Energy yield assessment of neXT gENeration and SustaInaBLE backsheets

Publieke samenvatting / Public summary

Aanleiding

In 2018 over 100 GWp of new photovoltaic (PV) installations were deployed with more than 80% using backsheets. Mono-facial glass-backsheet modules are the key workhorse of PV installations both in utility and residential scale. The shifting focus on PV module optimization for highest energy yield i.e. kWh-based performance, from the purely Wp performance requires both novel materials and adapted assessment methods. Co-extruded backsheets under development at DSM with simultaneously improved optical, thermal and reliability properties match this demand and marry it with sustainability using a halogen- and solvent-free formulation. For accurate assessment of the energy yield potential of different backsheets fast and precise comparison methods are indispensable in this swiftly changing industry. Outdoor measurements, although essential for validation, require 5-20 years. To assess the lifelong energy yield potential of PV modules, only crude estimates are available without resolving material or climate related difference. Current material formulations are often tailored to meet standardized reliability test and their environmental impact and recycling potential are rarely considered.

Doelstelling

Backsheet quality defines the PV module durability and safety, while its fabrication method and additives can make the difference in their sustainability. The main goal of EXTENSIBLE is the lifelong and precise energy yield and lifecycle

Projectinformatie / Project information

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assessment (LCA) of novel backsheets at various climates. The project partners will gather data to precisely calculate two key metrics: kWh/kWp and environmental impacts per kWh produced in the lifetime of the PV system. On the short-term these indicators will enable the selection of the relevant backsheet types for specific climates. Moreover, we aim to prove that halogen-free backsheets can meet and even outperform conventional ones. On the longer-term, the insights will provide guidelines to more sustainable material formulation. Developing a degradation rate modelling is an enormous undertaking, beyond the grasp of this project, however, we propose a semi-empirical method to resolve the evolution of the backsheet, laminates related to degradation. EXTENSIBLE contributes to 1.a: “PV-technologieën” innovation theme of TKI Urban Energy program and its goal of increasing the energy yield under practical conditions and maintaining it.

Korte omschrijving

DSM will prepare mini modules and test structures with 5 different backsheets combined with low and high quality EVA to reach statistically relevant differences. Initial material and laminate properties and their evolution upon exposure to environmental stress will be measured by IMEC using beyond the state-of-the-art indoor characterization methods. The samples will be exposed to warm&dry, warm&humid and moderate outdoor climates by DSM for ~1 year during the project and experiments will continue beyond. In parallel identical samples will be submitted to accelerate ageing tests at IMEC and DSM with intermediate non-destructive measurements. With the extracted input IMEC will calculate the energy yield for the various sample types and climates. Upon integrating the degradation rate prediction model the lifelong energy yield will be also estimated by IMEC. SmartGreenScans will evaluate life cycle environmental impacts and resource depletion for the investigated materials and conducts sensitivity analysis. Combined insights from the various assessments will be summarized in future material development guidelines jointly by the partners to

leverage their multi-disciplinary expertise.

Resultaat

The main results of EXTENSIBLE will be on the one hand calculation of the kWh/kWp and environmental footprint for the different backsheets and combined performance-reliability-sustainability guidelines for future material development for DSM. On the other hand development of energy yield simulation method including degradation rates and comprehensive environmental assessment of backsheets will be the scientific input for the broader PV community. Specific main results will be: - Physics-based energy yield simulation framework extended with possibility to consider temporal evolution of material properties - Report of high precision lifelong energy yield simulation (kWh/kWp) for 10 different material combinations at various climates - LCA of the different module designs in different climates. ILCD and Cumulative Energy Demand impact assessment methods will be calculated guided by the Product Environmental Category Rules for Photovoltaics (PEFCR-PV). - Summary report for future material development based on combined performance-reliability-sustainability insights.

De data in deze applicatie is afkomstig van de Rijksdienst voor Ondernemend Nederland (RVO) en wordt in samenwerking met de Topsector Energie ontsloten.
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