

Profitable Improvements in Photovoltaic Module Recycling

As part of R&D in the CU-PV project, "Profitable Improvements in Photovoltaic Module Recycling" provided a platform to companies across Europe to discuss and share expert opinion, knowledge and industry insight.

Participants: 20 pax, 17 different companies and institutions

Main topic: Cost and yields in PV module recycling

Break-out groups:

- profitable treatment solutions
- profitable materials
- profitable yielding solutions
- profitable process design

Main findings

Policies and incentives

- volume of modules for recycling is low, therefore incentives are necessary to motivate industry.
- a possible incentive that was considered positively is labelling of environmental footprint of modules
- another possible incentive that looks interesting is to impose mass fractions for recycling per material, instead of one overall fraction. However, this should be done in a staggered approach to allow sufficient time to reach a technology readiness
- difficulty of treating Building Integrated PV (BIPV) will increase as long as there are no appropriate guidelines how to treat the other materials of the building compared to the PV Modules part of the BIPV-system.
- in general, it is important to avoid an overwhelming amount of regulations; preferred option having a staggered introduction of new incentives; and having attention for the practicality of monitoring.

Opportunities for improvement of business case

- Glass: the PV module glass recycling is at the moment not producing a high purity cullet, which result in an economic break-even case of recycling. There is potentially much more value in the recovered glass than currently realized, if purity of the cullet would be high and if it would be available in large quantities.
- Taken into account the value of other materials available in a module but currently not recovered, the recovery of more materials from the module than glass and aluminium alone could lead to a more positive business case.
- A replacement market might improve the volumes for recycling, and therefore the business case, but it is questionable whether the PV market is ready for the existence of a replacement market (i.e., whether PV modules would be replaced before their end-of-life if more efficient or otherwise better modules became available).

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Cradle-to-cradle sustainable PV modules

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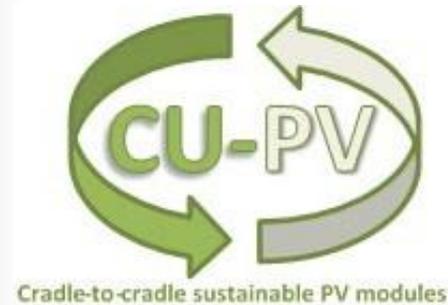
Main findings (ctd)

- Logistics: The shipping costs of rejected or end-of-life modules are a problem. For historical reasons, the recycling and treatment companies are often not at locations which allow low-cost bulk transport, such as harbours. Optimization of logistics is needed.
- As recycling volumes increase, it may become a problem to find markets for the separated fractions, since presently impurities are dealt with by dilution. Therefore technologies for recovery of materials in higher purity are required.

Opportunities for design for recycling

- In state of the art recycling, glass and aluminium are recovered but silver, silicon and polymer backsheet are not.
- The Cu-PV project presented some results of potential improvements in design, such as use of thermoplastic encapsulant, and framing without adhesive tape or kit. About the use of thermoplastic encapsulant it was noted that the module lifetime should not be affected.
- An alternative or complementary approach to design for recycling is to use minimal amounts of scarce or harmful materials, and simplify components (such as e.g. junction box). The rationale is that if a material is not present or there is no need to recover it, the needs for separation and reprocessing, the costs of recycling, and the environmental impact of the module, will all be reduced.
- It was agreed that design for recycling in c-Si PV modules is presently largely absent. Historically, in other industry sectors design for recycling sometimes originated from economic motivation from within the industry sector, but in other cases originated from policies. For PV it is still open how a design for recycling approach should be stimulated.

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