# LIFE CYCLE ASSESSMENT OF PV MODULE BACKSHEETS

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## Abstract

Increased deployment of solar PV enables the transition to decarbonized energy systems, capable of tempering the dire consequences of global warming. Even though backsheets are very important regarding lifetime energy yield of the PV module, the environmental impacts of their production, use and end-of-life (EoL) processing are largely neglected. As part of a recently finalized Dutch national project EXTENSIBLE (Energy yield assessment of neXT gENeration and SustaInaBLE backsheets) the environmental impacts for 7 different polymeric backsheets have been evaluated via a life cycle assessment (LCA). The selected backsheets include 3 traditional polyethylene terephthalate (PET) - based backsheets with a fluorine containing outer layer (two white pigmented and one fully transparent). The other 4 backsheets are novel high-performance polyolefin (PO) -based backsheets, manufactured by Endurans Solar , also including one transparent version. From results of the LCA it is concluded that in comparison with PET-based backsheets and fluoropolymer containing backsheets, PO-based backsheets perform best in terms of energy yield, reliability and environmental impacts. The production of fluoropolymer- and PET-based backsheets cause substantial environmental impacts, especially regarding climate change and ozone depletion. This conclusion is corroborated by recent literature data. Regarding the EoL phase, it was shown from a theoretical assessment that pyrolysis of the spent backsheets potentially leads to much lower GWP when compared to incineration, especially for the PO-based backsheets. Incineration of the shredded and solid backsheet material causes direct emissions of $CO_2$ with a limited heat recovery potential only. Deploying pyrolysis for spent PO-based backsheets significantly improves their life-time GWP per kWh produced. Pyrolysis offers the possibility to recover a large part of the polyolefin as an usable pyrolysis oil that might serve as feedstock for chemicals or as transportable liquid fuel for the generation of process heat in recovery boilers, thereby avoiding the use of new fossil resources. EoL pyrolysis (or incineration) of fluoropolymer-based backsheets is problematic due to the presence of fluorinated hydrocarbons, leading to corrosive and/or toxic products.

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