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Sustainability of Photovoltaic Recycling Planning

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Abstract : The usage of valuable resources and the potential for waste generation at the end of the life cycle of photovoltaic (PV) technologies necessitate a proactive planning for a PV recycling infrastructure. To ensure the sustainability of PV in large scales of deployment, it is vital to develop and institute low-cost recycling technologies and infrastructure for the emerging PV industry in parallel with the rapid commercialization of these new technologies. There are various issues involved in the economics of PV recycling and this research examine those at macro and micro levels, developing a holistic interpretation of the economic viability of the PV recycling systems. This study developed mathematical models to analyze the profitability of recycling technologies and to guide tactical decisions for allocating optimal location of PV take-back centers (PVTBC), necessary for the collection of end of life products. The economic decision is usually based on the level of the marginal capital cost of each PVTBC, cost of reverse logistics, distance traveled, and the amount of PV waste collected from various locations. Results illustrated that the reverse logistics costs comprise a major portion of the cost of PVTBC; PV recycling centers can be constructed in the optimally selected locations to minimize the total reverse logistics cost for transporting the PV wastes from various collection facilities to the recycling center. In the micro- process level, automated recycling processes should be developed to handle the large amount of growing PV wastes economically. The market price of the reclaimed materials are important factors for deciding the profitability of the recycling process and this illustrates the importance of the recovering the glass and expensive metals from PV modules.

Keywords : photovoltaic, recycling, mathematical models, sustainability
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