ABSTRACT

The increasing waste produced by the photovoltaic industry is of major concern as the field of renewable energy grows. With solar energy resources having a prominent role, over 500 GW of installed solar capacity exists worldwide and is anticipated to increase to 5000 GW by 2050. Given the predicted life lifetime of 25 years, this extraordinary development is estimated to produce enormous solar waste. While current solar research trends focus on increasing efficiency, the disposal of broken-down solar power panels is given significance. Recycling is an alternative, but only a small number of businesses can manage it effectively.

The technologies used in the field to look after this issue with the maintenance of environmental preservation, resource availability, and resource recycling are covered in this research. If solar waste is not adequately recycled, it will be there in 60 million tons by 2050. The view offers a thorough analysis of the different technical elements of waste management, environmental protection, and recycling and recovery of solar panel waste. The economics of recycling solar energy includes its effects upon health, environment. Further the policies are examined to insist that toxic-free technologies may be developed in the future.

Many sectors and corporations have begun to examine the environmental effect of their products. LCA, or life cycle assessment, is one such method used for this. It takes into account all aspects of the environment, human health, and resources. It is a process for examining and measuring the environmental implications of a material, product, or service over the course of its full life cycle. Endorsed by the bureaucratic undertaking and declining expenses, solar firms are thriving promptly in India and around the world. At the initial stages of their wheel of life, PV panels account for no ambiance spoliation.

Displacement of conventional energy sources to solar power photovoltaic installations has burst forth solar photovoltaic waste volume. Hence a crucial need is to enhance the photovoltaic recycling method to a vast industry level. Economically established countries like China, the UK, and Japan by now have started formulation of their solar photovoltaic recycling policies while India still needs to shape its solar photovoltaic recycling policy. In spite of the increasing PV installations, recycling of solar

photovoltaic waste presents a supreme and uncommon platform for recovering valuable materials from PV waste and harboring the recycling industry on large scale across the world. This work also addresses the apparent increase in environmental, social, and economic influence of the life span accomplishment of photovoltaic modules. To potentially tackle the above-mentioned complications a novel policy framework is proposed for the Indian government to administer.

The researcher has focused on the end-life management of 160 kW on grid rooftop solar PV plant installed in Bhartiya Skill Development University Jaipur Rajasthan. The objective is to lay down the complete cost analysis from the setup of the plant to its dismantling at the end of life. Energy generated in the payback period also plays a key factor in deciding the overall benefit from the installed plant. Such analysis will help in promoting the installation of rooftop solar panels at the domestic and commercial levels across the state. End-life responsibilities should be taken care of by the manufacturers to facilitate the steps for easy and economic recycling and also to eradicate toxic components. This will be promoting the onset of an independent & sustainable society in the crisis era of fossil fuels.

The research presents the current reality of solar waste handling in India. The DPSIR approach is used to properly control the end-of-life of solar panels. A comparison of present solar waste management regulations in India and other nations across the world has been developed. Solar waste management solutions from across the world have been analyzed, and a solar waste management strategy for India has been developed. Furthermore, the suggested policy's operational performance has been assessed in terms of vigour, vulnerability, convenience, and risk associated for future prospects. The suggested policy will have the greatest vigour and effect if it is implemented in every zone of waste creation by all collaborators.

Keywords: Solar panel, photovoltaic waste, recycling policy, end life, human health impact, end life management, life cycle assessment, socioeconomic impact, environmental impact, cost analysis.