

Konstanz 31.03.2022



FuturaSun®

anticipate tomorrow

ZEBRA

Achieving higher energy
yield with n-type IBC
modules

Presented by:

Lisa Hirvonen



The Company

About Us



- › FuturaSun was founded by a group of young industry experts in 2008.
- › It's an Italian company specialized in the manufacturing and sale of PV modules.
- › The commercial network is spread to more than 70 countries and has over 15 years of experience in the PV market.
- › 2 production plants situated in Taizhou, China with an annual production capacity of 1 GW.



N-Type technology

Back to the origins

The very first solar cell made of silicon was an **n-type back contact** solar cell and it was fabricated at the Bell Labs, USA, in 1954.

We are now **returning to the origins** of using N-type wafers to benefit the several advantages that this technology has to offer.

The New York Times - April 25th 1954

“may mark the beginning of a new era, leading eventually to the realization of one of mankind’s most cherished dreams—the harnessing of the almost limitless energy of the sun for the uses of civilization.”



N-Type technology

Differences P-Type Vs. N-Type

P-Type (positive base)

- › Doped with boron
- › One electron less making it positively charged
- › **P-type cells suffer from LID** (Light Induced Degradation)
- › Higher degradation rates over time

N-Type (negative base)

- › **Is doped with phosphorus**
- › With **one electron more** making it negatively charged
- › This extra electron is **boosting the efficiency**
- › **Resistant to LID and LeTID**
- › **Low temperature coefficient**
- › **More kWh per kWp**
- › A sustainable choice for your business plan



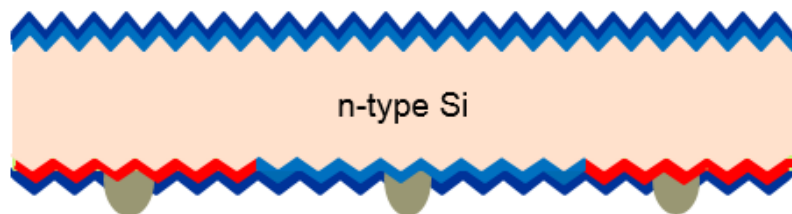
ZEBRA

PV panel with 132 IBC half-cut cells

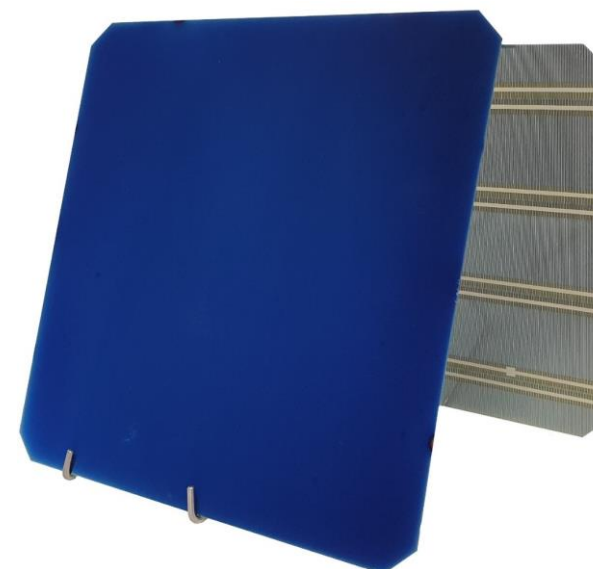
Industry standard module sizing



- › Innovative technology developed in Europe by ISC Konstanz



- › Industry leading cell efficiency: +24%
- › Based on **M6** (166 x 166 mm)
N-TYPE Cz-Si wafers



Front

Back

IBC Technology

Maximum light absorption

This new high-efficiency module stands out for its **IBC technology** with all electrical contacts on the back.

- › No metallization on front side
- › n+ and p+ doping on the rear
- › Maximum light absorption

Bifaciality factor module ~80% with glass-glass configuration



ZEBRA series

Standard White | FU420-430M

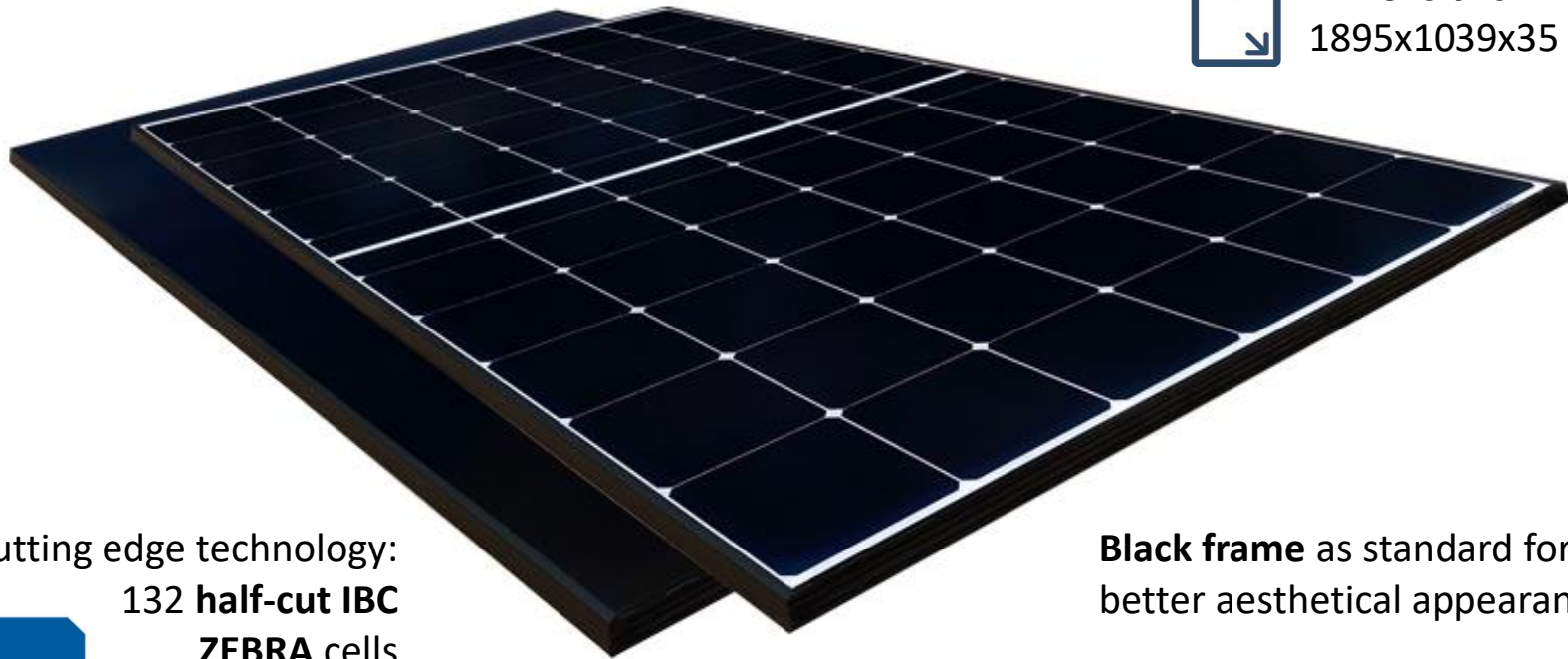
Total Black | FU415-425M



Superior module efficiency up to **21.84%**
More energy on less space



Dimensions:
1895x1039x35 mm



Cutting edge technology:
132 **half-cut IBC**
ZEBRA cells



166 mm

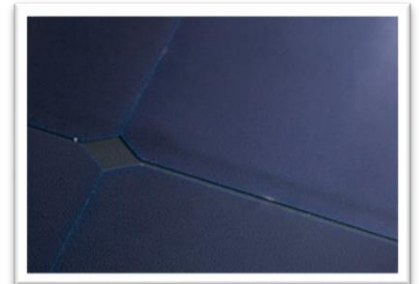
Black frame as standard for a
better aesthetical appearance

ZEBRA series

Total Black | FU415-425M



- › Available also with an elegant total **black design**
- › Particulary suitable for buildings with a **high architectural value**



ZEBRA series

Module layout

- › Innovative cell layout
- › Overlapping cells – full size cell appearance
- › Reduced cell to cell and string gaps
- › Optimized module size
- › **Module efficiency 21.84%**



CELL OVERLAPPING

REDUCED CELL TO CELL DISTANCE

CELL OVERLAPPING

GLASS

ZEBRA CELL

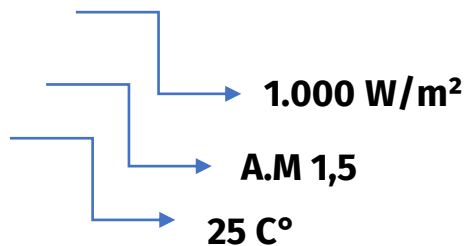
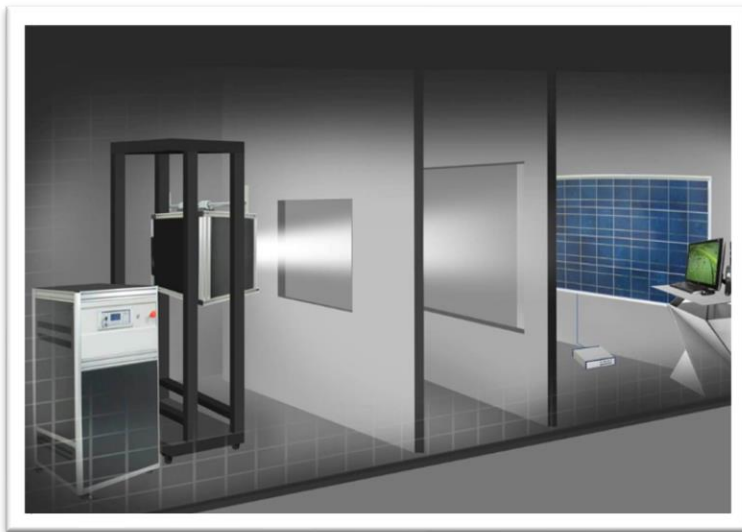
WIRE

BACK SHEET

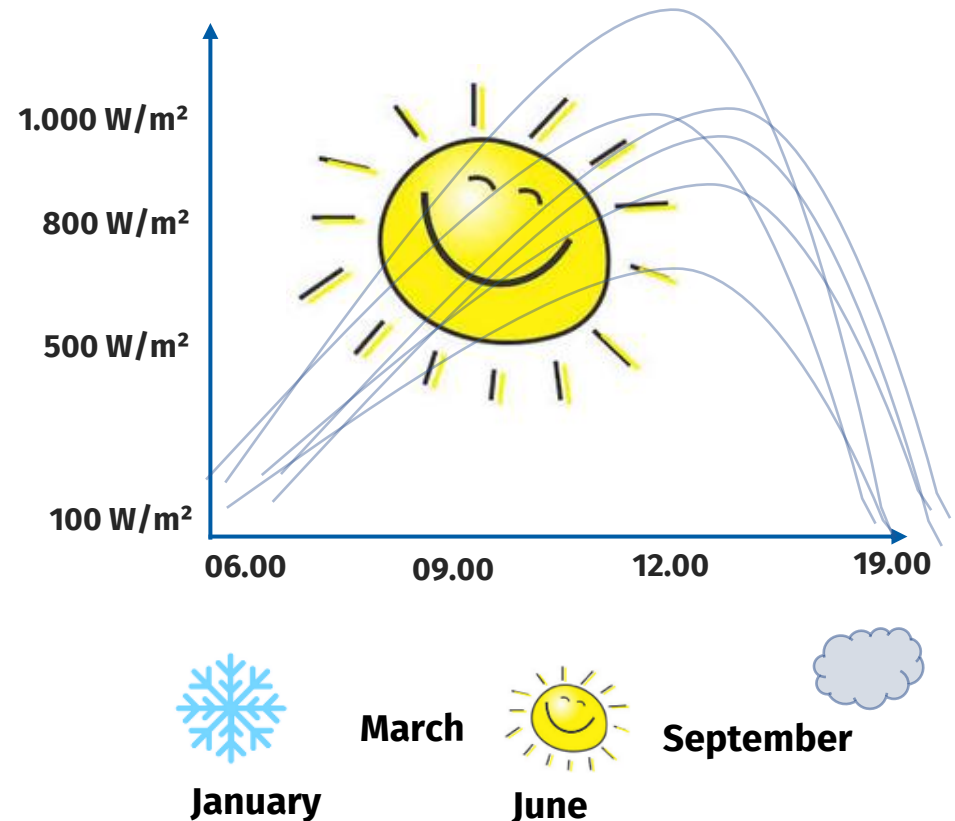
Factory Vs Outdoor

The importance of talking about kWh

Factory: perfectly perpendicular light



Outdoor: various tilts and angles



The importance of talking about kWh

Improve your yield with ZEBRA

- › **Resistant to LID and LeTID**
- › Market leading power stability over time (93% at the 25th year)
- › **Improved low light performance**
- › Better yield at various tilts
- › No shading on the cell
- › **Improved behavior under partial shading**
- › ZEBRA cells do not degrade under UV illumination
- › Bifaciality



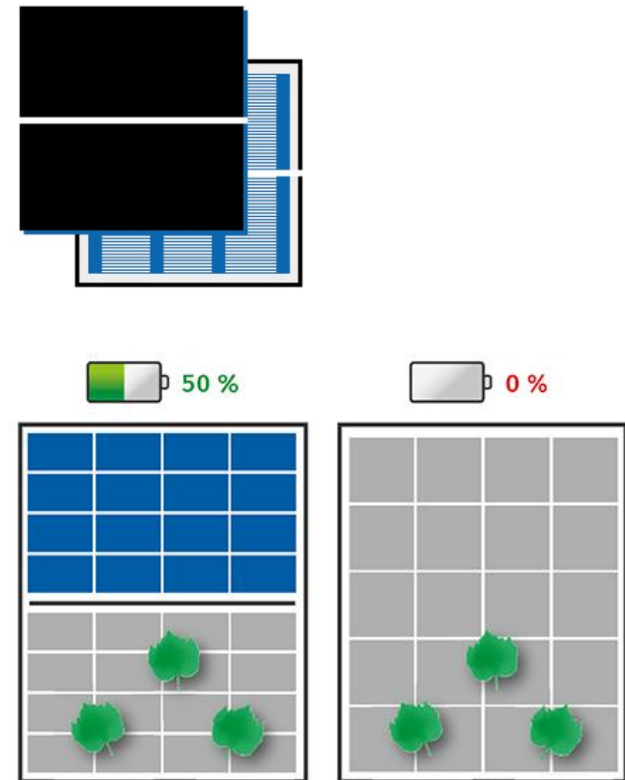
 kWh

ZEBRA – PARTIAL SHADING 1°

Improved behavior under shaded conditions

Special benefit for residential applications

- › **ZEBRA - IBC module with half-cut cells**
- › 2 independent section design secures a higher energy yield under shaded conditions
- › **Shading, a typical problem of residential installations**
- › **Simplifies the design of the installation**
- › Minimize the need of optimizers



ZEBRA – PARTIAL SHADING 2°

Improved behavior under shaded conditions

Moreover, thanks to the distributed junction, **ZEBRA** cells have a low break down voltage. This benefit the module behaviour under partial shading as a larger shaded area is needed to turn on the bypass diode.

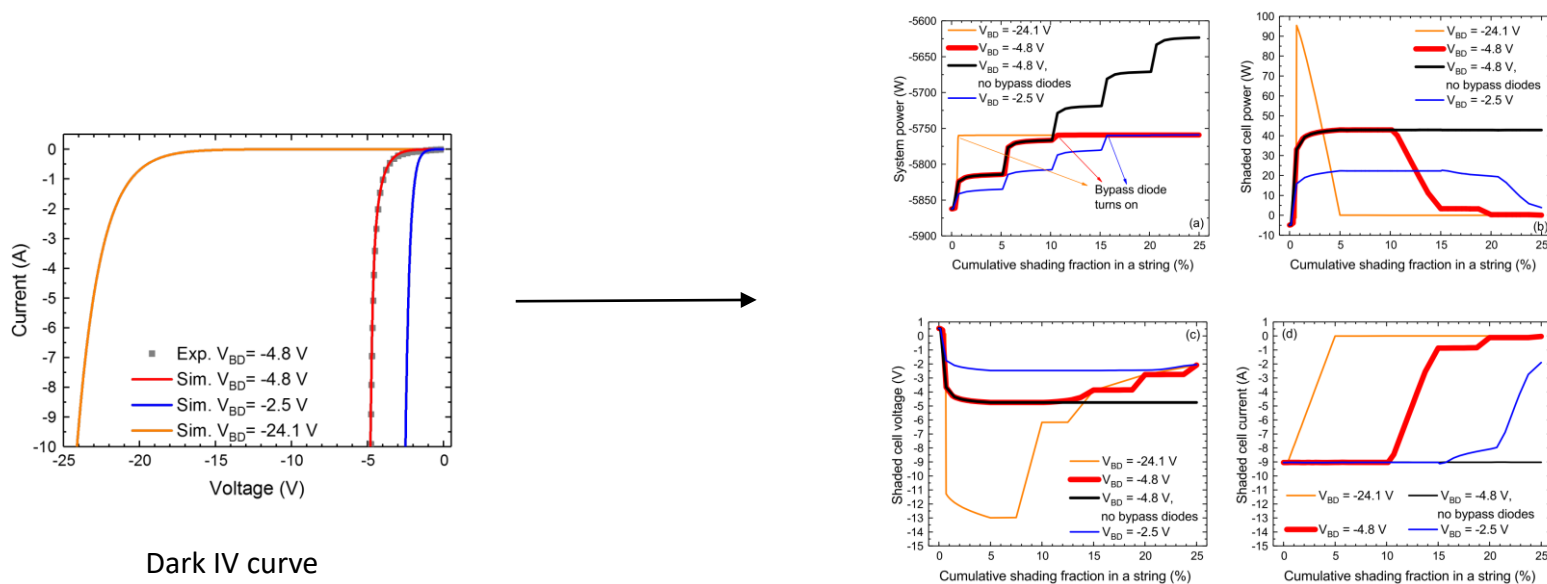
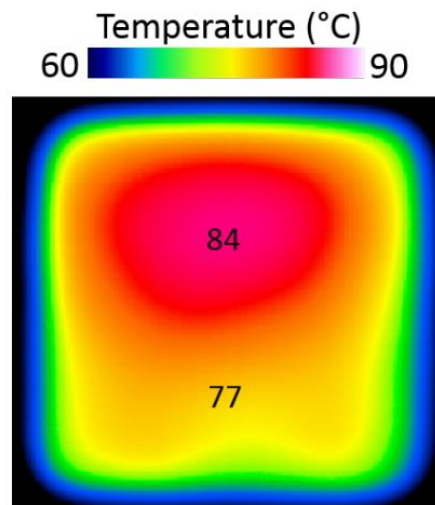


Figure 5.42: Simulation results: comparison of solar cells with different breakdown voltages. System power (a), shaded cell power (b), shaded cell voltage (c), and shaded cell current (d) are plotted against the cumulative shading fraction in a string. One string consists of 20 solar cells.

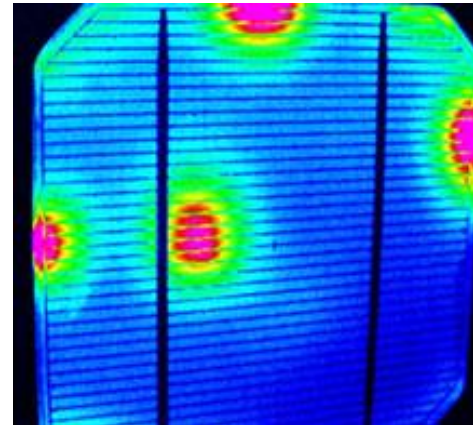
ZEBRA – PARTIAL SHADING 3°

Lower Hot-spot risk

Thanks to the distributed junction, **ZEBRA dissipates** in reverse bias conditions the **heat** over a larger area and stays at a lower temperature, **minimizing the risk of damaging the panel.**



ZEBRA IBC CELL



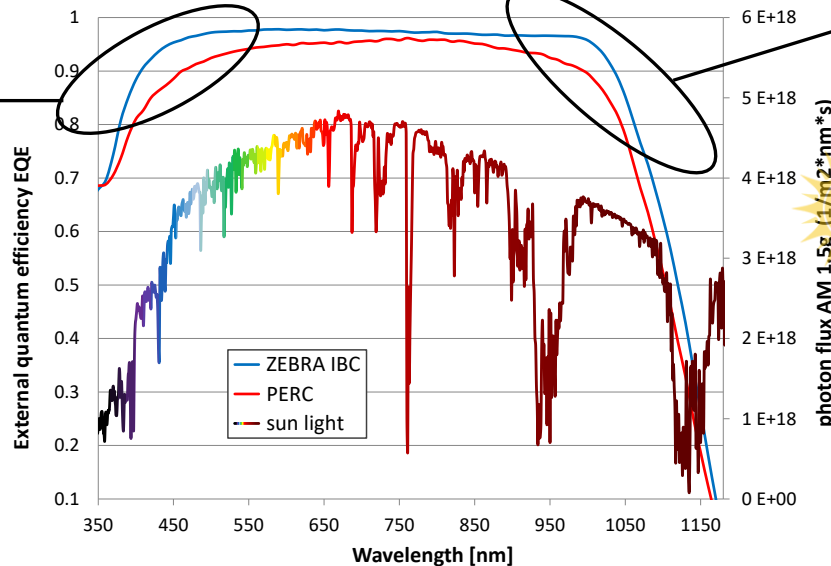
PERC CELL

ZEBRA

Improved low light performance

The ZEBRA cell can gather **more light at every wavelength** thanks to the unshaded front side and even at **low irradiation levels ZEBRA maintains high efficiency allowing a better energy yield.**

Higher generation on **cloudy days**, when **light is shifted to blue**



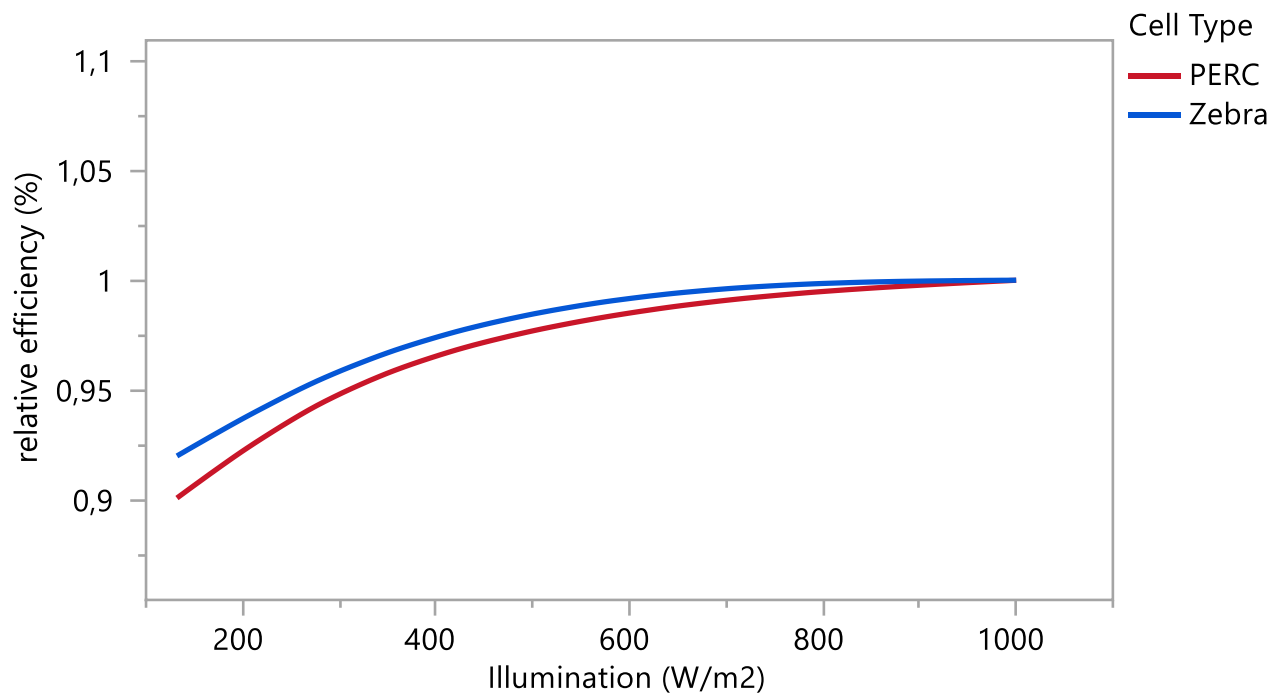
Higher generation in the **evenings**, when **light is shifted to red**

EQE comparison of ZEBRA cell with industrial 9BB PERC cell, measured at **ISC Konstanz**

ZEBRA

Improved low light performance

Compared to PERC cells the biggest differences are found at short and long wavelengths due to a **better surface passivation**.



EQE comparison of ZEBRA cell with industrial 9BB PERC cell, measured at **ISC Konstanz**

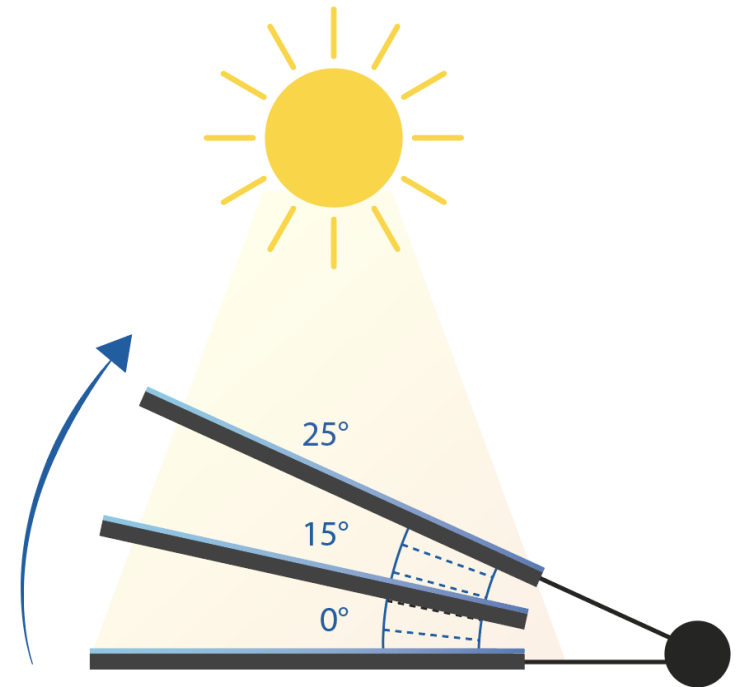
ZEBRA

Better yield with various tilts

Test to check the operation at different angles compared to perpendicular **STC conditions**.

Angle	Power ZEBRA	Power PERC
0°	100.0%	100.0%
20°	98.6%	97.1%
25°	94.8%	93.2%

Angle 0° is corresponding to perpendicular STC



ZEBRA Pro

Excellent temperature coefficient



The **temperature coefficient** indicates the module's power loss with **increasing temperatures**.

A low temperature coefficient **ensures a higher yield during hot weather conditions**.

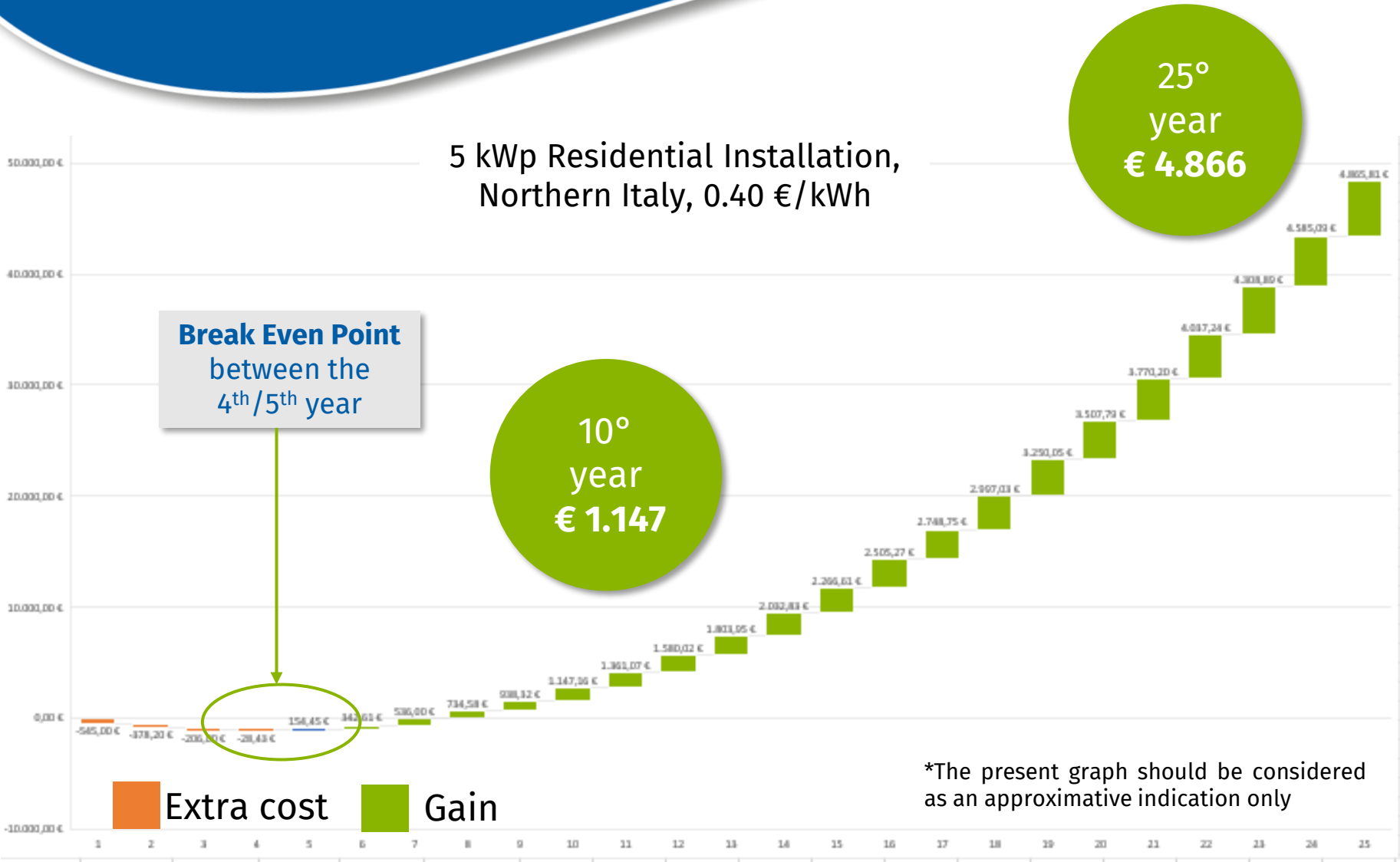
ZEBRA voltage 700 mV – ensures a low temperature coefficient.

Excellent temperature
coefficient of
-0,29%/°C



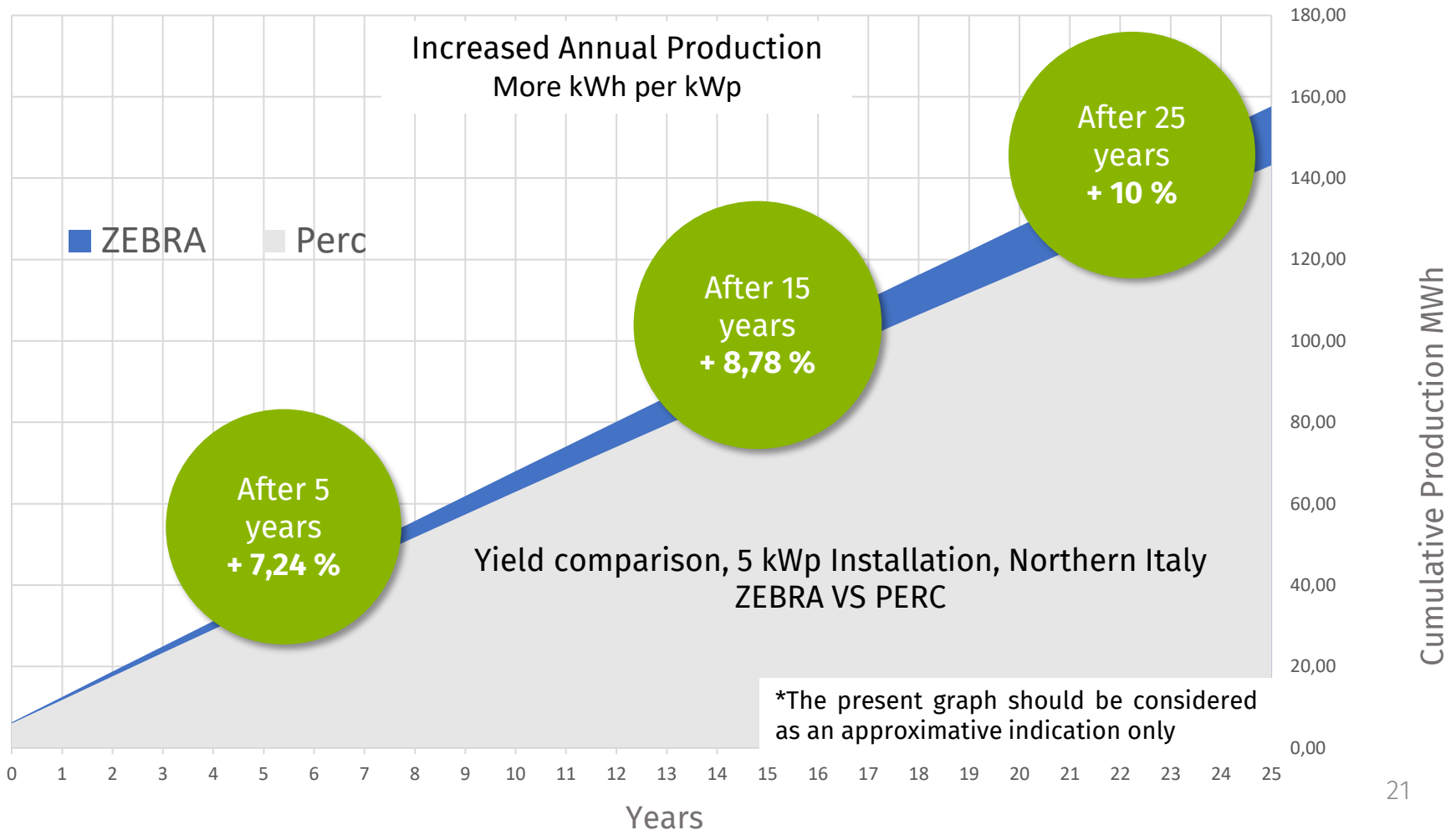
Accumulative financial gain over time

IBC ZEBRA Vs PERC
Residential



More kWh per kWp

Comparison to traditional installations Residential

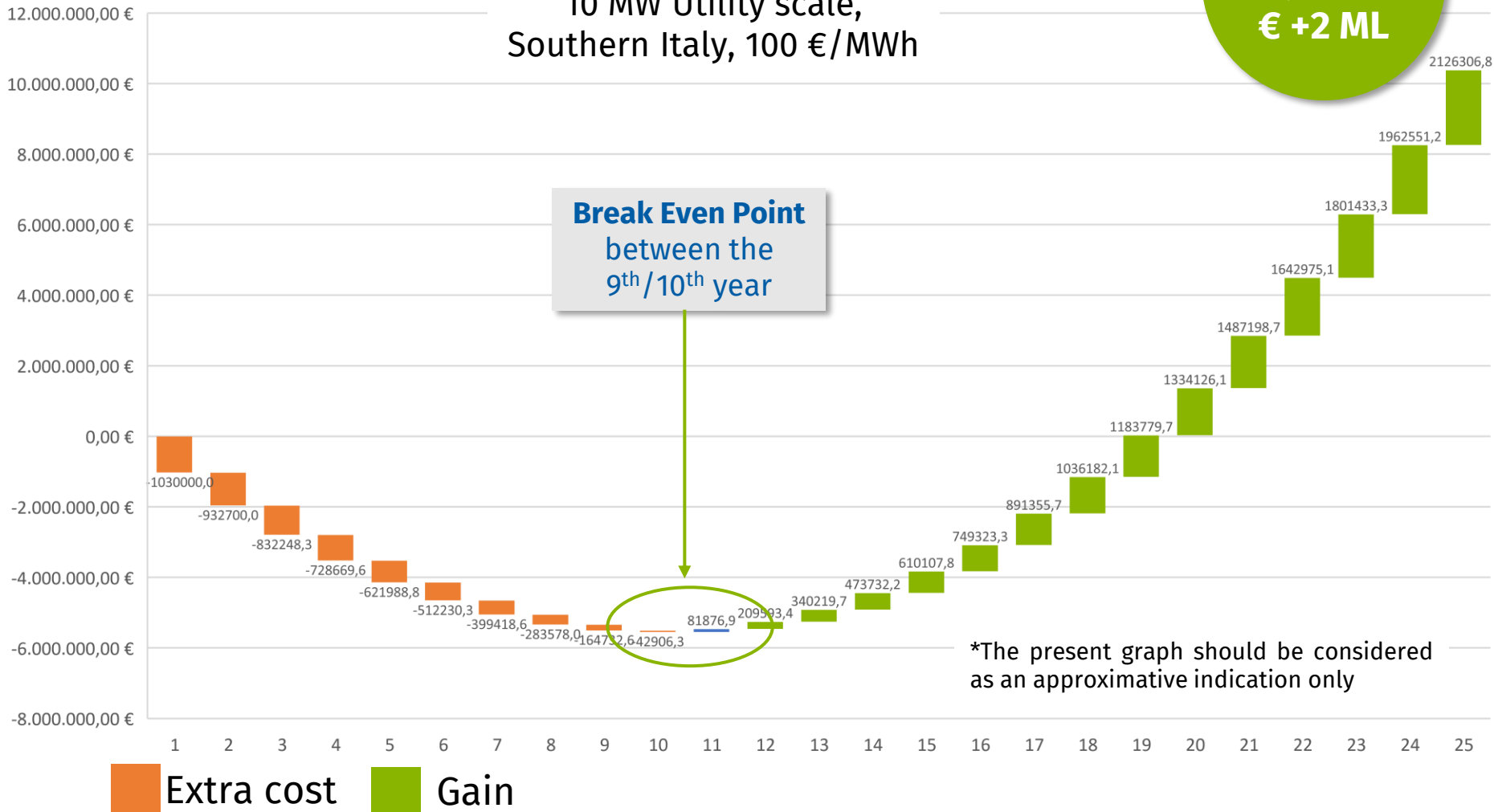


Accumulative financial gain over time

IBC ZEBRA Vs PERC
Utility scale

25°
year
€ +2 ML

10 MW Utility scale,
Southern Italy, 100 €/MWh



SAY IBC

THINK ZEBRA

- › Perfection in aesthetic design
- › Superior energy performance
- › **More kWh per kWp**
- › Reliability & Availability
- › Competitive cost compared to other high-end panels



ZEBRA Warranties

Market leading power stability over time
(93% at the 25th year)



PERFORMANCE GUARANTEE

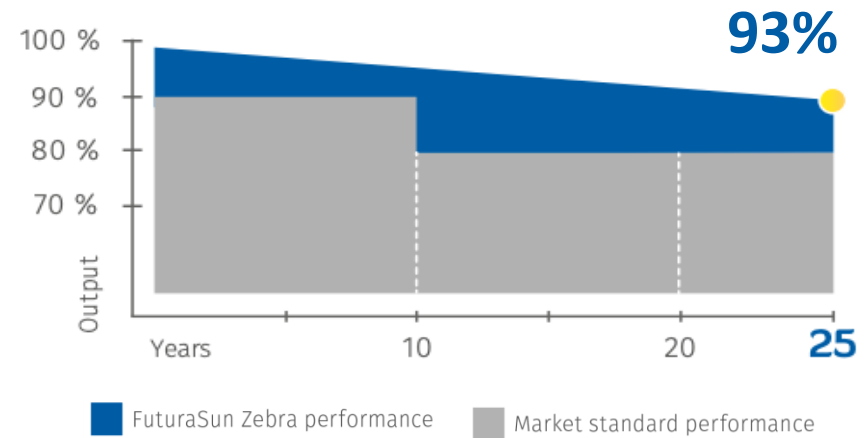
Max power decrease 0.25%/year

1st year degradation < 1,0%

99 % at the end of first year

93 % at the end of 25th year

Product guarantee 25 years



THE PAST

- › **Europe was the main player** in the development of the photovoltaic industry in terms of **R&D** and **supply chain**
- › Europe had a **strongly incentivized market** for the **end user**
- › Quick spread of the photovoltaic culture as a **sustainable and profitable energy choice**



BUT WHAT HAPPENED IN LESS THAN A DECADE?

BOOM → MATERIAL SHORTAGE →
ASIAN SUPPLY CHAIN GROWTH →
OVER CAPACITY → PLUMMETING PRICES
→ END OF TARIFFS →

WHAT WENT WRONG FOR EUROPE ?

A strongly stimulated market but without adequate supports for the industries present in Europe.

**GAME
OVER**

EU SUPPLY CHAIN



THE PRESENT

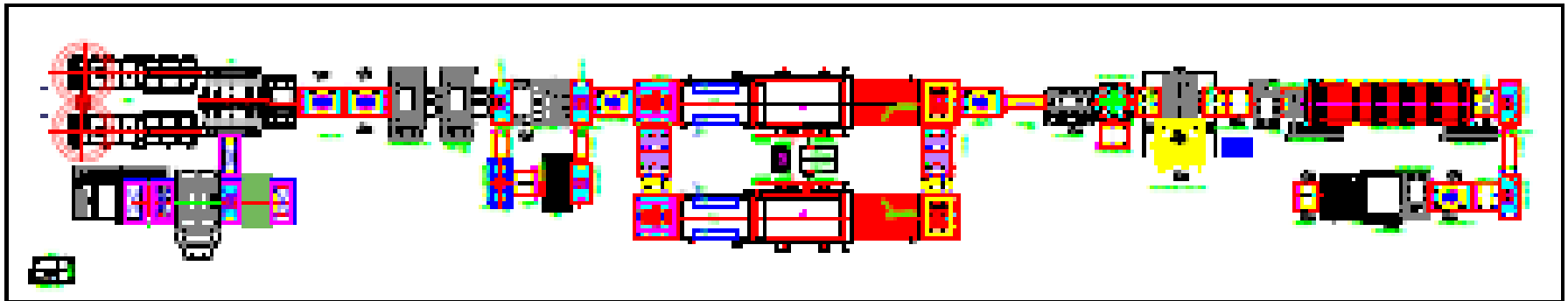
Never as today **energy independence** has been this important and with a future energy demand from renewable sources that will exceed the existing production capacity, **it will become strategic for Europe to restore the photovoltaic supply chain** to meet the decarbonization targets set for 2030.



Today EU wants to support the industry but
it will take time to recreate a true European supply chain

OUR PLAN EUROPE ZEBRAS

- › 50 MW pilot line in Italy ~ Q1 2023;
- › Development of **bifacial glass-glass ZEBRA modules**;
- › ~ 2024 **European supply chain** also for **European ZEBRA cells** from **EURECA** partners
- › Pilot line turns into GIGA fab...



Thanks for your attention!

For further information, please don't hesitate to contact us!



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Italian Company



State of the art certifications



Full range of PV solutions from stand-alone to utility scale



Worldwide installation track record



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