THE UNIVERSITY OF MELBOURNE

Faculty of Engineering and Information Technology

2022 Faculty of Engineering and Information Technology Case Competition

Upcycling of Solar Panel Waste

In partnership with

ELECSOME

INTRODUCTION

The deployment of Photovoltaic (PV) technology has shown a dramatic increase in recent years. The number of newly installed PV panels worldwide was estimated to be 4 M tonnes by the end of 2016 and is forecasted to increase to 6.5 M tonnes annually by the end of 2050.

Along with the increasing uptake of PV technology, there are serious issues associated with their end-of-life (EoL) treatment. The number of PV panel waste worldwide is forecasted to increase from 220 k tonnes in 2020 to 6 M tonnes annually by the end of 2050, resulting in accumulative panel waste of 79 M tonnes. Further, there is a plethora of PVs in the market that are not meeting market life cycle expectations, accelerating waste generation from what should have been a sustainability initiative. This problem needs urgent attention.

There are different types of PV panels based on the technology categories. However, the first PV technology, crystalline silicon (C-Si) PV, currently dominates the market and is expected to remain dominant for some time. C-Si PV panels have the following structure (see Figure 1): i) aluminium frame, ii) tempered glass, iii) encapsulation films encapsulating the PV cells commonly made up of ethylene vinyl acetate, iv) PV cells, v) back sheets, commonly made up of composite polyvinyl fluoride. Glass makes up approximately 80% of C-Si PV panels. However, PV panels also contain polymer, aluminium and potentially hazardous materials such as lead, copper and zinc.

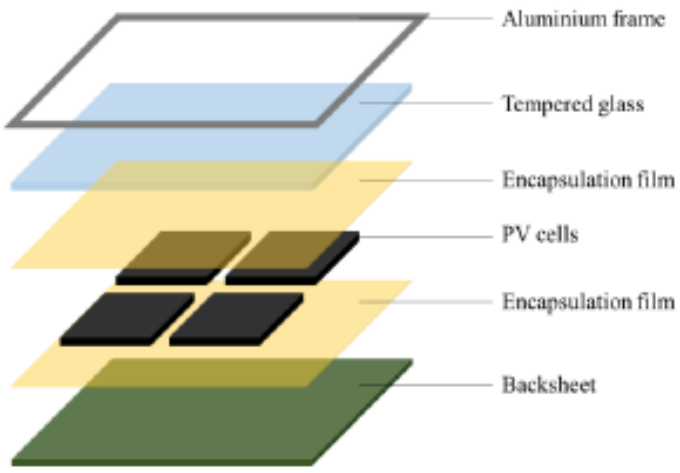

Figure 1 Structure of C-SI

The current approach to the PV panels that have reached their end of life is to dispose of them as general waste. Disposal in regular landfills poses significant issues as PV wastes can easily break, leaking the hazardous materials into the soil. To tackle the EoL issues of PV panels, the European Union issued Guideline 2012/19/EU requiring producers to consider their collection, recovery and recycling. Following suit, Australia's environment ministers in April 2019 have agreed to fast-track the introduction of a new product stewardship scheme for PV panels, which makes producers and retailers take responsibility for an item across its lifecycle. However, recycling PV waste currently costs more than the economic value of the materials recovered, adding cost to the supply chain.

COMPETITION BRIEF

Your task in this case competition is to propose an innovative upcycling solution to solar panel waste. Your solutions may consider a combination of different aspects of the process, e.g., the dismantling and removal process, the logistic of the transportation, the processing of the solar panel waste, and the end use of the processed materials (extra points if more than one aspects have been addressed). However, you MUST address the end use of the processed materials and consider the cost of turning the processed materials into use. That being said, it does not make sense if the processing cost of the materials is significantly greater than the value of the materials themselves. In this sense, you may also consider some Information Technology to reduce the processing cost. For example, proposing algorithms to design effcient disposed PV panel collection routes or to decide whether it is worth collecting a PV panel which is near the end of use right away to save the collecting cost, and etc.

In the first stage of the competition, you are required to submit a visually appealing proposal document of no more than 2 A4 pages (or one A3).

ASSESSMENT CRITERIA

Your submission must demonstrate:

1. The innovation of the upcycling solutions
2. The circularity of the end products -how the end-of-life of the products has been considered.
3. The cost-effectiveness of the upcycling solutions
4. Commercial potentials of the end products
5. Other benefits of the upcycling process

REFERENCES

REFERENCES THAT MIGHT BE USEFUL FOR THE PROJECT

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