
Cost assessment of the photovoltaic recycling chain based on optimization of reverse logistics

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Résumé

The growth of the photovoltaic (PV) market in recent years will inevitably generate a large volume of end-of-life (EOL) panels in the medium term. Take-back and recycling of EOL panels will become a major issue that PV players have to deal with.

The final objective of this work is to design innovative assets to evaluate sustainability performance of the PV recycling chain. The cost indicator has been firstly investigated because it is usually considered a barrier to stakeholders.

The first specific difficulty is linked to the dispersed distribution of PV installations with different types and so the mass of panels. Another issue is the high uncertainty in the exact moment the panels become wastes and its quantities.

In this paper, we consider the reverse logistics issue and develop a multi-level chain model for the PV recycling chain. This model has been addressed to as the Multi-Level Facility Location Problem: the panels must be shipped from initial points to collection centers and then to recycling facilities. A Mixed Integer Linear Programming model has been developed and then solved with the solver SCIP. Secondly, we have implemented a genetic algorithm proposed by M. Maric [1] to our model and tested different termination criteria and various cost configurations.

We have analyzed the simulations that yielded to high values of the mean relative error, and noticed that the scatterplot Solving Time VS Best Cost in these cases shows a different qualitative trend than in cases where the simulation yielded to low mean relative errors. This qualitative phenomenon can be further analyzed.

In conclusion, we have obtained a first model for a simplified recycling chain. In the next step, we will take into account the time evolution of the PV wastes distribution and of the availability of the collection points and of recycling facilities in order to obtain the more realistic results.

MARIC, M.: An efficient genetic algorithm for solving the multi-level uncapacitated facility location problem. *Computing and Informatics*, Vol. 29, 2010, 183–201

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