

Shining Bright: Reliable AND Sustainable backsheets for high-performance modules

TaiyangNews Reliable PV
Module Design Conference

Imco Goudswaard
Commercial Manager & Sustainability Lead
26 October 2023



Endurans™ Solar

Experts in PV polymer science & manufacturing



2011-2021

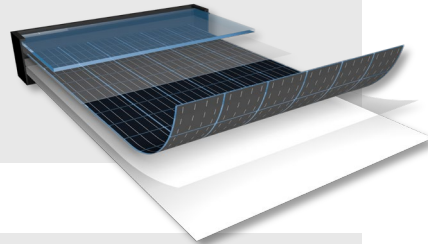


since 2021

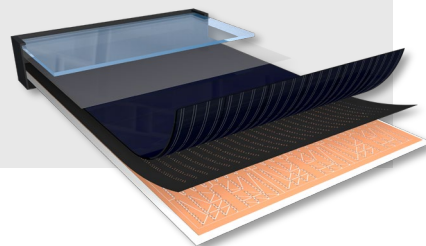


since 2023

High performance backsheets
Endurans™ HP



Conductive backsheets
Endurans™ CB



We believe that the solar industry has a huge role to play in creating a better, more sustainable future for our planet.

And we are making this a reality by boosting the performance of PV modules and developing solutions that are **circular by design**.

Backsheet challenges

A critical module component.

- Reliability
- Sustainability
- Supply

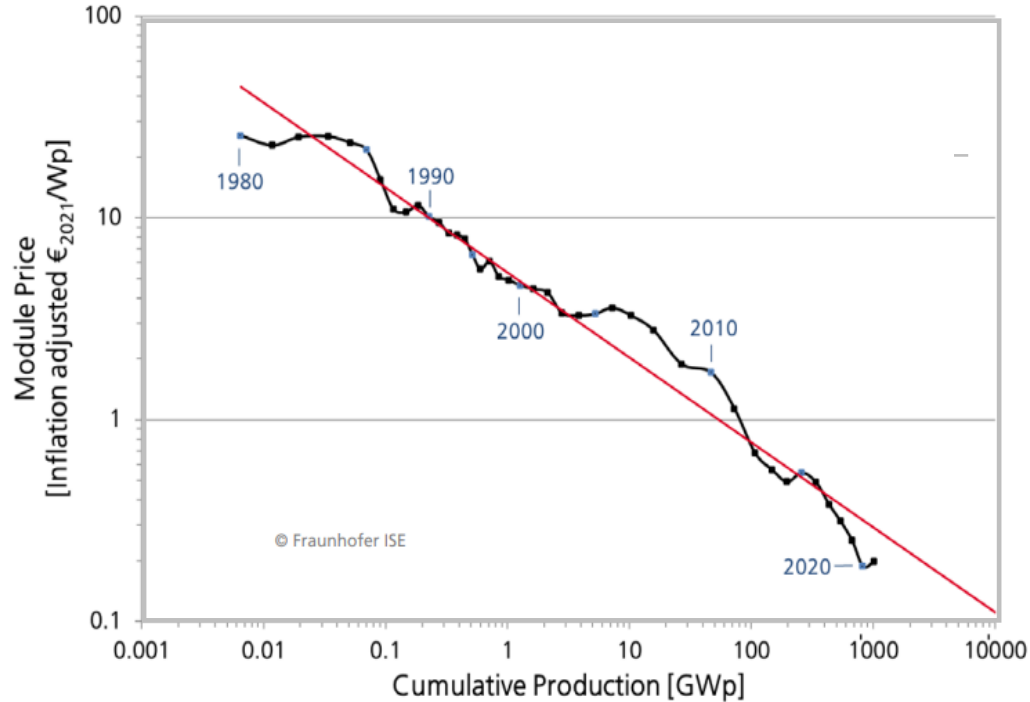


Market reality

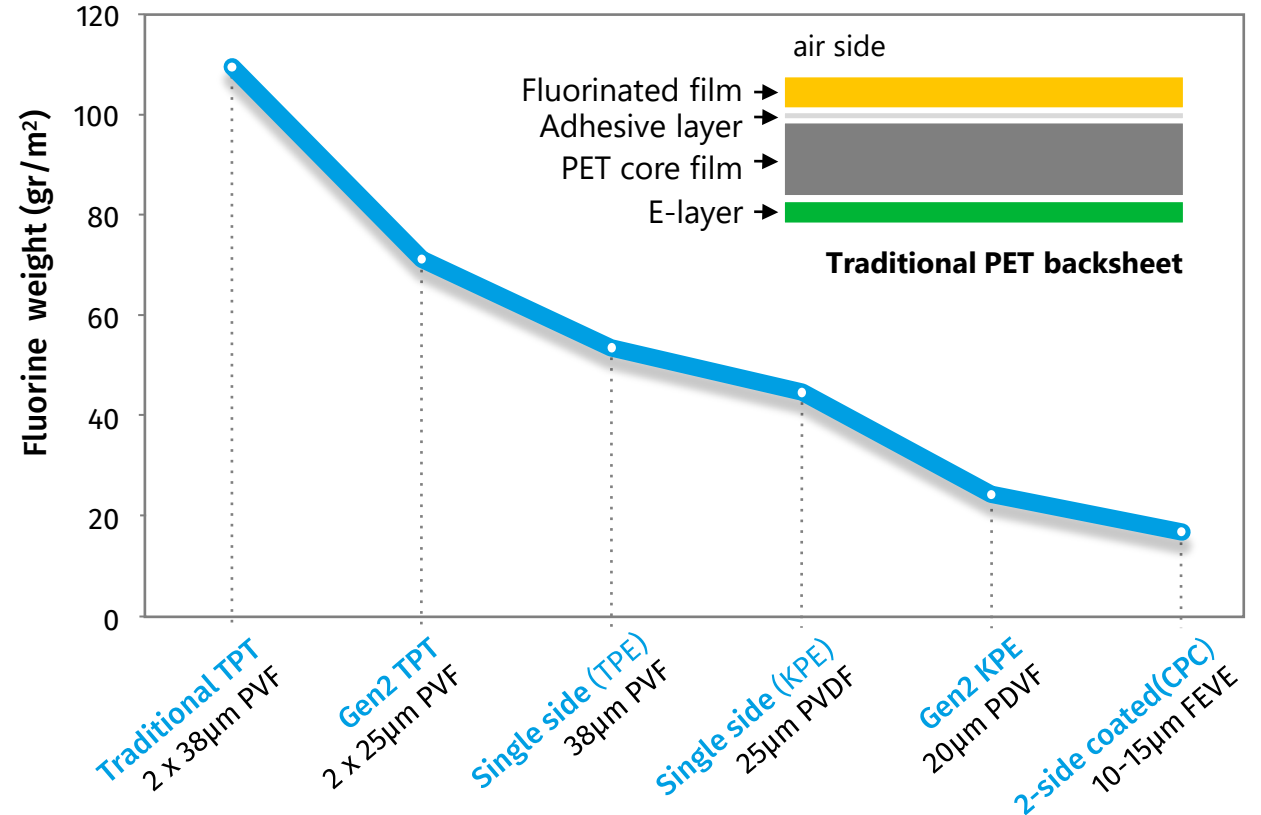
Severe price pressure on modules and its components

Since 1980 every time cumulative production doubled, the price dropped by 25%

Under price pressure, protection of the PET core layer has decreased over time, compromising reliability



Source: Photovoltaics report, Fraunhofer Institute, February 2023

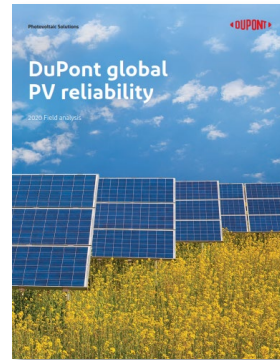


Reliability challenge

Compromised quality leading to field failures whilst new cell technologies raise the bar.

DuPont Global PV reliability report (2020)

16% of all 3GW inspected modules showed backsheet failures (cracking & glass delamination).

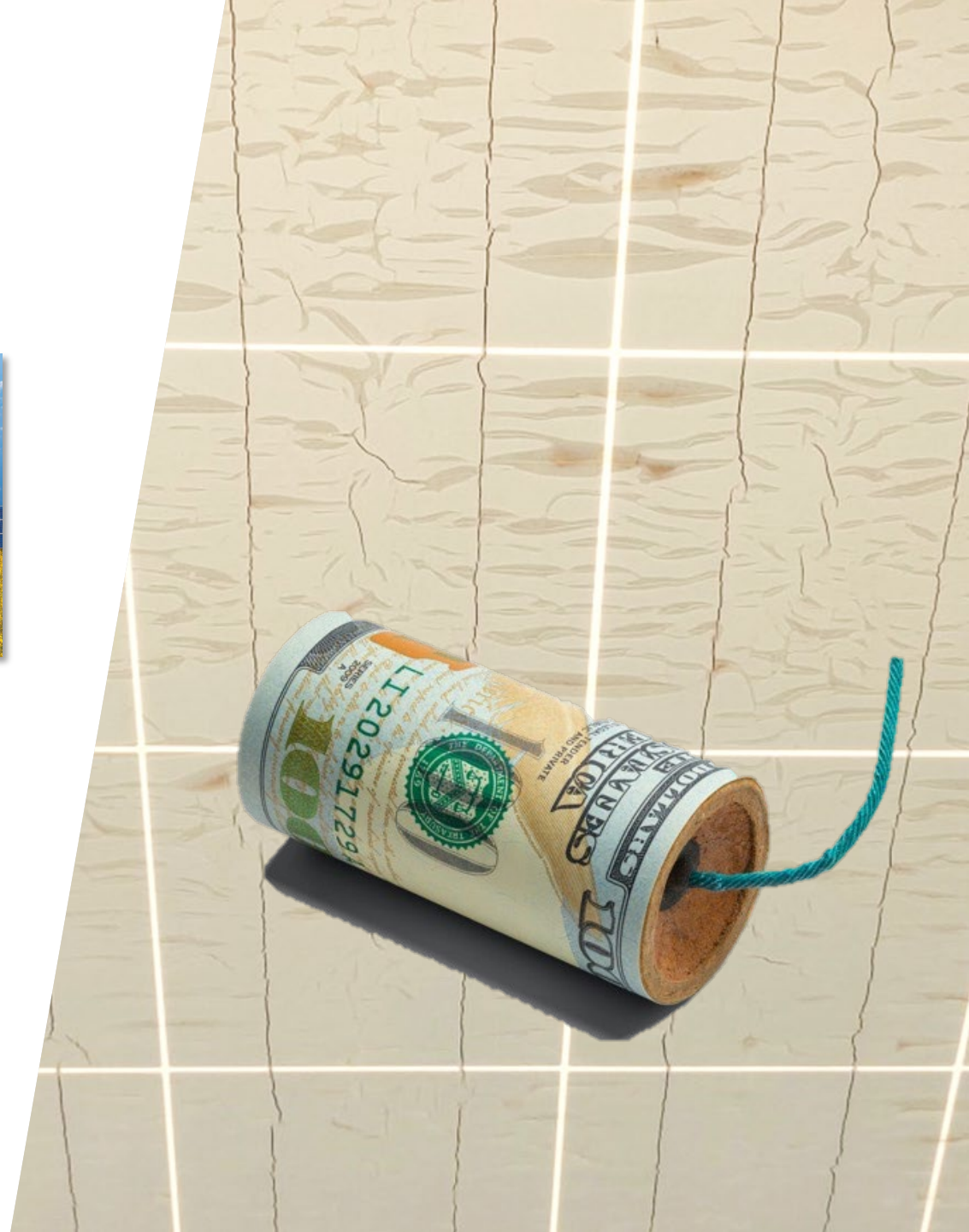


Spotlight on TOPCon: PI Berlin shares concerns about degradation

Asier Ukar, the director of PI Berlin Spain, discusses the importance of addressing the risks associated with tunnel oxide passivated contact (TOPCon) tech early on, even though it outperforms (passivated emitter rear contact (PERC) when considering standard and tangible indicators.

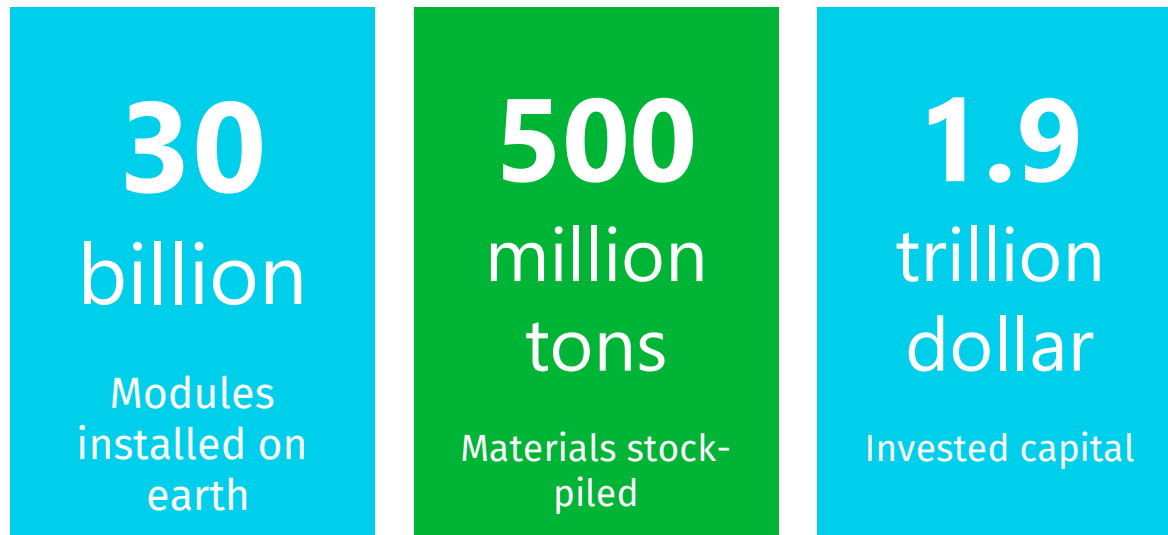
JUNE 19, 2023 **PILAR SÁNCHEZ MOLINA**

Source PV Magazine 2023



The PV waste challenge

By 2050* there will be enough solar panels installed on earth to stack a stairway to the moon and back.

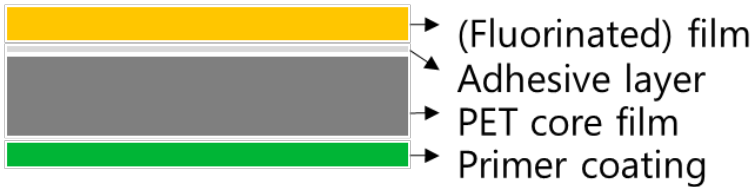


How to turn waste into value?

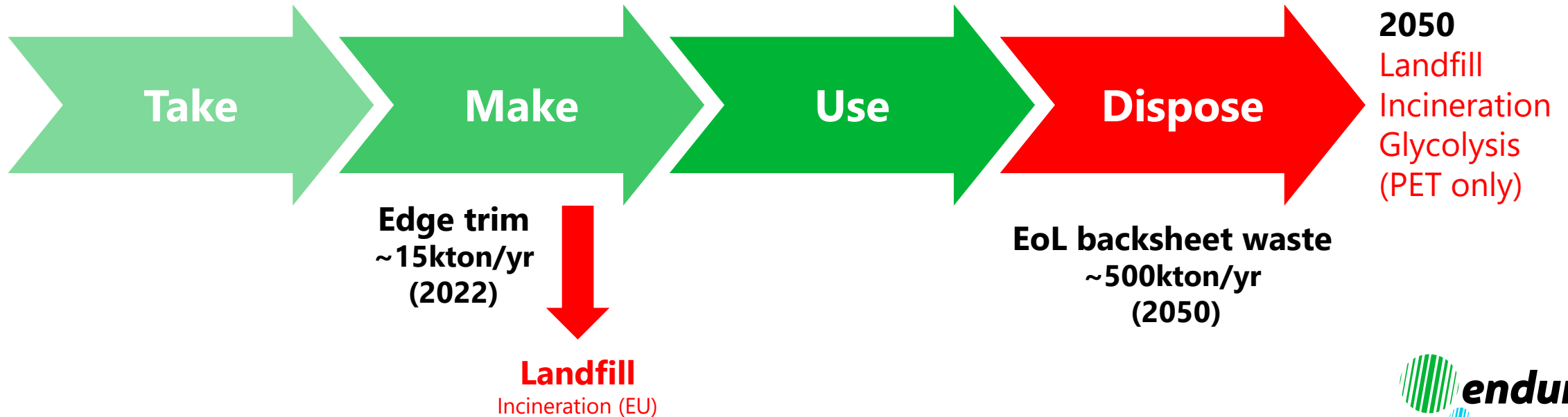
Traditional backsheets follow a linear model

Backsheet material choices made today will have big impact in 30 years

air side



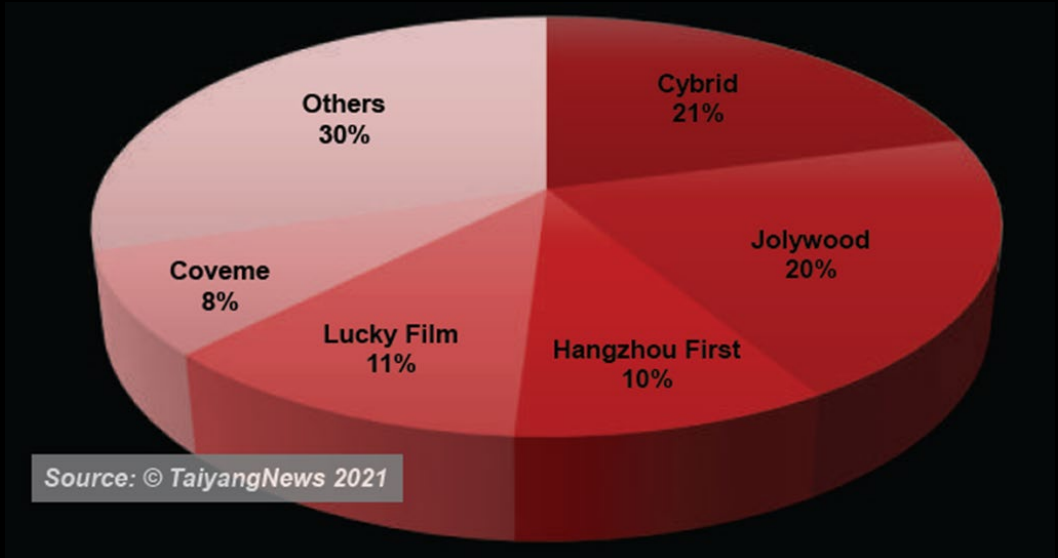
- No option of low-cost mechanical recycling (re-melting)
- Tripling of incineration cost (fluorinated waste)
- Complex chemical recycling (multi-material film)



Supply chain risks

- **Insecure supply chain** with ~ 85% from one country
- **High import duties** on backsheets imported from China (US & India)
- **Sustainability regulations** increasingly discouraging the use of fluoropolymers
- Reliance on off-the-shelf base films supply **Most backsheet suppliers do not directly control critical characteristics.**
- Risk of **high module end-of-life costs.**
Dominant global market share of fluorine-based backsheets

Backsheet supplier market shares



It's time for change



Endurans™ HPO backsheet technology

Enhanced reliability by means of material choices & manufacturing technology

HIGH PERFORMANCE POLYOLEFIN TECHNOLOGY

Always a **strong polyolefin core**
moisture & UV resistant polyolefin

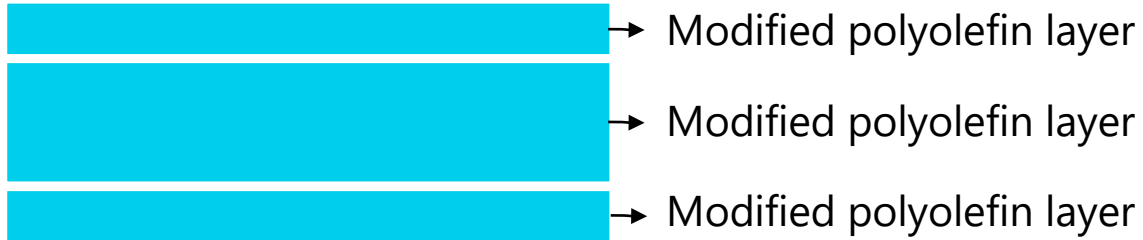
Made via **co-extrusion** for
ultimate performance



Backsheets designed to last

Long life time performance of polyolefins and mono-layer consistency of co-extruded films

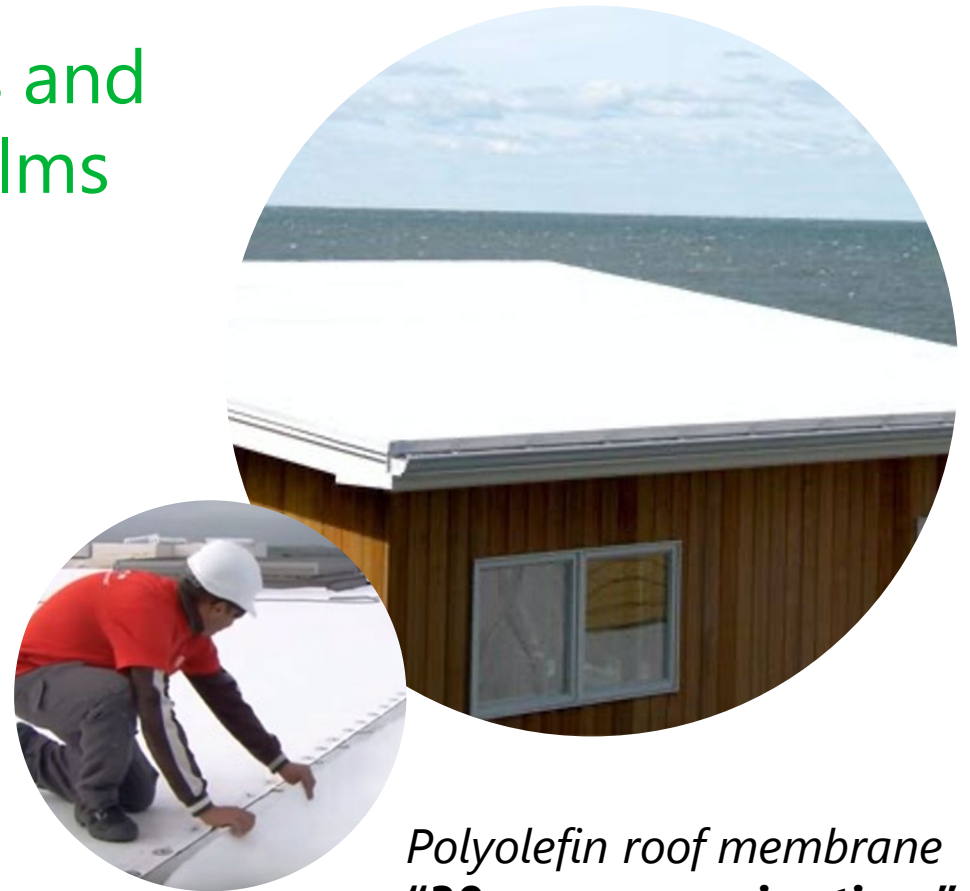
air side



Endurans™ HP backsheet

Intrinsic film properties

- Excellent UV & hydrolysis resistance
- Abrasion & acid resistance
- High water barrier & acetic acid permeability
- Strong interlayer adhesion



Polyolefin roof membrane
"30+ years service time"



Endurans™ HP, building a strong track-record

~20
million

Panels using
Endurans™
backsheets

~6
GW

Installed
globally

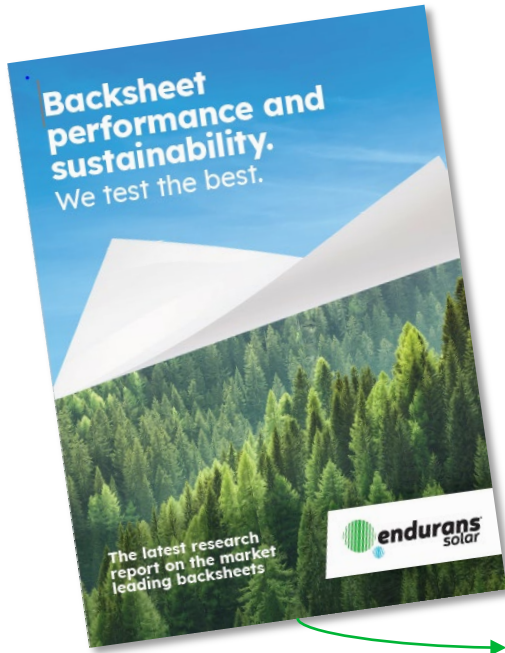
> 8
years

Performance
track record



Benchmark study beyond price and IEC

Comparing simulated lifetime yield and carbon footprint



Benchmark:

- CPC
- KPf
- HPO
- Glass
- TPC transparent
- HPO transparent

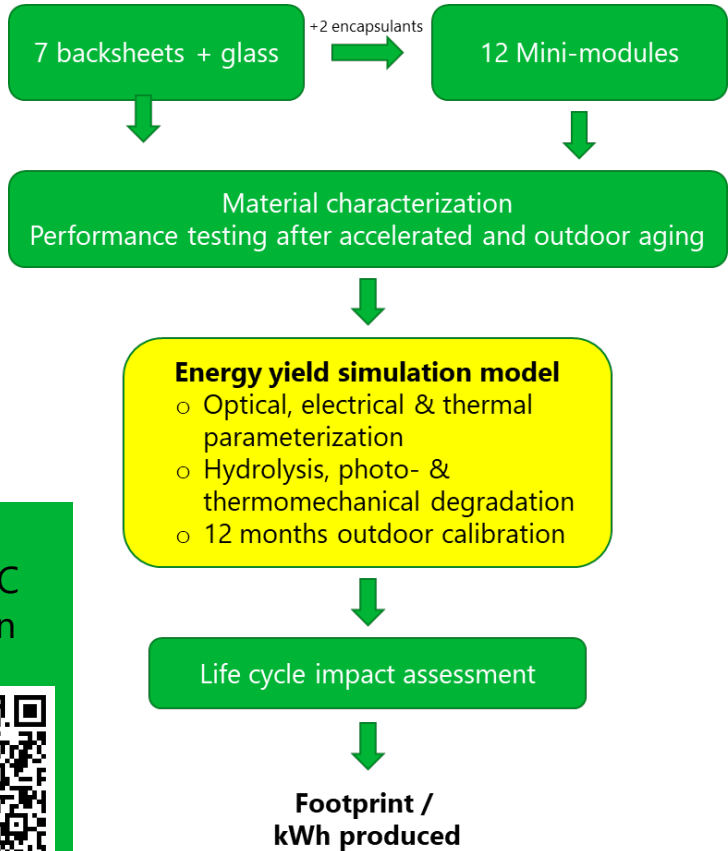
Download brochure



Download Public summary report

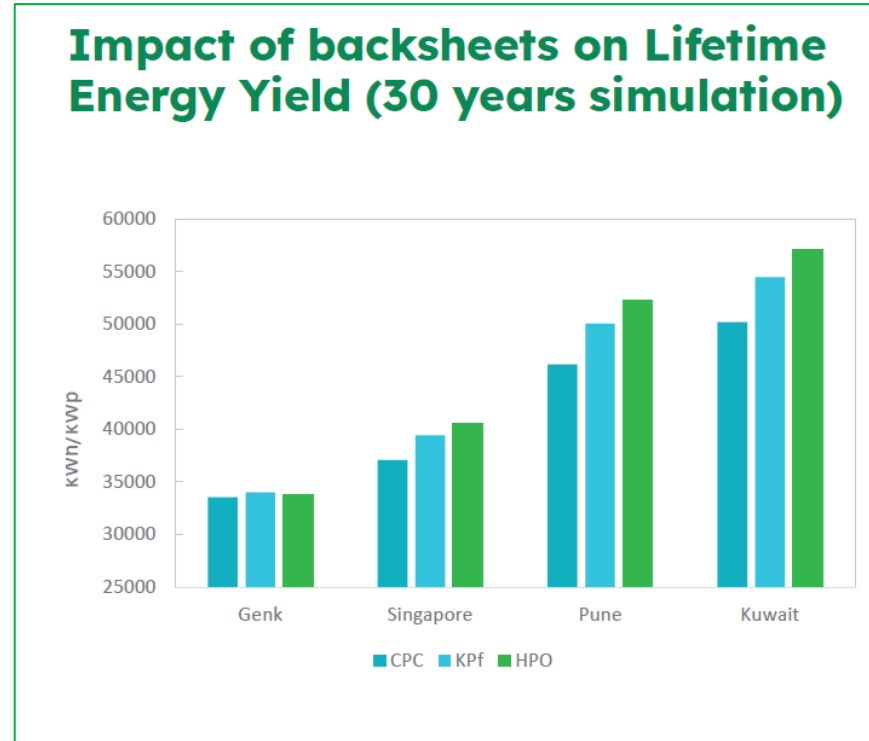
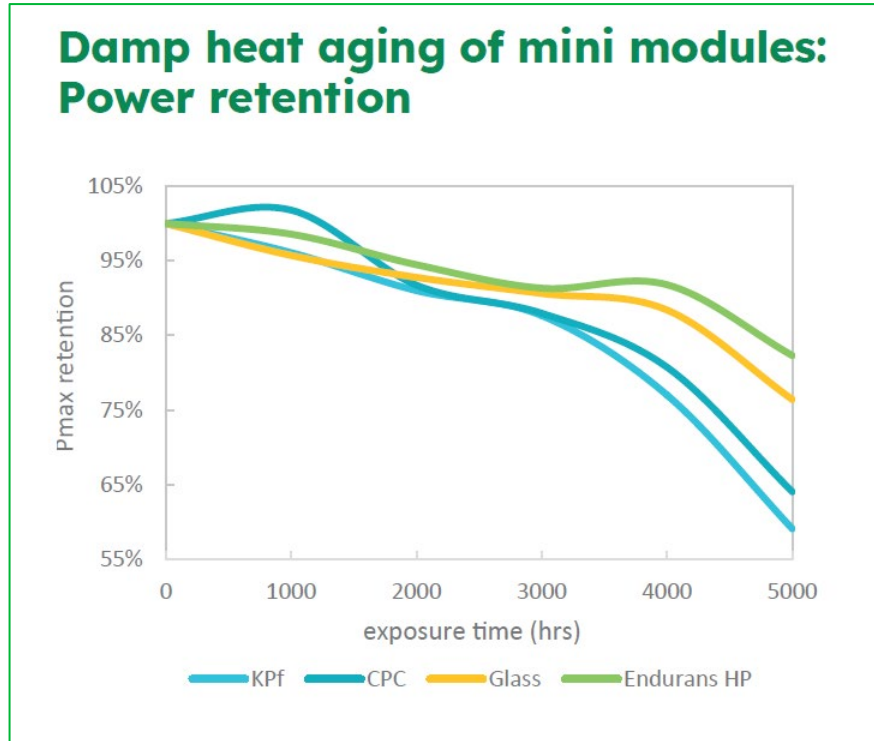


Download the EUPVSEC presentation



Polymeric backsheet giving glass-like protection

Endurans HP's superior barrier properties result in enhanced lifetime energy yield



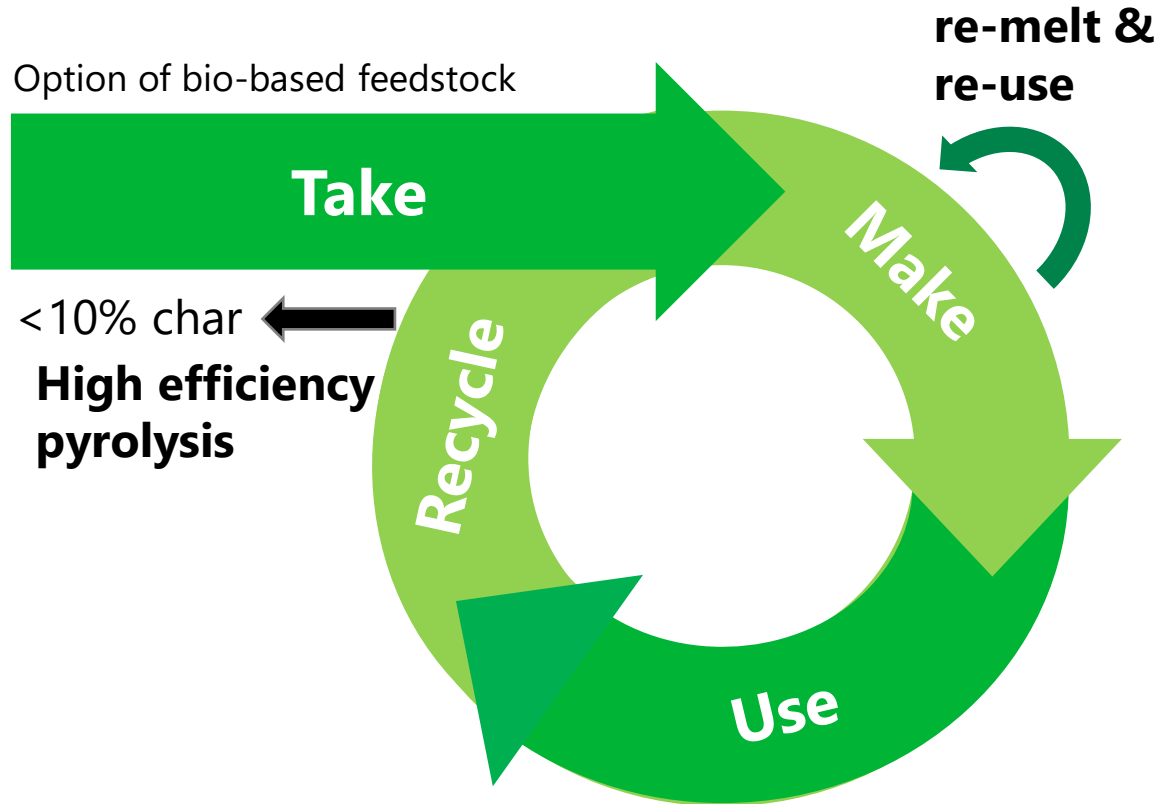
Source: Extensible TEUE119008 Public summary report 27-11-22

EXTENSIBLE subsidy project: lifetime energy simulation (hydrolysis, photo & thermomechanical degradation), based on accelerated aging and 12 months outdoor exposure characteristics.

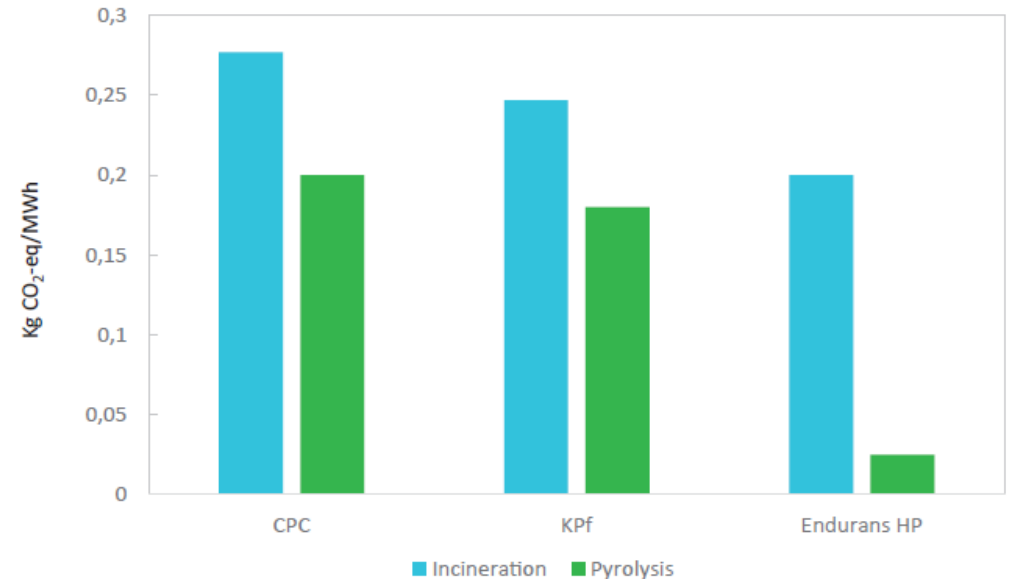


Endurans HP: Designed-for-Circularity

Lowest carbon footprint per MWh produced

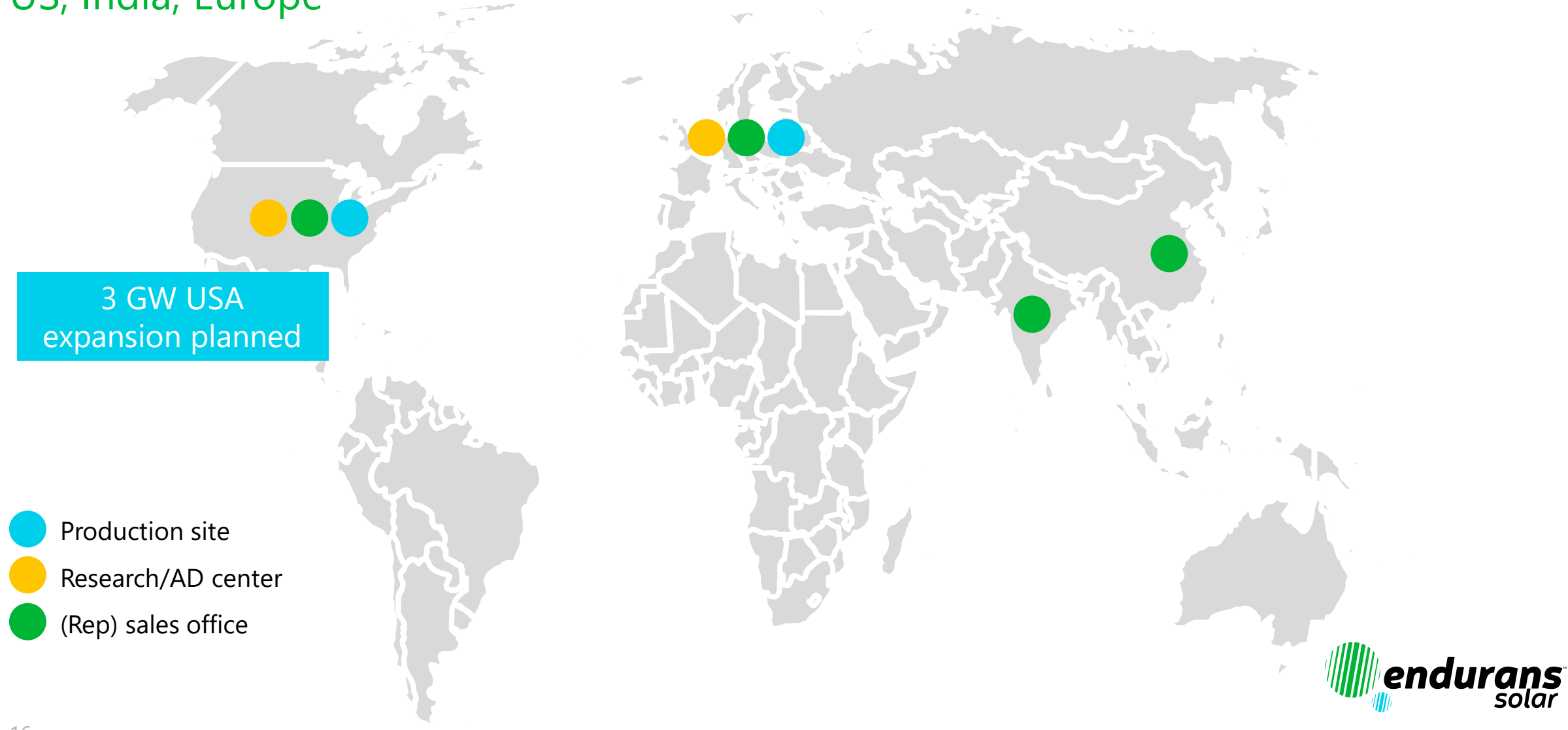


Carbon footprint of backsheets over a 30 year simulated module lifetime: Cradle-to-cradle emissions per MWh produced³.



Focused local-for-local presence Endurans™ Solar

US, India, Europe



Made-in-America backsheet

Only active US backsheet manufacturer

- Local supply & team
- Easier logistics
- Maximize IRA benefits (domestic content)
- No import duties
- Lower logistic carbon footprint



New product development

Building on HPO platform, driven by cost, reliability and sustainability

Backsheet
engineered
for bifacial
modules

High-
performance
Encapsulants

Rear
Perforated
Insulator for
back-contact
modules*



#ForwardThinkingBacksheets.

- **Glass-level protection**
- **1st (near) net zero carbon footprint**
- **Focused local-for-local supply**

Imco.goudswaard@endurans.com

www.endurans.com

info@endurans.com

Polyolefin co-extruded backsheets (Endurans™HP) have passed assessments and tests done at a/o UL, PCCL, DuraMAT, TÜV-SÜD, CPVT, NREL, Enertis, Black&Veatch IMEC and SmartGreenScans. For more info contact us at info@endurans.com.



Same sun. More power.™

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