



## An efficient waste management ecosystem

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**(Mains GS 3 : Conservation, Environmental Pollution and Degradation, Environmental Impact Assessment.)**

### **Context:**

This year's Budget emphasised the role of cleaner technologies such as solar energy & batteries and the importance of transitioning to a circular economy for India's future economic growth.

### **Circular economy:**

- A circular economy entails markets that give incentives to reusing products, rather than scrapping them and then extracting new resources.
- In such an economy, all forms of waste, such as clothes, scrap metal and obsolete electronics, are returned to the economy or used more efficiently.
- This can provide a way to not only protect the environment, but use natural resources more wisely, develop new sectors, create jobs and develop new capabilities.

### **Waste management ecosystem:**

- The emphasis for creation of a circular economy is significant since an efficient waste management ecosystem would be necessary to manage the enormous waste generated by renewable energy projects in the coming decades.
- According to the International Renewable Energy Agency (IRENA) the cumulative waste generated by India's total installed solar capacity could be as high as 325 kilotonnes by 2030.

- A consulting firm, JMK Research and Analytics, estimates that the market for battery recycling will be around 23 Gigawatt hours (GWh) by 2030.
- Further, the prevalence of a circular economy could also partially insulate these industries from potential supply chain shocks triggered by extraneous developments.

### **Helping net-zero target:**

- A study by the Council on Energy, Environment and Water (CEEW) has estimated that India would need over 5,630 GW of solar and 1,792 GW of wind energy to achieve its net-zero target in the year 2070.
- A robust renewables waste management and recycling ecosystem could help people and India reduce environmental harm, provide energy security, and also create new jobs.
- Thus India needs to take some comprehensive steps to nurture a circular economy in the Indian renewable energy industry.

### **Revised regulations:**

- Policymakers should revise existing electronic waste management rules to bring various clean energy components under their ambit.
- These rules are based on extended producer responsibility that identifies component producers as responsible entities to manage their waste products.
- The Indian renewable energy industry has a complex structure that comprises various manufacturers, assemblers, importers and distributors.
- Hence, the revised regulations should clearly define the responsibilities of various stakeholders involved in the renewable energy value chain and provide annual targets for the collection and the recycling of waste.

### **Dumping and burning:**

- Currently, in the absence of any regulation, landfilling is the cheapest and most common practice to manage renewable energy waste, however, it is not environmentally sustainable.
- All clean energy technologies thrive on metals and non-metals with different levels of toxicity thus If the waste equipment is dumped in the open, then these elements could leach into the environment and enter the food chain.
- Studies show that the leaching of heavy metals such as lead and cadmium from solar photovoltaic modules could increase by 90% and 40%, respectively, under acidic conditions.
- Further, burning the polymeric encapsulant layer in solar photovoltaic modules releases toxic gases such as sulphur dioxide and some volatile organic compounds.

### **Invest in R&D:**

- The renewable energy industry should invest in the research and development of recycling technologies as recycling is a multistep process that includes dismantling, disassembly, and extraction.
- Dismantling is largely a manual process that is sometimes automated. Disassembly can be done mechanically, thermally or chemically.
- Besides these traditional methods, investments in research and development could help discover new ways of recycling that result in higher efficiency and a less environmentally damaging footprint.
- Industries should also explore technology transfers with global recycling firms for establishing domestic waste recycling facilities.

### **Access to finance:**

- There has to be a creation of innovative financing routes for waste management as access to finance is a major roadblock for players in the recycling ecosystem.
- The central government should nudge public and private sector banks to charge lower interest rates on loans disbursed for setting up renewable energy waste recycling facilities.
- Assurance of a minimum waste quantum to run these facilities and issuing performance-based green certificates to recyclers that could be traded to raise money for waste management would also help ease the financial burden.
- A market for recycled materials could also be created through mandatory procurement by the renewable energy and other relevant manufacturing industries.

### **Product design and quality.:**

- In India there is a strong need for an improvement in product design and quality.
- Renewable energy component manufacturers should find substitutes for toxic metals such as cadmium and lead used in their products and simplify product designs to reduce recycling steps.
- Such improvements in process efficiencies could go a long way in curbing waste creation at the source and its subsequent impact on the environment.

### **Stringent quality control:**

- The Union and State governments should set stringent quality control standards for components used in their tenders as this will prevent premature end-of-life of components, and consequent waste creation.
- Substandard components generate considerable waste due to early life damage that is often irreplaceable, and the components often have to be discarded.

- Such quality enforcement could also position India's renewable energy industry as a global supplier of quality products.

**Multiple actors involved:**

- The renewable energy recycling ecosystem has a complex structure where there are multiple actors involved, but it would be an integral part of our journey toward a sustainable future.
- Beyond sustainability, it would also offer quality employment opportunities for the future generations as new jobs would be created across the entire value chain of waste management and recycling.
- Further, workers in the informal sector could access various socio-economic benefits and look forward to an improved quality of life.

**Conclusion:**

The majority of India's recycling sector is informal and workers have to work in unsafe environments without standardised wages; therefore, developing an efficient renewable energy waste management and circular ecosystem is imperative rather than a choice.