

Chapter 9

FUTURE SCOPE

Growing PV panel waste poses a new environmental concern, but it also gives unparalleled opportunity to produce value and seek new commercial routes. These include raw material recovery as well as the development of new solar PV end-of-life businesses. PV recycling, for instance, is essential in the world's transition to a more sustainable, economically viable, and more renewable energy future. To reap the benefits of such enterprises, the institutional foundation must be created in advance of the predicted spike in panel waste. End-of-life management for PV panels will create new sectors, provide significant economic value, and is compatible with a worldwide movement toward long-term sustainable development.

Although we recognize that solar PV is a clean source of energy and an ecologically favorable technology, it, like other technologies, matures and degrades with time. The silicon-based solar PV modules are intended to last 20-25 years, after which they must be decommissioned and the system components properly recycled and disposed of. As the number of solar PV installations grows throughout the world, particular attention and engagement from industry, policymakers, and stakeholders are required at each stage of the product life-cycle. In general, it is advised to employ a sustainable waste management strategy that provides chances to reduce, reuse, and recycle. With the enormous anticipated amount of PV waste, PV module recycling has become a major research focus for creating novel materials recovery methods as well as formulating relevant legislation, guidelines, and policies.

This thesis examines laws, regulatory frameworks, and life cycle management approaches for implementing PV waste recycling in chosen nations (i.e., Germany, UK, Italy, Switzerland, Norway, Czech Republic, Japan, USA, China, South Korea, and India). In addition, some of the recycling initiatives taken by PV producers (such as First Solar, Solar World Global, and PV Cycle) have been researched. This research will aid in the provision of learning and best practices from chosen nations to improve knowledge and capacity development concerning technological and regulatory systems dealing with PV module trash and recycling.

It has been found that the establishment of legislative frameworks or guidelines and novel business models, as well as the capacity building of local institutions and the PV recycling sector, are vital for the PV end-of-life management system.

The scarcity of essential minerals jeopardizes the viability of these clean energy solutions. End-of-life management and recycling of these goods are critical in this context. It will assure sustainability by adhering to the circular economy principle, encouraging new industries, and generating job opportunities. Metals may be reused inside the sector to make more items locally in the future, lowering the cost of these technologies. Furthermore, because mining these metals generates as much trash as landfilling, material recycling will reduce the environmental effect throughout the production stage as well.