



SUSTAINABLE SOLAR — EUROPE 2024

Session 5: 'How to Lower the Carbon Footprint of PV Modules and Components: Sharing Industry Best Practices'

12 December 2024

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EUROPE 2024

Decarbonization with TrinaSolar

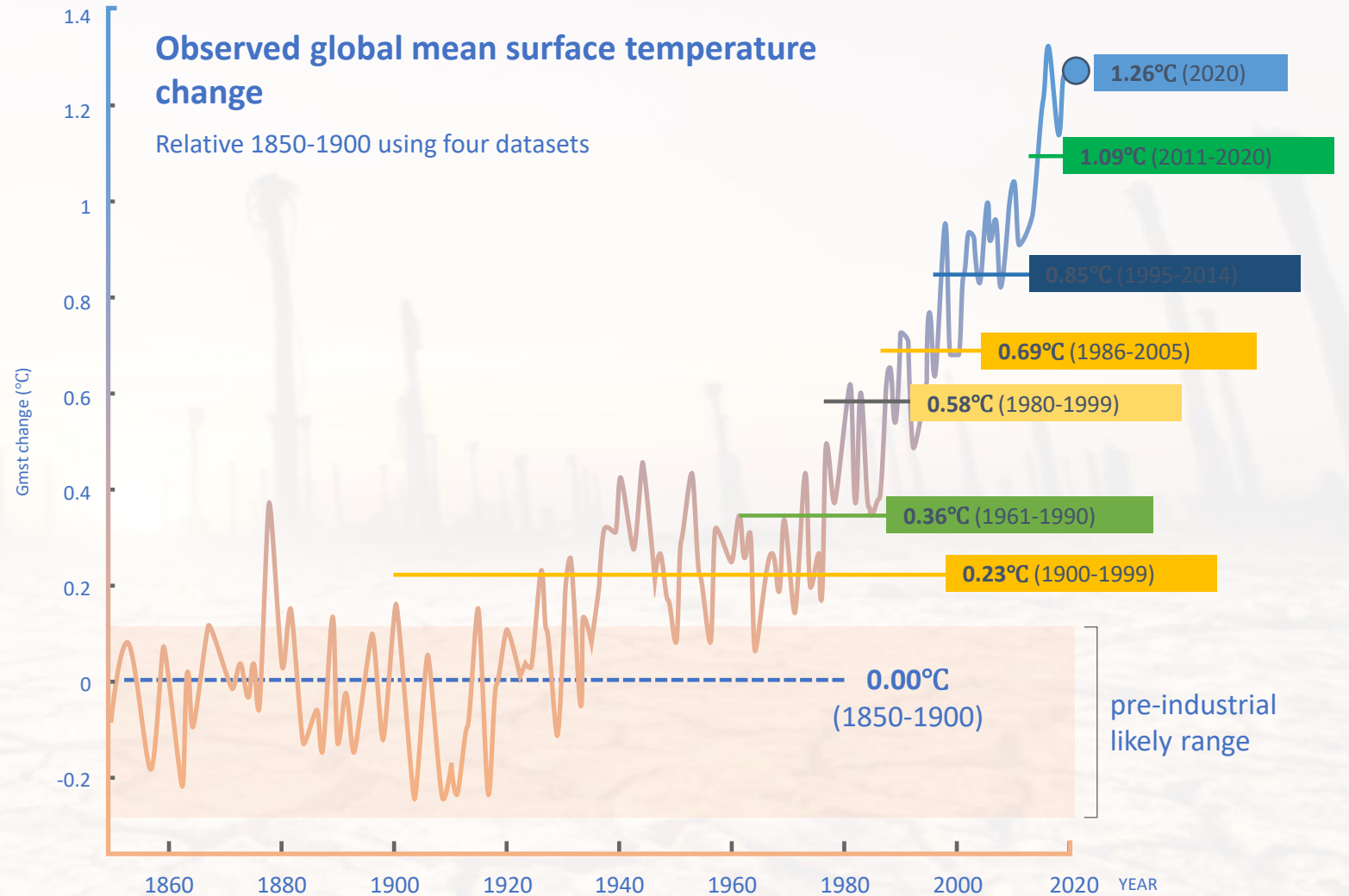
Sharing Industry Best Practices

Pia Alina Lange

Director EU Public Affairs & Policy

Sustainable Solar Summit 2024 | Brussels

Global Warming



Source: IPCC, 2021. The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. In Press.

Climate strategy goals



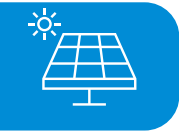
GHG, electricity and water intensity targets



100% renewable energy use by 2030



Energy saving



PV systems and storage in Trinasolar facilities



Zero Industrial Park and Zero Carbon factories

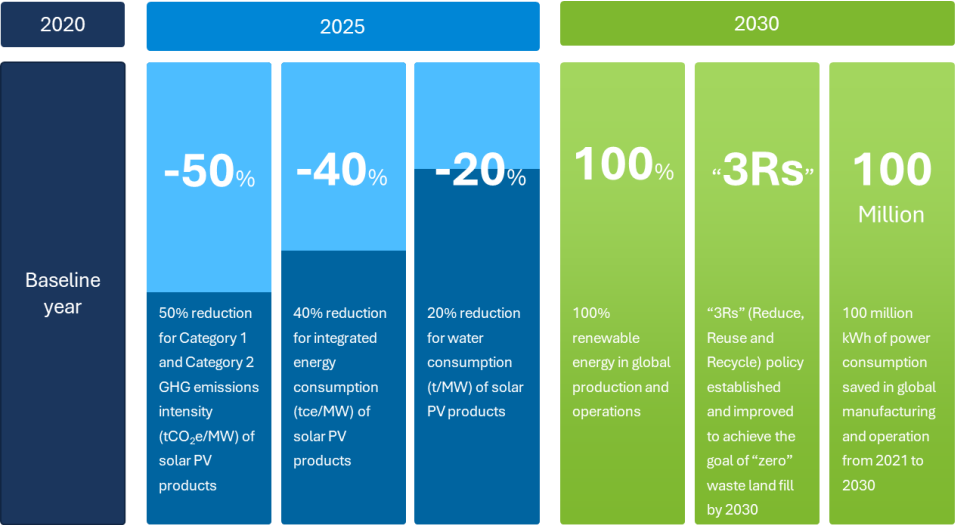


Promote a green supply chain

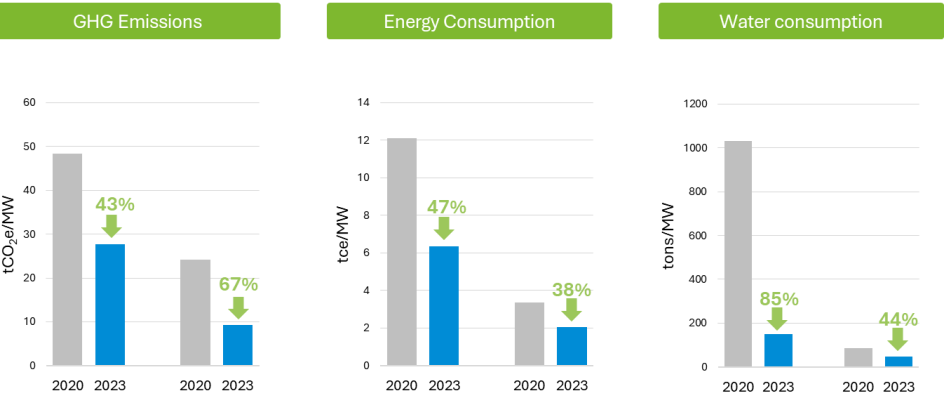


Reduce products carbon footprint

Sustainable development goals for 2025 and 2030 (2020 baseline)



Trina Solar Yiwu
First zero carbon factory certificate in the PV industry. Four-star level



Trina Solar Yancheng
Zero-Carbon Factory and Zero-Waste Landfill Certificates

Recognition to our ESG efforts

WE SUPPORT



2023 ESG Innovative Enterprise

**Bloomberg
Green**

Bloomberg
Green ESG 50 list



中华人民共和国工业和信息化部
Ministry of Industry and Information Technology of the People's Republic of China

National Green Supply
Chain Management
Enterprise



European Chamber
中国欧盟商会

Decarbonisation
leader



WWF Climate Solver
Award



ESG rating upgraded
to BBB in 2024



#2 in global solar module
manufacturing ranking



For the tenth year in a row



The image features a scenic landscape of rolling green hills under a warm, golden light, likely from a low sun. The hills are covered in lush green grass and scattered trees. In the distance, a small cluster of buildings is visible on a hilltop. The Trinasolar logo is centered over the landscape. It consists of the word "Trinasolar" in a white, sans-serif font. The letter "i" in "Trina" is replaced by a solid red circle.

Trinasolar

Frederik Leus



XCarb Business development.
Customer decarbonisation
partnerships,
Arcelor Mittal

Mitigating the CO₂ eq footprint in solar: Low carbon-emissions steel for PV structures, foundations, and frames

12 December 2024
ArcelorMittal Europe – Flat Products

Frederik Leus

XCarb Business development, customer
decarbonization partnerships

ArcelorMittal



XCarb[®]
Recycled and renewably
produced

Cleaner energy sources deserve cleaner solutions, starting at the design stage.

“By utilizing low carbon-emission steel in the top two sections of an offshore tower, we can achieve **25% reduction of emission** compared to a tower made from steel made via conventional steelmaking route.” Vestas



XCarb[®]
Recycled and renewably produced



© Vestas

Baltic Power project:

- **1.2GW of capacity: 76 turbines from Vestas (V236 -15MW) => electricity to 1.5 million households**
- **Supply of ~10kT XCarb[®] recycled and renewably produced steel plates**

Summary - Carbon PayBack Time and Carbon Reduction

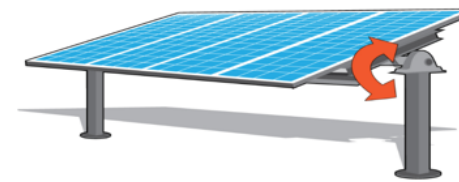
Mounting Structure Focused Results



Germany

Total lifetime CO₂ Germany, fixed Payback

Standard Steel	XCarb [®] Steel
2.44 <u>years</u>	2.1 <u>years</u>



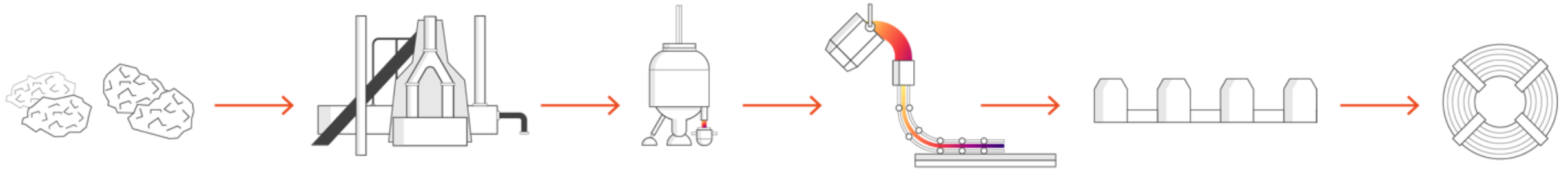
Spain

Total lifetime CO₂ Spain, tracked Payback

Standard Steel	XCarb [®] Steel
2.76 <u>years</u>	2.45 <u>years</u>

- Carbon Payback time can be reduced by up to 13%
- XCarb[®] Steel can decrease the steel manufacturing emission ratio by approximately up to 30%
- Looking at BOS components the substructure plays a major role for CO₂ reduction
- However, do not forget the PV modules

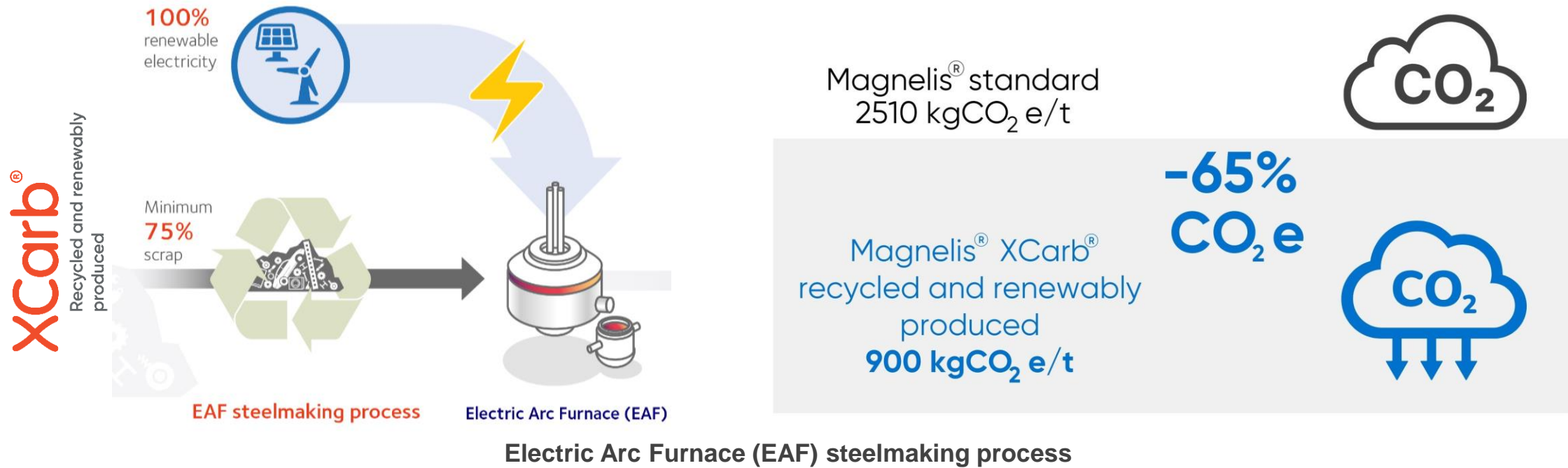
Traditional steel making route: blast furnace is the main contributor to CO₂e emissions



- 1.**
Iron ore / coal
Iron ore is processed to sinter and pellets
Coal is being transformed into coke.
- 2.**
Blast furnaces
In the blast furnaces, iron is produced by reducing iron ore with coke and coal.

~90% of CO₂ emissions occur during the ironmaking stage
- 3.**
Basic oxygen steel plant
By blowing pure oxygen into the liquid iron, iron is transformed into steel.
- 4.**
Casters
In the continuous casters, liquid steel is poured into slabs of steel.
- 5.**
Hot strip mill and cold mill
The steel slabs are rolled into coils of steel.
- 6.**
Coil of steel.

XCarb® recycled and renewably produced: low carbon-emissions steel already available for solar applications



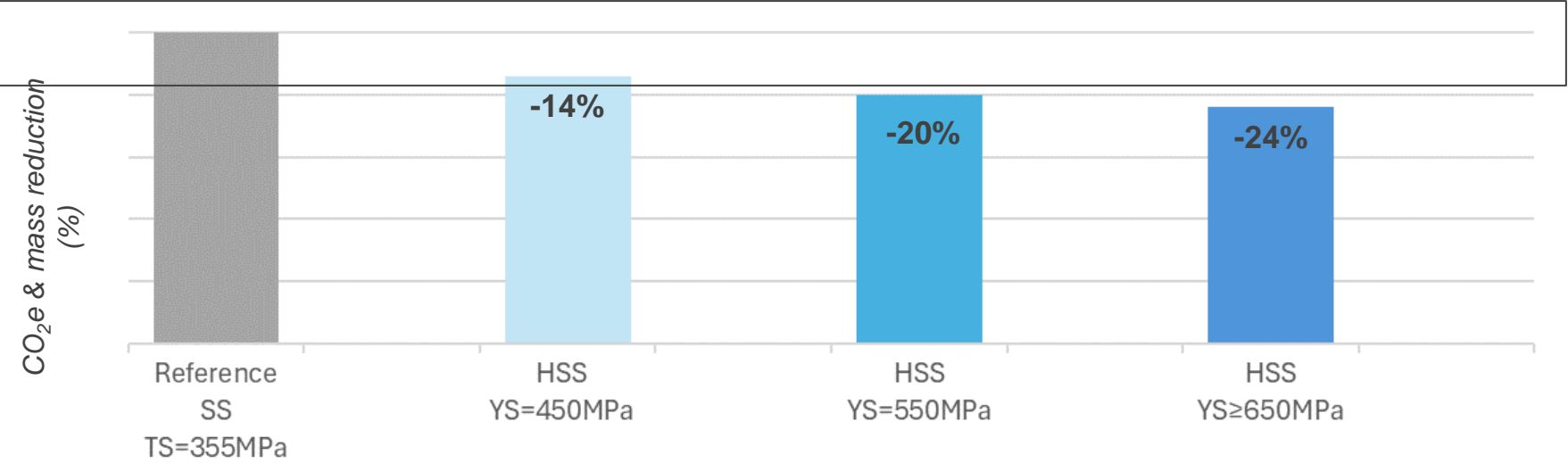
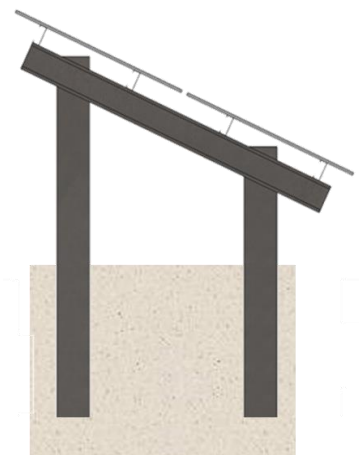
Minimum 75% of scrap and using **100% renewable electricity**.

Carbon footprint of galvanised material reduced by **~65% on a life cycle basis** (LCA cradle-to-gate).

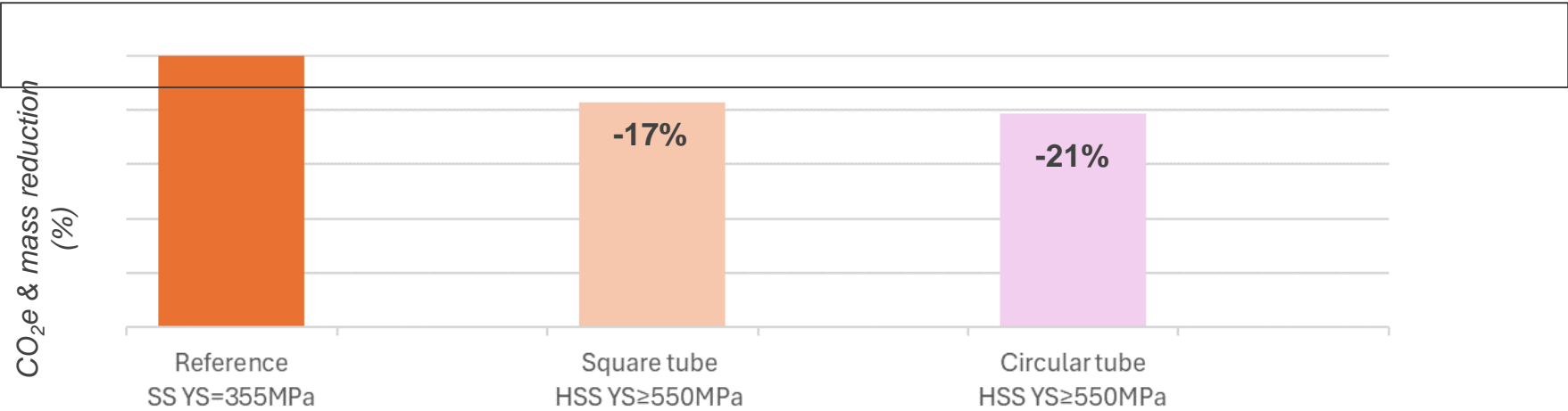
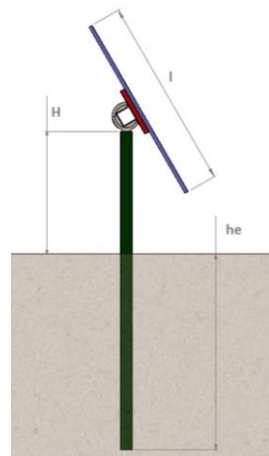
Products offered with a **verified Environmental Product Declaration (EPD)**.

Up to 24% reduction of material usage and CO₂ footprint by material optimisation...

Fixed tilt

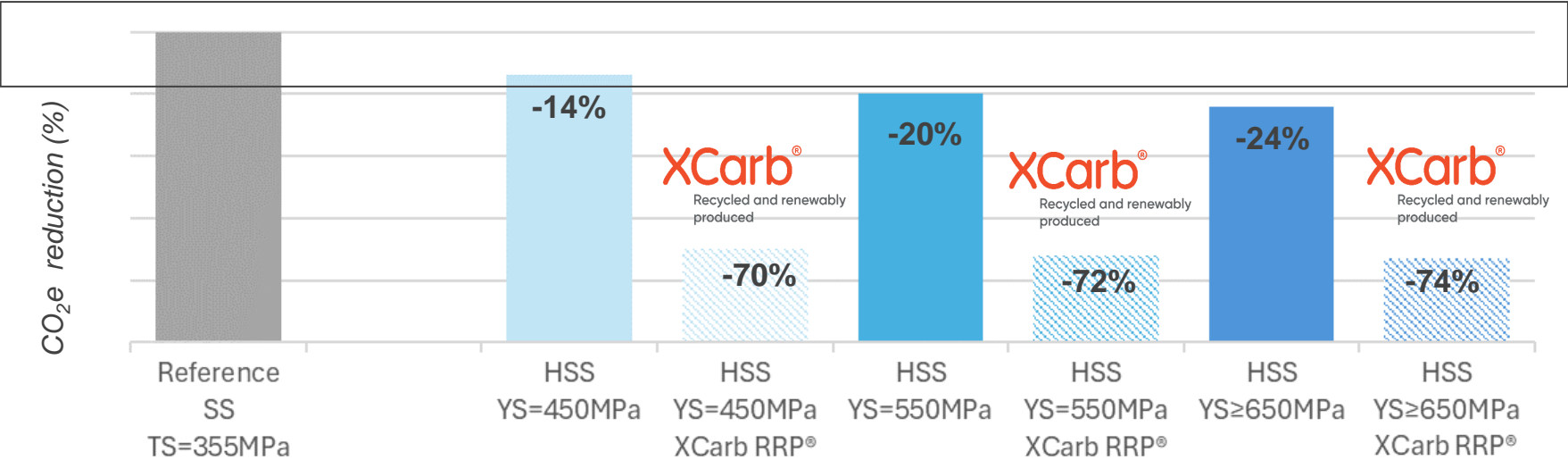
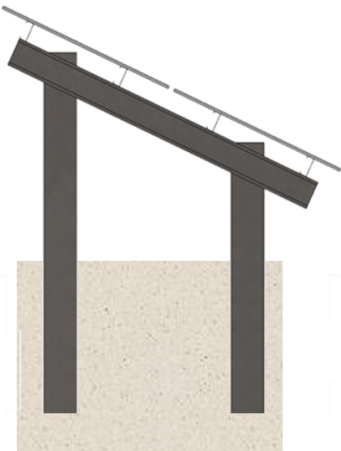


Horizontal Single Axis Tracker

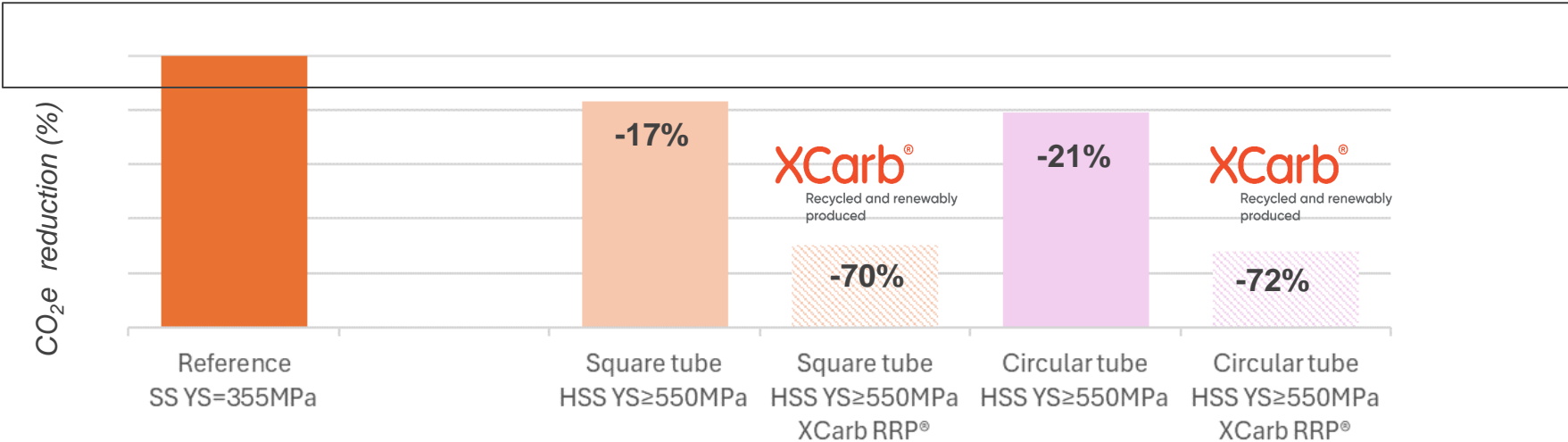
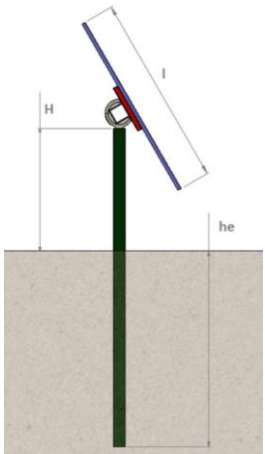


... and up to 74% when material optimisation is coupled with low CO₂ emissions material

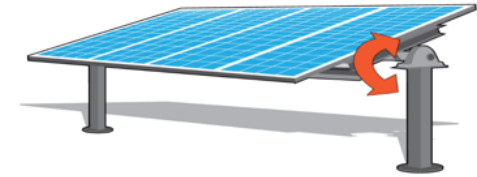
Fixed tilt



Horizontal Single Axis Tracker



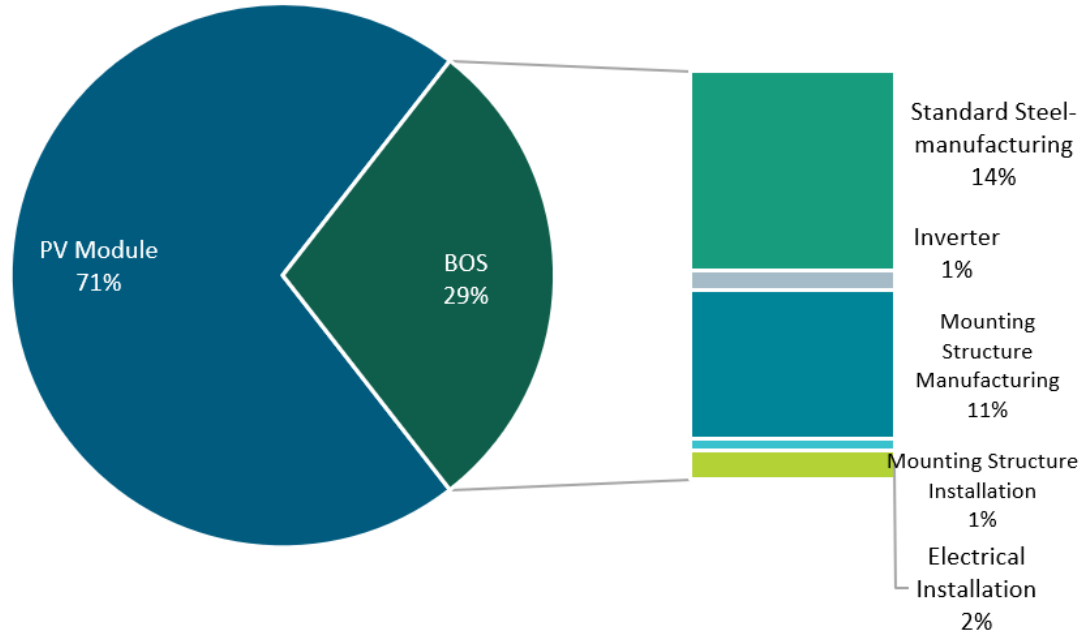
Balance of System (BoS) Results Horizontal Single Axis Tracker PV Plant



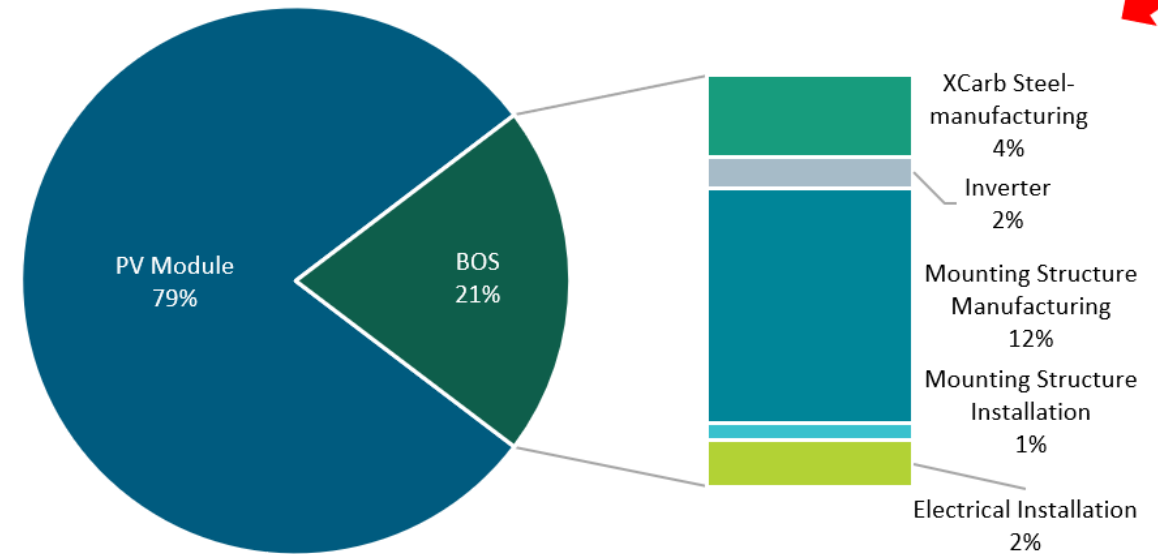
Standard Steel

XCarb[®] Steel

Climate Change kg CO₂ eq.

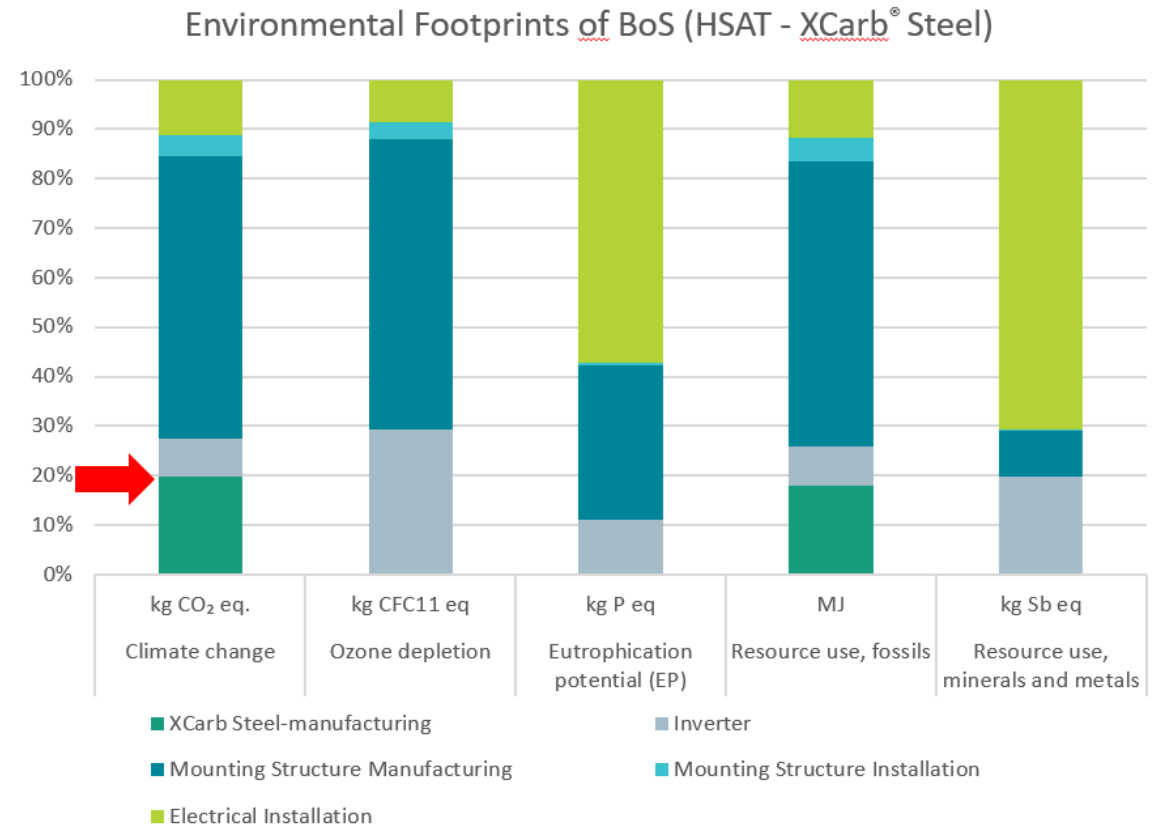
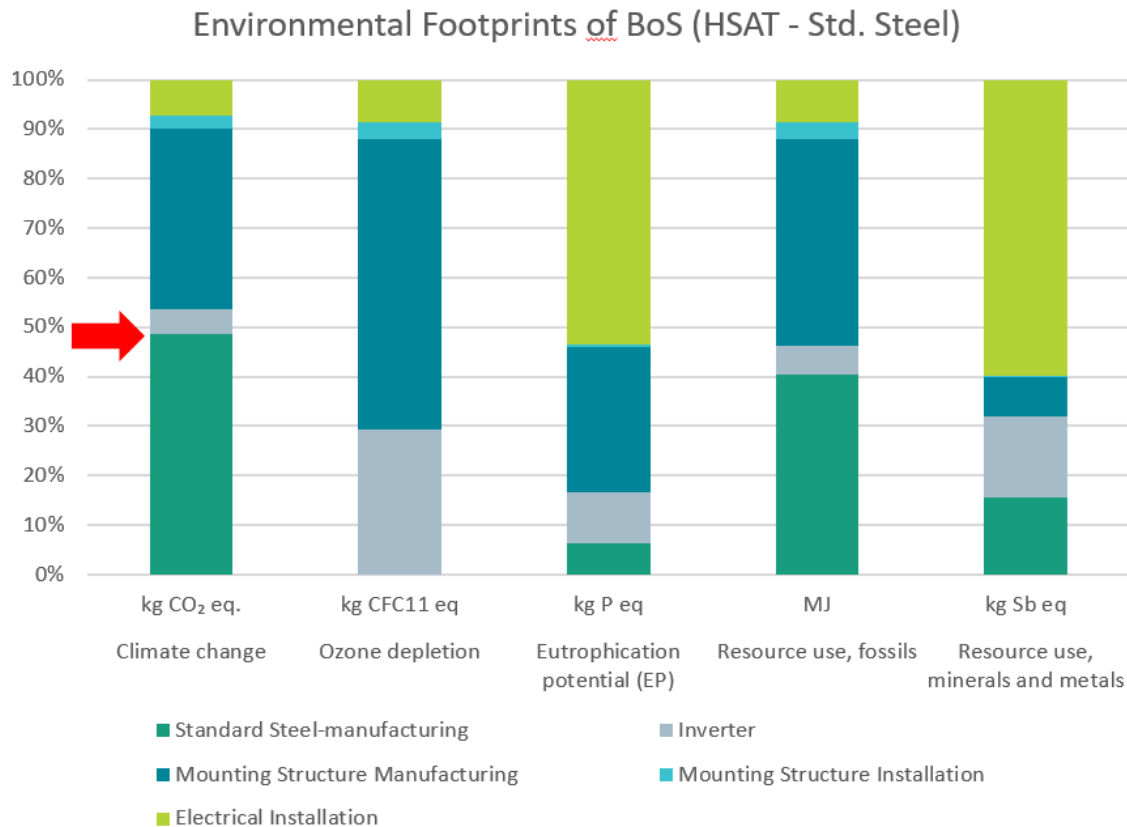


Climate Change kg CO₂ eq.



Balance of System (BoS) Results

Focus on Balance of System and Impact Categories



Combining Magnelis® coating + XCarb® recycled and renewably produced steel to build sustainable solar infrastructures

Example of PV plant & solar trackers in Portugal

Gonvarri Solar Steel and Iberdrola will install 41 MWp of solar trackers made from ArcelorMittal's recycled and renewably produced Magnelis® XCarb® for a project in Portugal



<https://europe.arcelormittal.com/newsandmedia/europenews/news-2023/xcarb-gonvarri-solarsteel-iberdrola>

Key takeaways



1. ArcelorMittal is a solid and innovative partner for solar PV projects.
2. Cleaner energy sources deserve cleaner solutions; the available XCarb[®] steel coated with Magnelis[®] can contribute to lower emissions.
3. Our facts and figures are backed by EPDs, LCA, and performed by third parties.
 - 1 tonne of Magnelis[®] = 2.51 tonnes of CO₂ equivalent
 - 1 tonne of Magnelis[®] XCarb[®] recycled and renewably produced = 0.9 tonne of CO₂ equivalent
 - the carbon payback time of a ground-mounted PV farm can be reduced by 15%.
5. Magnelis[®] coatings are continuously upgraded to meet solar PV constraints.
6. The momentum for decarbonisation has begun – stay tuned!

Thank you



ArcelorMittal



Yuliya Katsyuk

Sustainability Manager,
FuturaSun

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EUROPE 2024

Lowering the Carbon Footprint

Our ongoing commitment

Yuliya Katsyuk, Sustainability Manager at FuturaSun - Sustainable Solar Europe 2024

A photograph of a two-story peach-colored house with a terracotta roof. The house features multiple windows with green shutters and a balcony with a metal railing. To the left, a portion of an older white building with yellow shutters is visible. The background is filled with lush green trees and a hill. A set of stone steps leads up to the house from the right. The text "About FuturaSun" is overlaid in the center.

About FuturaSun

New Production in EU

Lower carbon footprint

- Cells from our facility with EU IP and traceability
- Use of European components
- Reduction of transport-related emissions
- Recycling
- Certifications: LEED and BREEAM
- NZIA compliant
- Short term: GHG emissions of the panels below 400 kgCO₂eq/kWp
- Mid term: below 300 kgCO₂eq/kWp



Carbon footprint of the technology range

High efficiency PV modules



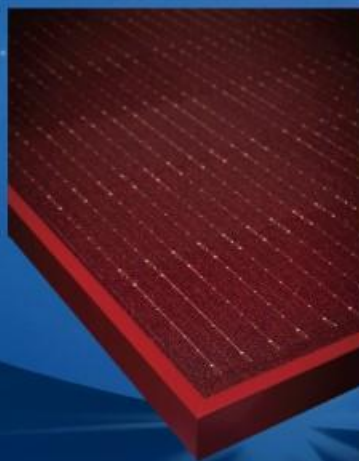
N-type

Silk® Nova
420 - 700 Wp
Backsheet & glass-glass



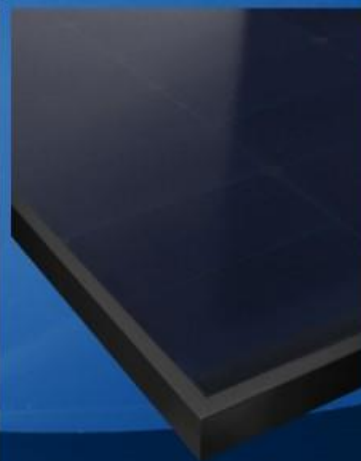
PERC

Silk® Plus
400 - 550 Wp
Backsheet & glass-glass



N-type

Silk® Nova Colour
360 - 390 Wp
Red, Orange, Silver, Green



IBC

IBC ZEBRA
420 - 430 Wp
High aesthetic value



HTJ

Velvet
430 - 470 Wp
Glass-glass

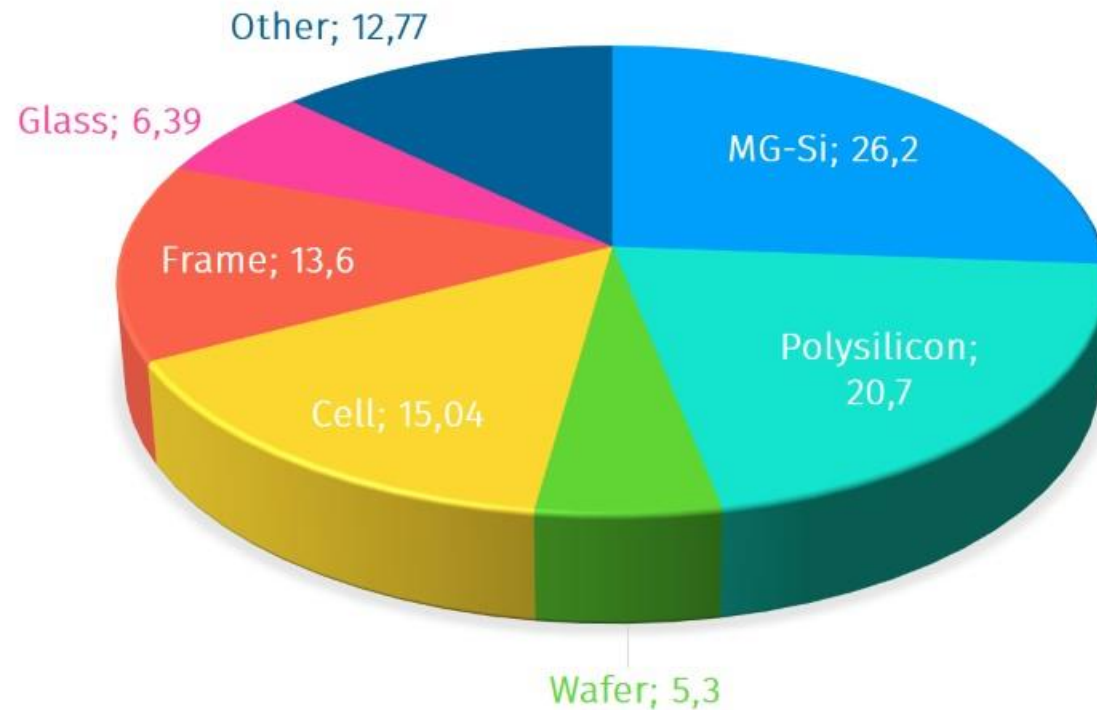


Repowering

Mono & Polycrystalline
190 - 455 Wp
For repowering plants

Life Cycle Assessments

Impact of processes and materials



Process	Impact (%)
MG-Si	26,2
Polysilicon	20,7
Wafer	5,3
Cell	15,04
Frame	13,6
Glass	6,39
Other	12,77
TOTAL	100

How are we reducing our carbon footprint?

R&D	Bifacial perovskite modules
Mid Term	IBC4EU* project
Short Term	Alternative materials for frames Higher durability
Right now	Carbon Neutral PV modules



*This project has received funding from the Horizon Europe Programme for Research and Innovation (2021-2027) under grant agreement No 101084259.



Everything, everywhere and all at once!

Contacts

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Yuliya Katsyuk
12/12/2024

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Jerzy Rudnicki

Senior Technical Manager,
Astronergy

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EUROPE 2024

Advances in Lowering The CO2 Footprint: PV Manufacturing



ASTRONERGY

12/12/2024

Jerzy Rudnicki – Senior Technical Manager



ASTRONERGY At The Forefront Of TOPCon Mass Production

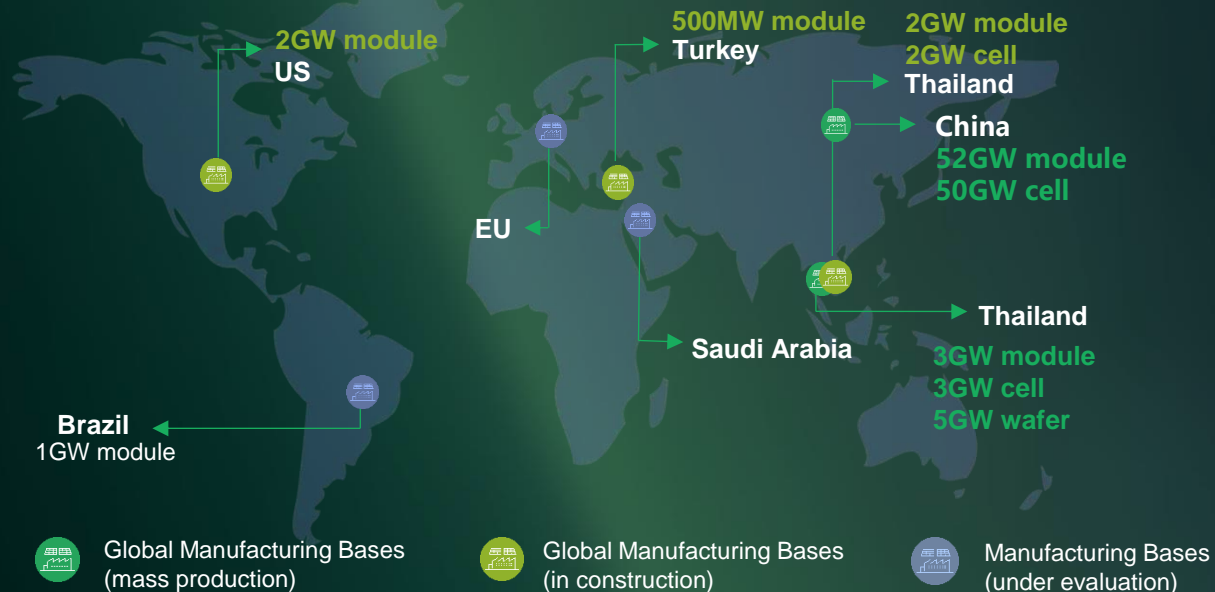


ASTRONERGY

- Solar PV manufacturer since 2006
- A brand of the CHINT Group (1984)
- A Long-Term Tier 1 Company
- Accumulated shipments >100GW
- **Mission:** To create a sustainable and net-zero carbon world with solar power



MANUFACTURING FACILITIES

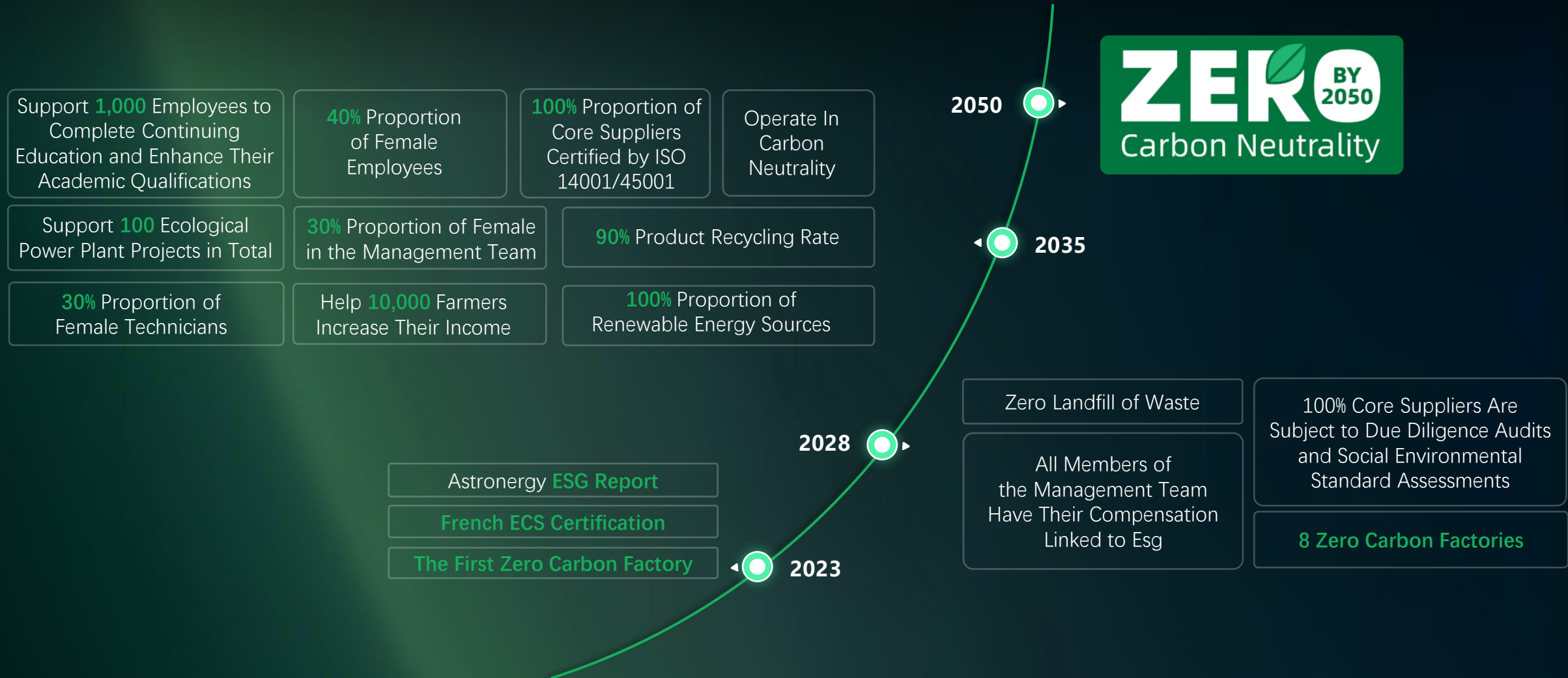


- 9 China Based Manufacturing Plants
- 3 International Manufacturing Plants: Thailand, Turkey, US (in construction)
- 91% of manufactured cells are N-type (TOPCon)
- Annual capacity e.of 2024: 55GW Modules
- Rapid growth: Since 2022 production capacities has been tripled

Sustainability Strategy Roadmap



ASTRONERGY





ASTROENERGY

Zero Carbon⁷ Solar Panel

FROM ZERO TO ZERO

Product Lifetime Assessment



Green Manufacturing – Yancheng Zero Carbon Factory

YANCHENG BASE:



Rooftop PV Powe Plant

26,590	11.18
Pv modules installed	million kWh Electricity annually
80,000 m²	6,376 tons
Coverage	Carbon emission reduced



PV Carports

4,614 m²	220
Coverage	Motor vehicles parked
920,000 kWh	400
Electricity annually	Non-motorized vehicles parked



PV Powered Lighting system

200+	31,080 kWh
Streetlights installed	Electricity annually
17.7 tons	
Carbon emission reduced	

Additional Interventions implemented:

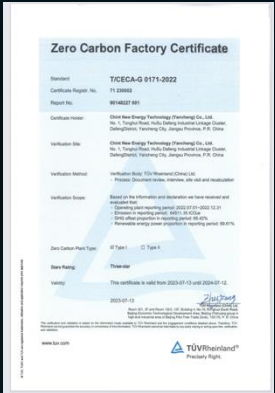
- Water-saving Fixtures
- Waste management
- Green Building Materials
- Energy & Carbon Emission Intelligent Management System
- Green Energy Certificates Trade



First Zero Carbon Factory In The World
 Certified by TÜV Rheinland

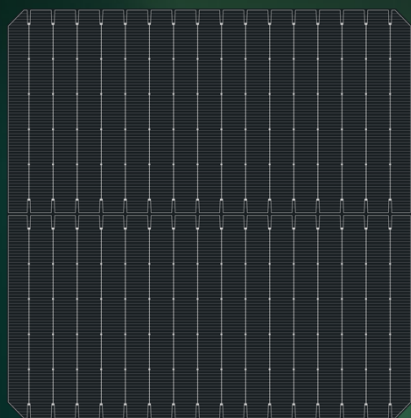
During reporting period:

- >69% of energy came from renewables
- GHG offset proportion >65%
- Emissions ~64.5kTCO₂e



ASTRO N7s ZBB CORE TECHNOLOGY

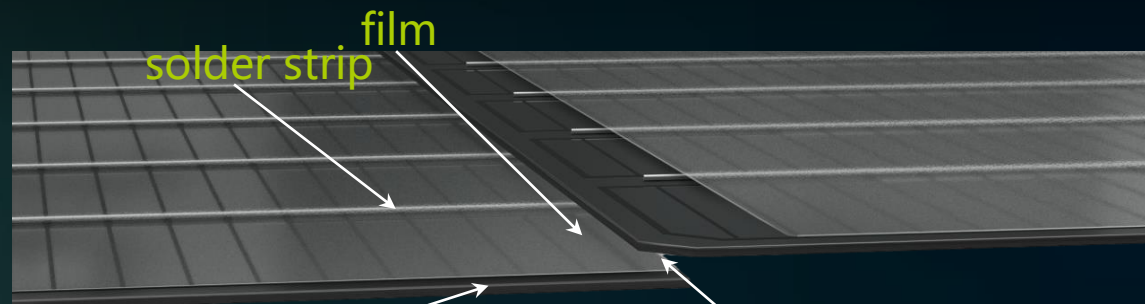
PV cell



Traditional metallization design with multi busbar



Zero busbar design



The film extends over the cell overlap, providing a cushioning effect that reduces the risk of hidden cracking.

IMPLEMENTATION:

- Using soldered thin cell connectors to replace cell busbars
- ZBB interconnection:
 1. Application with low-temperature soldering to fix the connectors on PV cells;
 2. Forming ohmic contact during lamination (second soldering)

RESULT:

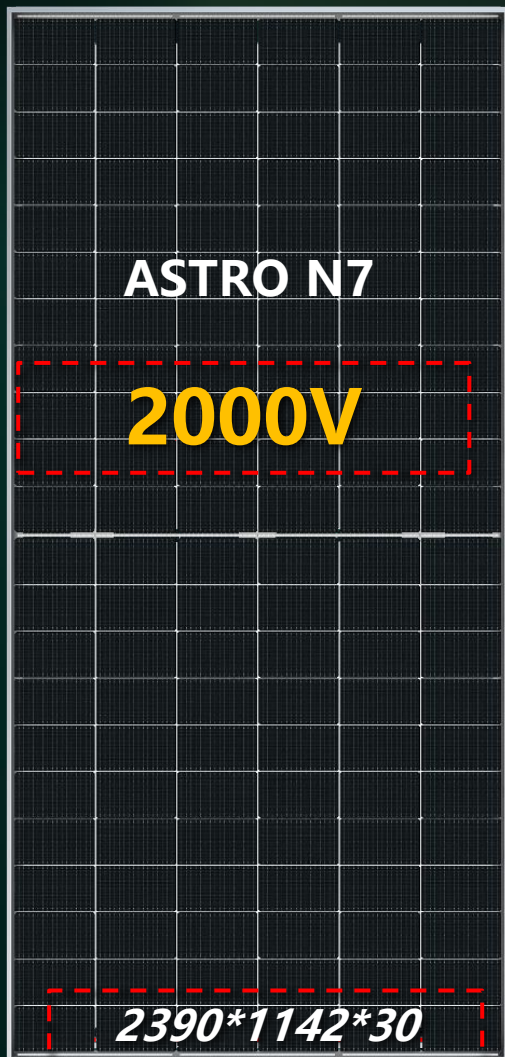
- Reduced energy consumption (low temp. process)
- Reduced raw material (silver)

ZBB is currently implemented also in N5 series

High Voltage System -ASTRO N



ASTROENERGY



Optimized Sytem

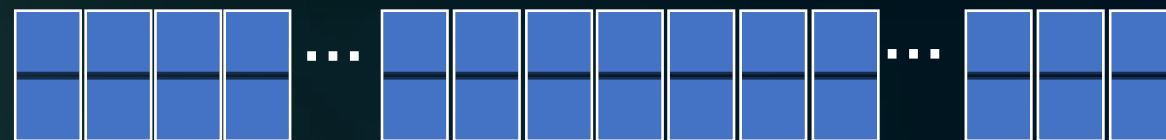
ASTRO N7 uses 210R wafer, Low Voc leads to a larger string size, improving string capacity by 38%

Better BOM

Better combination of encapsulation film, lower the effect of PID under high system voltage

2000V system advantage

Lowest ambient temperature: -10°C



Land saved

3.6%



BOS save

0.29 c\$/W



Power yield increased

0.5%~1%



Stephan Margeth

Head of Sales MEA Asia
Kaco

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EUROPE 2024

Welcome to KACO new energy

Best inverters for photovoltaics, battery storage, and
energy management

Guidelines for more sustainability.



We design our **processes**
to be both **climate-friendly**
and **efficient**.



We **develop**
and **produce**
CO₂ neutral.



We support our
employees, suppliers and
customers in **optimizing their**
ecological footprint.



We enable
innovative
thinking and acting.



We develop
innovative solutions
for the **energy transition**.



We develop and
and maintain **strategic**
partnerships in order to grow.



We promote a **diverse,**
inclusive and tolerant
culture of togetherness.



We offer **attractive**
working conditions.



We actively support
the individual needs
of our employees.

EPD - Overview

EPD – Type I

- Voluntary third-party programs based on multiple criteria, which award a license entitling the holder to use environmental labels on products indicating the general environmental compatibility of products within a certain product category on the basis of life cycle considerations.



EPD – Type II

- Environmental claims made, without independent third-party certification, by manufacturers, importers, distributors, retailers or anyone else likely to benefit from such a claim.

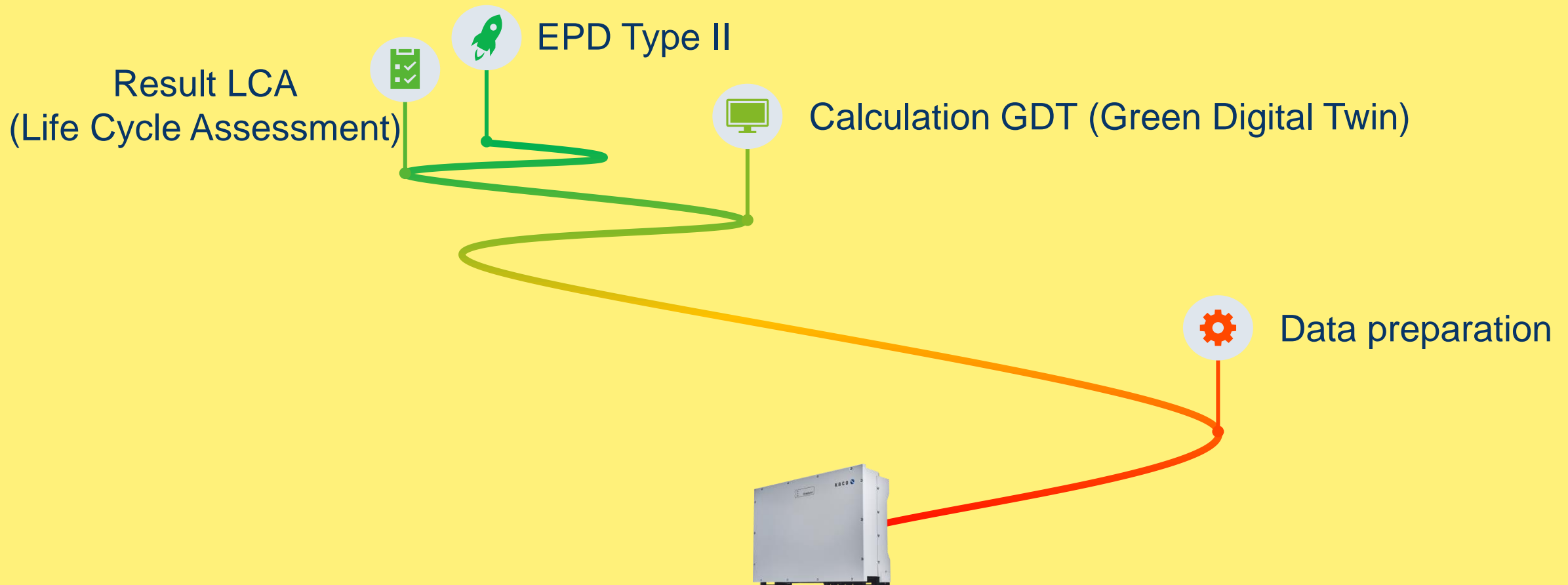


EPD – Type III

- Environmental declarations with quantified environmental data using predefined parameters and, where appropriate, additional environmental information.
Verification and publication by an independent third party.

source Siemens AG

EPD Type II - From finished product to EPD



Environmental Product Declaration.

Materials composition

The following chart outlines the overall material composition of the calculated reference product. Product weight of 83,37 kg adds up with packaging weight of 6,78 kg to a total weight of 90,15 kg. Packaging consists of Box, Foil Film Wrap Bag, Label, Paper.

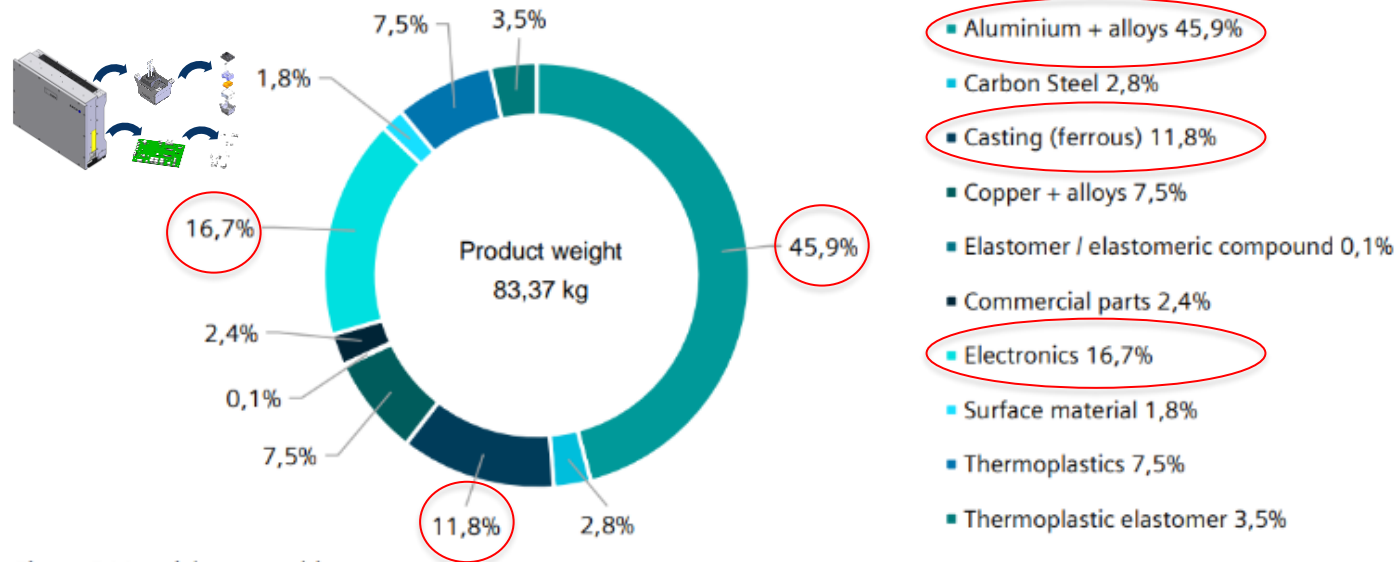


Figure 2 Materials composition

Life cycle stages and reference scenarios



Manufacturing

This stage covers the extraction of natural resources, production of raw materials, transport, manufacturing, packaging and transport distances.



Operations

This stage covers the product's distribution, installation, use and maintenance. Different operating conditions e.g., use of eco-energy-mix can lead to deviations from the standard scenario.



End-of-Life

This stage covers the disassembly, material recycling and thermal treatment of all recyclable materials as well as the disposal of all other materials.

Scenarios

Energy model used:

Supplier:
EU-28: Electricity grid mix

KACO location:
DE: Green Electricity

Transportation model used:
According to EN 50693, and
primary data supplier location

Energy model used:

EU-28: Electricity grid mix

Use scenario:
4,78 W – 12h per day for a
reference lifetime of 20 years

Transportation model used:
Container Ship, New Panamax
120000 DWT 14000 TEU
19000.0 km Truck, 7.5 t – 12 t
gross weight 1000.0 km

Energy model used:

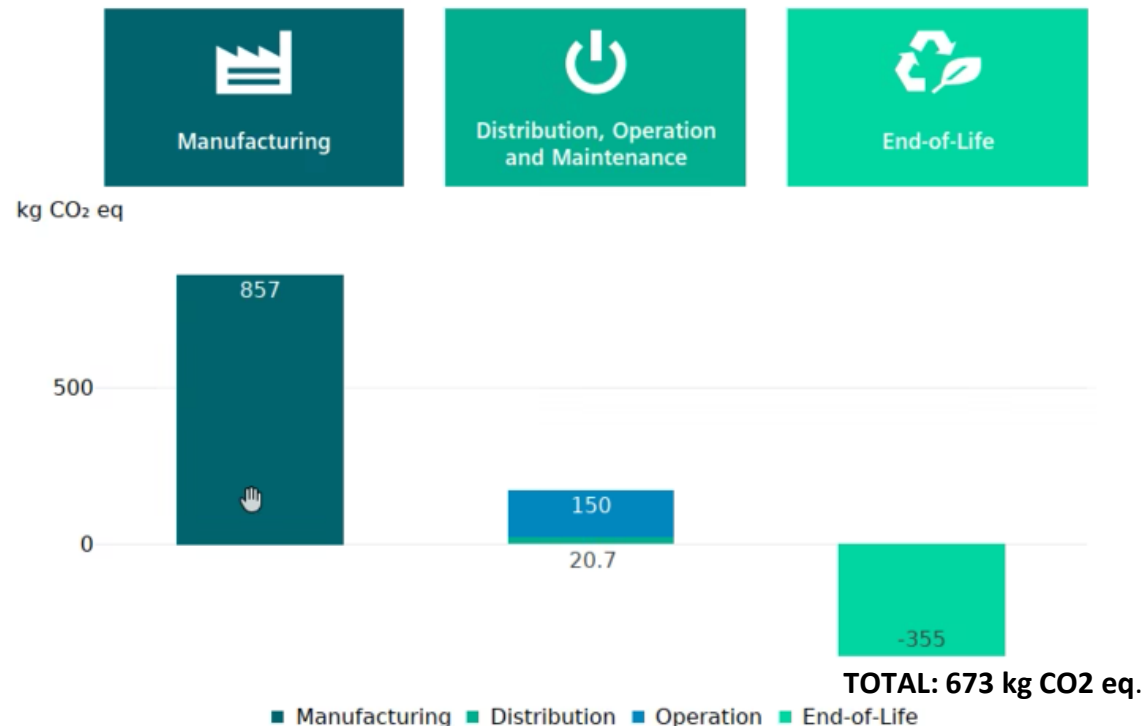
EU-28: Electricity grid mix

Avoided burden method

Environmental Product Declaration.

Climate change

This chart shows the overall impact of the product on climate change – total. The manufacturing phase is the lifecycle phase with the biggest overall impact of the maintenance free reference product. Different operating conditions can lead to deviations from the reference scenario.



End-of-life results

The end-of-life stage was modelled by using state of the art processes, including sorting and material separation. The end-of-life parameters are calculated according to IEC TR 62635 and EN45555.



It leads to:

- an overall **product recyclability of up to 79%** mainly due to metal content
- an **energy recoverability of up to 12%** from plastic materials
- a **minimum disposal rate of 9%**

The exact final values depend on the used recycling process and add up to 100%

Note: The device should not be disposed of as unsorted municipal waste. Special treatment for specific components may be mandated by law or recommended for environmental reasons. Observe all local and applicable laws

Product Portfolio Overview

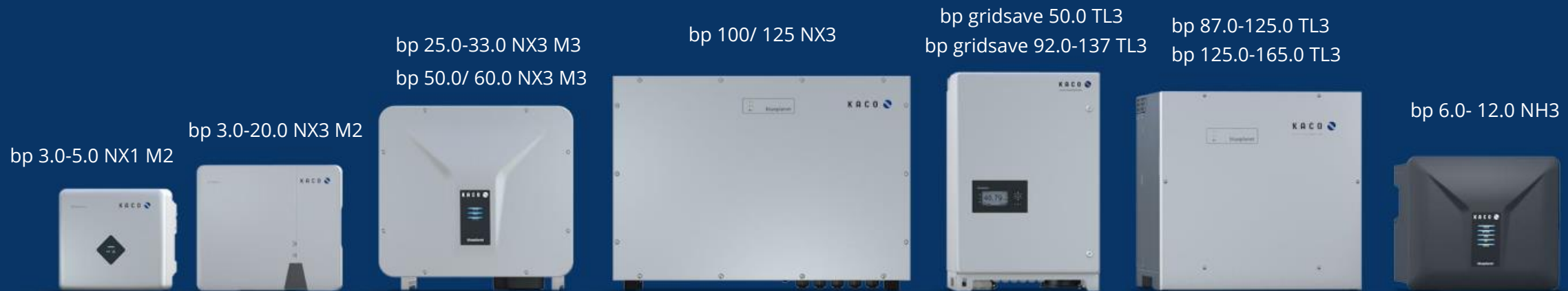
Masters of the strings – covering all your bases

A seamless spectrum of advanced **3-phase string inverters** provides turn-key solutions for all your PV projects – whatever the size or location.

Right from the smallest units up to the compact power-houses our products deliver **top performance** combining **robustness** with **maximum ease of use**.

For solar power stations, we have developed the **Virtual Central** system approach: it combines the economical advantages of a de-centralized approach with all the benefits of centralized designs.

On top, we offer solutions for **energy storage** and **reactive power compensation**: shift your yield to later times of use, reduce the electricity bill of your business or become part of intelligent grid management.



THANK YOU FOR YOUR ATTENTION.

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A Siemens Company
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Panel discussion



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Stephan Margeth

Head of Sales MEA
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Kaco



Raffaele Rossi

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intelligence,
SolarPower Europe

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EUROPE 2024

THANK YOU



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