consists of waste generated during transportation and handling, damage incurred by solar modules during their lifetime, and end-of-life waste when modules are no longer usable.
- According to the International Renewable Energy Agency, India is projected to become *the 4th largest producer of solar panel waste* by 2050, with cumulative volumes ranging from 4.5 to 7.5 million tonnes.
- Photo Voltaic (PV) waste poses environmental risks, particularly through the leaching of harmful metals such as lead, cadmium, and silver into soil and groundwater.

Photovoltaic cell is an electronic device that converts the energy of light directly into electricity by means of the photovoltaic effect.

What are the key highlight of the study?

- **Title-** Enabling a Circular Economy in India's Solar Industry – Assessing the Solar Waste Quantum.
- **Current solar capacity**- As of March 2013, India's solar capacity stands at 66.7 GW, it has increased by 23 times in the past 10 years.
- It is slated to jump to 292 GW of installed solar capacity by 2030 which highlights the importance of solar waste.
- **Focus**- The study focussed on the waste from the field category and excluded waste generated during manufacturing.
- **Increase in solar waste-** By 2030, India's current installed solar capacity is estimated to generate around 340 kilo tonnes (kt) of waste, 3 times more than the present.
- By 2050, this figure is expected to increase dramatically to about 19,000 kt.
- **State wise distribution of waste**- Approximately 67% of the projected waste by 2030 is expected to be produced by five states namely *Rajasthan, Gujarat, Karnataka, Tamil*

Nadu, and Andhra Pradesh.

- **Waste composition**- It is expected to contain critical minerals such as silicon, copper, tellurium, and cadmium, which are important for the country's economic development and national security.
- The 340 kt waste expected to be produced by 2030 would consist of 10 kt of silicon, 12-18 tonnes of silver, and 16 tonnes of cadmium and tellurium.

What are the recommendations suggested by the study to deal with solar waste management?

- **Comprehensive database**- Policymakers are urged to maintain a comprehensive database of installed solar capacity to estimate future waste generation accurately.
- **Incentivise recyclers**- The government should provide incentives for recyclers to encourage effective management of solar waste.
- **Market creation**- There is a need to create a market for solar recycling, focusing on both end-of-life modules and other sources of waste generated during the lifecycle.
- **Recycling methods**- The study describes two methods of study

Conventional recycling	High value recycling
• It involves mechanical processes such as crushing, sieving, and shearing of waste. • It can recover materials like glass, aluminium, and copper. • More valuable materials like silver and silicon cannot be recovered through this method.	• It combines mechanical, chemical, and thermal processes to recycle modules. • It can recover valuable materials like silver and silicon through chemical processes.

What are the challenges with solar waste management?

- **High cost**- Estimates indicate that there is a negative cost differential ranging from 5% to 15% between the value of materials recovered from recycled solar panels and the cost of transportation and recycling, hence it requires additional support in the form of incentives.
- **Reliance on producer plans**- Depending solely on plans from solar panel waste producers for waste management may pose uncertainties due to changes in ownership, financial stability, or adherence to the proposed recycling strategies.
- **Mixed materials**-PV panels contain mixed and difficult-to-separate materials, posing challenges for efficient recycling.
- **Infrastructure deficit**- The existing waste management facilities, such as Treatment Storage and Disposal Facilities (TSDFs), may not be equipped to handle the specific requirements of solar panel waste effectively.
- **Issues with conventional recycling**- They are effective in recovering materials like aluminium and glass, but they may not yield materials of high enough quality to be used in the production of new solar panels, particularly in applications requiring high-grade glass.

What lies ahead?

- Governments and industry stakeholders should invest in developing specialized recycling facilities capable of handling solar panel waste.
- Collaboration between government agencies, industry players, research institutions, and waste management experts can facilitate knowledge sharing and the development of best practices for solar panel waste management.
- Public-private partnerships may also be leveraged to improve infrastructure and resource allocation.
- Implementing *Extended Producer Responsibility* schemes can incentivize manufacturers and producers to take responsibility for the entire life cycle of their products, including end-of-life management.

Quick facts

Global regulatory landscape to address solar waste
• **Guarantee fees**- Countries like Germany and the Netherlands impose guarantee fees on manufacturers or developers involved in the production or installation of solar panels which can be used for *managing solar panel waste at the end of its life cycle*. • **Recycling plans**- States such as California and Washington in the United States require detailed recycling plans from solar panel waste producers, including manufacturers, developers, or installers. • **European Union**- It is the *first* to revise its *Waste Electrical and Electronic Equipment legislation* to include *Photo Voltaic modules*, recognizing them as a category of waste that needs special handling. • **India-** E-Waste (Management) Rules, 2022 regulate the handling of PV waste and require manufacturers and recyclers to adhere to specified guidelines and standards. • **China-** It has introduced *new industrial standards and rules* detailing the decommissioning, dismantling, and recycling of solar facilities.

References

1. Indian Express- A new study of India's solar waste
2. Down To Earth- Challenges with solar waste management
3. Economic Times- Mounting solar waste of India

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