



**FuturaSun<sup>®</sup>**

*anticipate tomorrow*

## IBC ZEBRA module GigaFactory in Italy

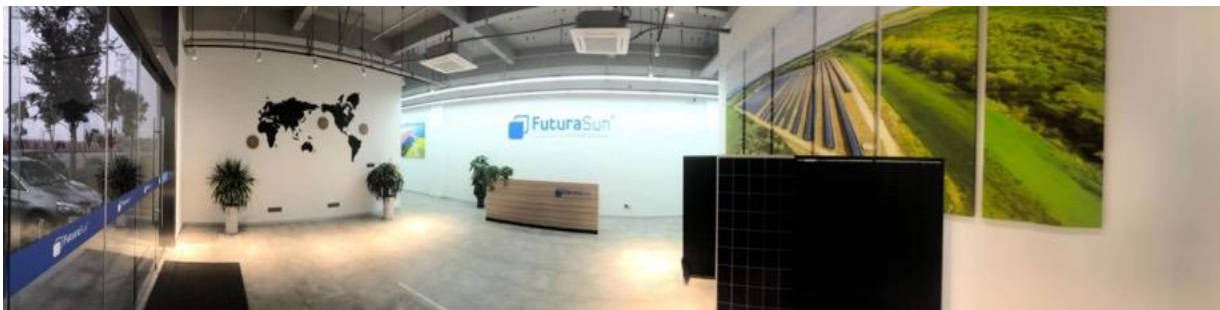
Presented by Lisa Hirvonen  
November 22 - 2022

# The Company

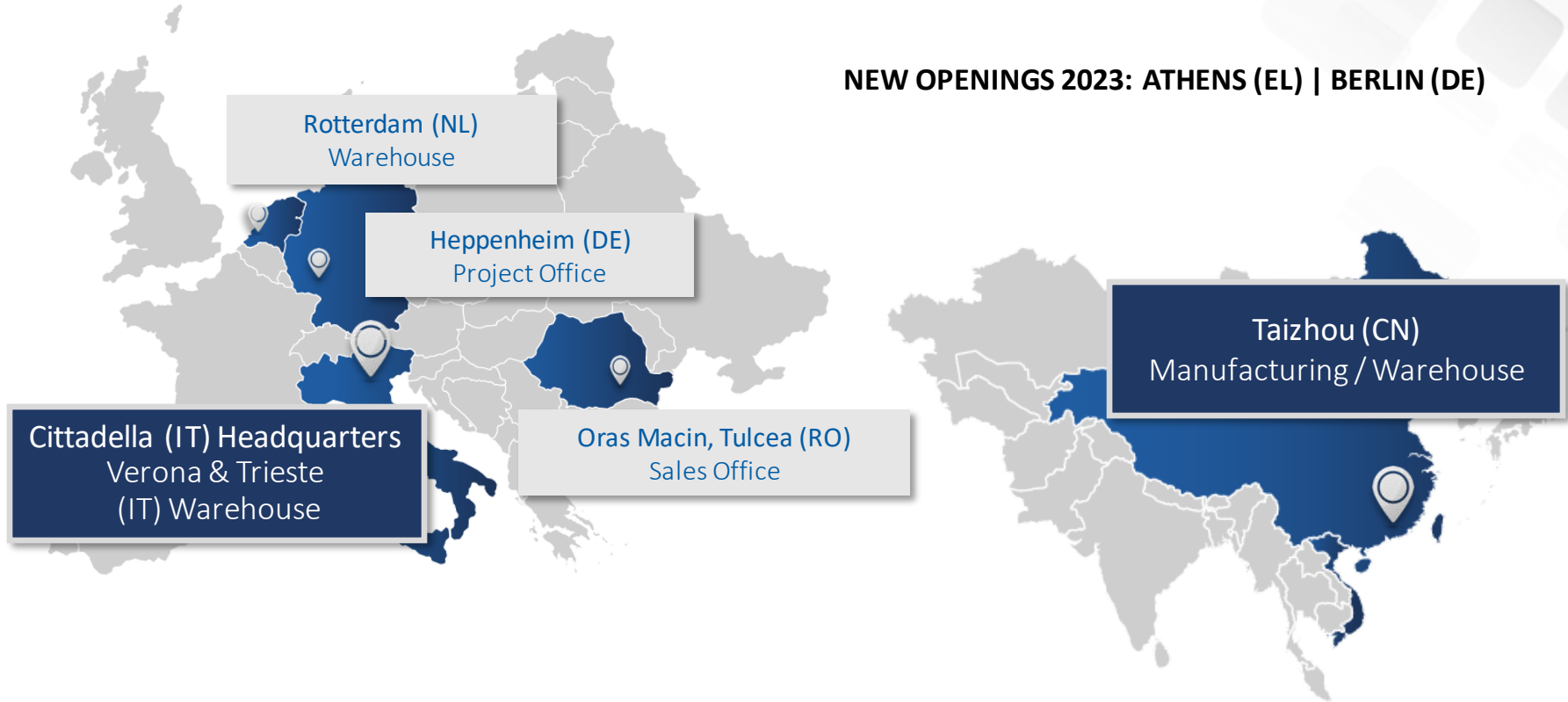
**1 GW**

**PRODUCTION  
CAPACITY**

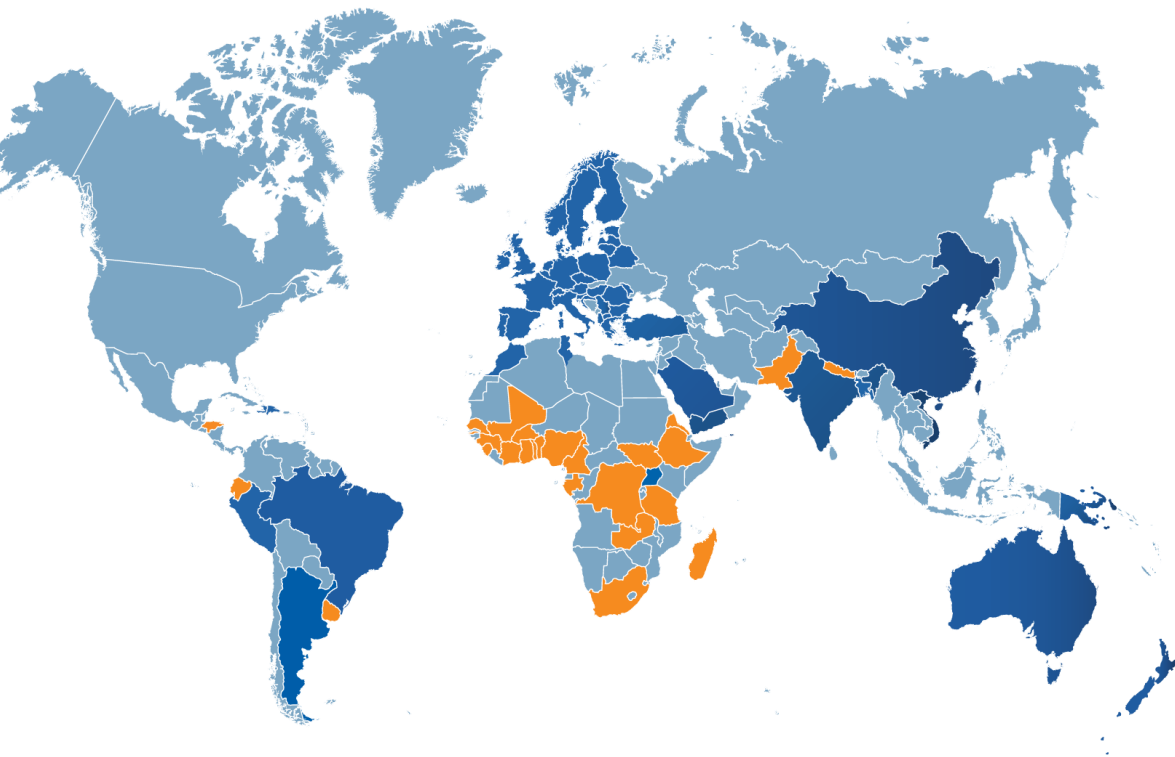
- FuturaSun was founded by a group of young industry experts in 2008
- It's an Italian company specialized in the manufacturing and sale of PV modules
- FuturaSun is the only Italian module manufacturer with exclusive property of its own factory in China



# Locations Worldwide



# FuturaSun in the World



**70**

**COUNTRIES  
SERVED**

**+500**

**CUSTOMERS**

**OffgridSun**  
leading-edge technology for energy access

OffgridSun is a FuturaSun Group company specializing in off-grid and solar lighting products for emerging markets.

# The Company

- 2 production plants situated in Taizhou, with an **annual production capacity of 1 GW**
- The highly automated production lines can process PV cells up to 210 mm half/third-cut multi-busbar







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 **ZEBRA**<sub>Pro</sub>  
*Technology Inside*

# N-Type IBC

## 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 25<sup>th</sup> 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 or gallium
- One electron less making it positively charged
- Suffers from LeTID and LID if boron doped
- 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

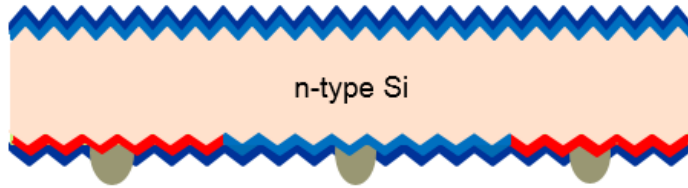




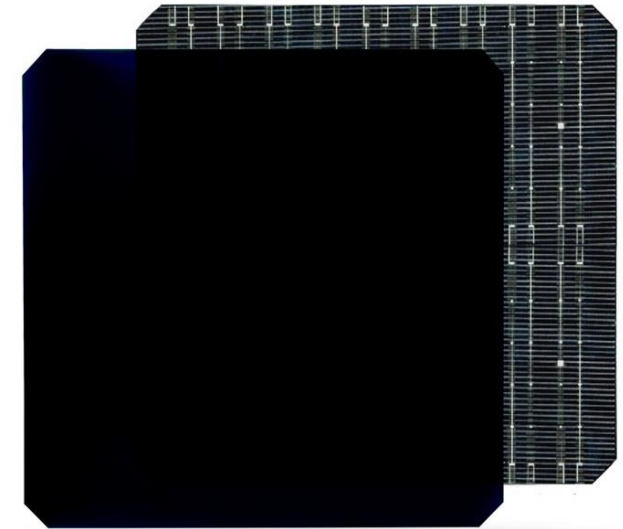
# ZEBRA Pro

## IBC cells

- 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

# ZEBRA Pro series

## 132 half-cut cells



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



# ZEBRA Pro series

Standard White | FU420-430M  
Total Black | FU415-FU425M



Dimensions:  
1895x1039x30 mm



132 cells  
half-cut IBC

166 mm

Superior module efficiency up to 21,84%  
More energy on less space

● Black frame as standard for a better  
aesthetical apperance

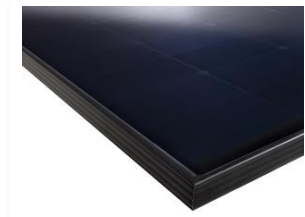
# ZEBRA Pro series

## Total Black | FU415-FU425M

- Available also with an elegant totally black design
- Particularly suitable for buildings with a high architectural value



**ZEBRA<sub>Pro</sub>**  
*Technology Inside*

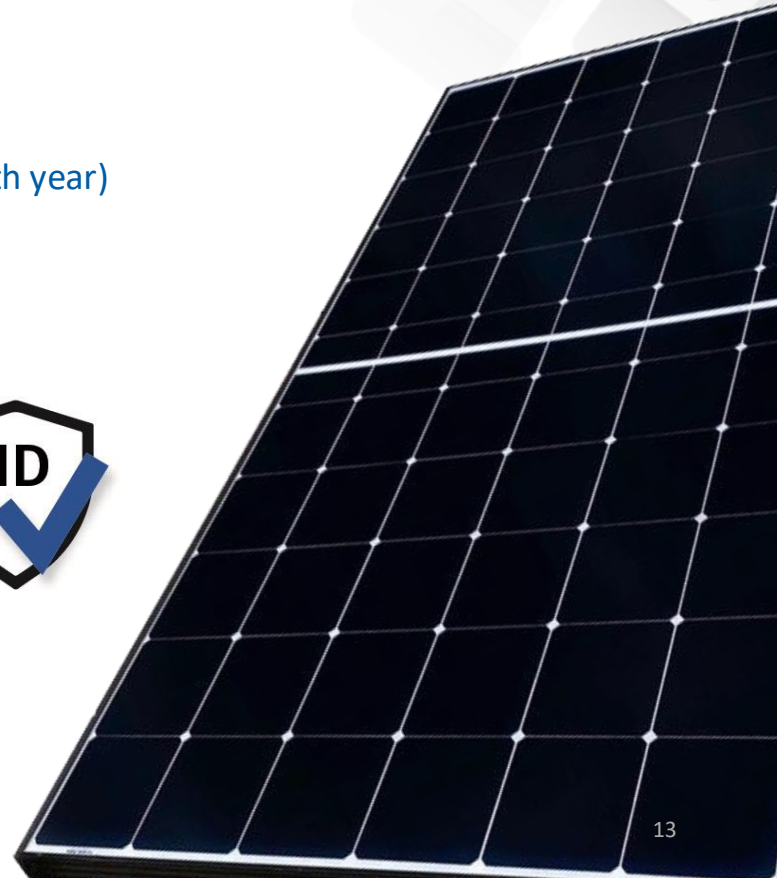


# ZEBRA

## Improve your yield with ZEBRA

- Resistant to LID and LeTID
- Market leading power stability over time (93% at the end of the 25th year)
- Improved low light performance
- Better yield at various tilts
- No shading on the cell
- Improved behavior under partial shading
- Excellent temperature coefficient of  $-0,29\% / ^\circ\text{C}$
- ZEBRA cells do not degrade under UV illumination
- Bifaciality

 kWh





# ZEBRA Pro

## Warranties

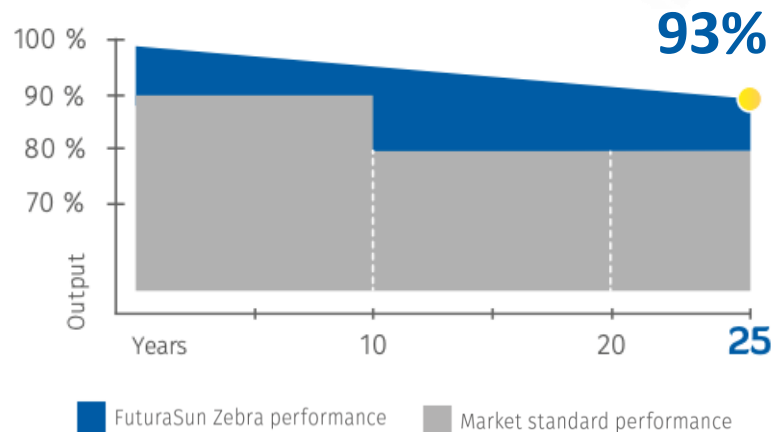
Max power decrease 0.25%/year

1<sup>st</sup> year degradation < 1,0%

99 % at the end of first year

93 % at the end of 25<sup>th</sup> year

Product guarantee 25 years



# ZEBRA Pro

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## Summary

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

**SAY IBC  
THINK ZEBRA**



# ZEBRA Pro series

## Cell interconnection



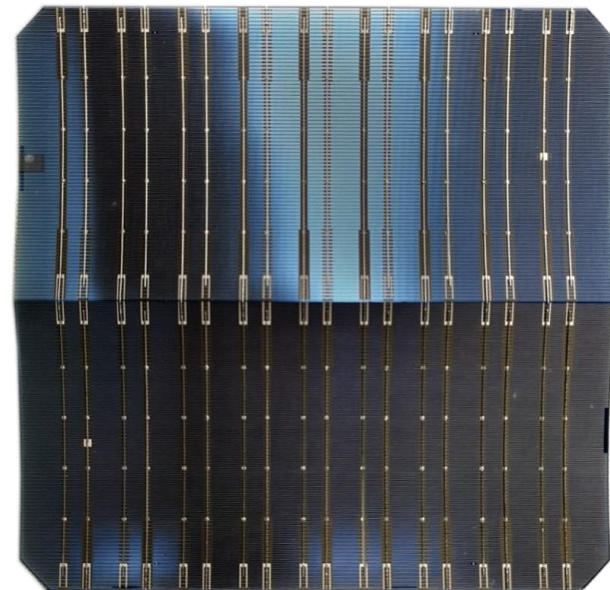
**Interconnection**  
by «traditional»  
stringing



**Traditional  
manufacturing  
process** regarding  
the module assembly



**9 bb**  
becomes  
**18 bb**



# ZEBRA Pro series

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## Cell interconnection

### DIFFICULTIES WITH A STANDARD TECHNOLOGY FOR ZEBRA CELLS

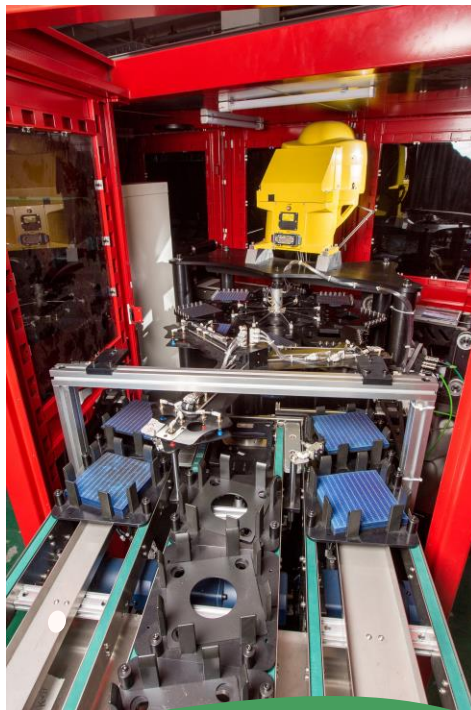
- Soldering of only the back side tends to create a notable bending of the cell due to the thermal return of the ribbon;
- This problem exists also on normal cells but as both sides are soldered the consequences are less noted;
- The mechanical tensions, either if connected on both sides or on one side only, remain active during the module's lifetime and could create, in severe cases, quality problems



# ZEBRA Pro series

## Standard Cell interconnection

Development of a FuturaSun stringer machine to simplify the soldering of MBB standard cells



**Patent EP3493278B1**

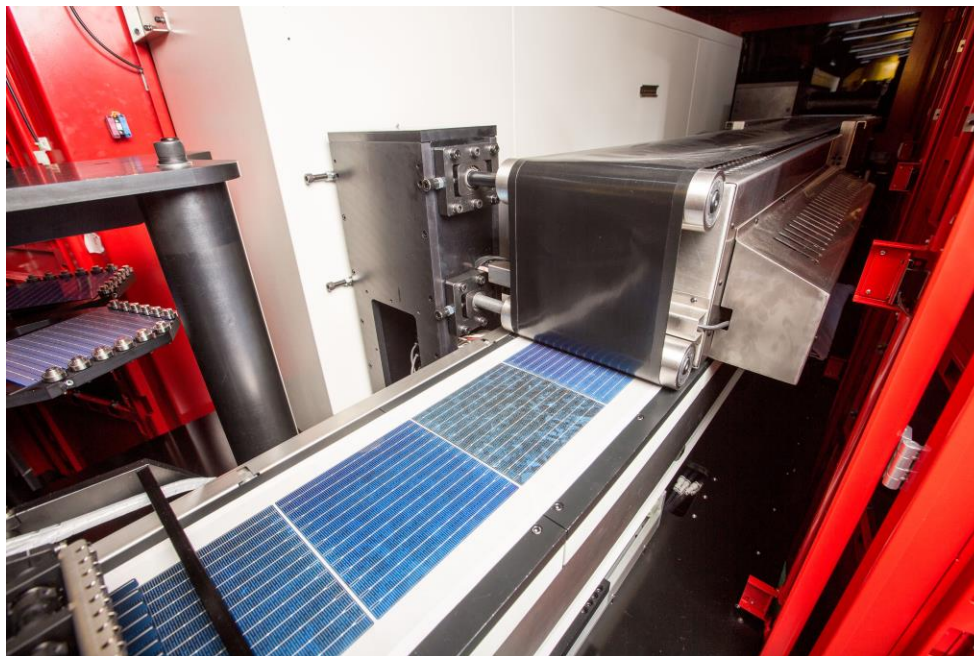


# ZEBRA Pro series

## Cell interconnection

### OUR PATENT IN A STANDARD SOLUTION

- Two conveyor belts are mated together encapsulating the cells and the ribbon still to be soldered;
- Vacuum is created between the two belts and atmospheric pressure keeps the belts on the entire cell surface;
- Induction heating brings the coating of the ribbon to its melting point and the soldering of the string is performed;



# ZEBRA Pro series

## Cell interconnection

### THE NEW ZEBRA STRINGING CONCEPT

- The cells and the ribbon will be distributed on the principal conveyor;
- The concept of the patented solution will be maintained;
- During the forward movement of the soldering system the mated belts will be curved mechanically;
- The created curve is studied to be the opposite of the curve created during soldering;
- The soldered string exits from the mated belts without curving and without mechanical tension

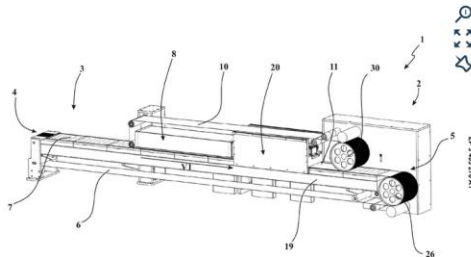
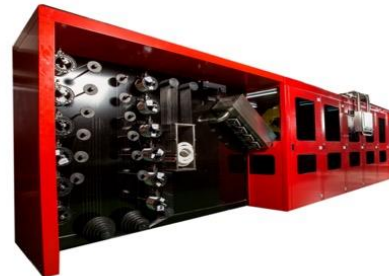


Fig. 1



# ZEBRA Pro series

## Cell interconnection

### THE NEW ZEBRA STRINGING CONCEPT - KEY POINTS



#### **SIMPLICITY**

Thanks to the IBC structure of the cell



#### **FLEXIBILITY**

The new concept will be studied to handle ribbon with different technical specifications, cell sizes and metallizations (silver free)



#### **COST EFFECTIVE**

Low cost equipment for a quick return of investment



The project has received funding from the European Union's Horizon programme

Grant agreement No.  
101084259

# Company vision

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## What's cooking

### 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 spreading of the photovoltaic culture as a sustainable and profitable energy choice

# Company vision

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## What's cooking

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 support for the industries present in Europe.



**GAME  
OVER**

EU SUPPLY CHAIN



# Company vision

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## What's cooking

### THE PRESENT

Today, like never before, **energy independence** has been this important and with photovoltaics now proven to play a key role for the European energy needs it is now strategic for **Europe to restore the photovoltaic supply chain**.

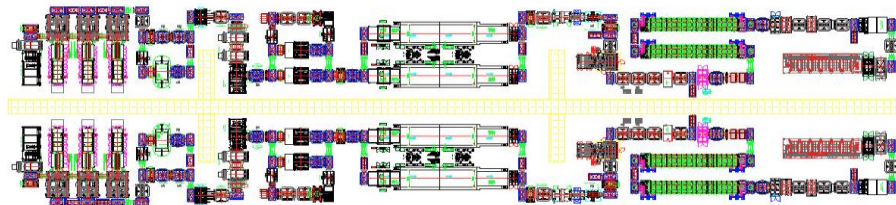
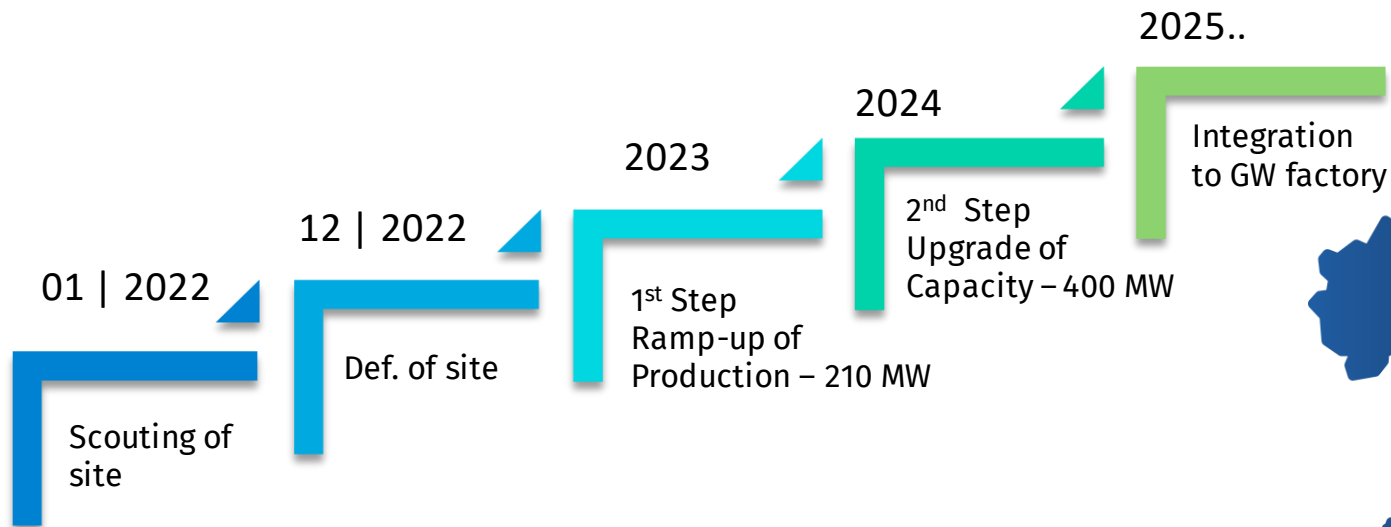
### OUR CONTRIBUTION

European ZEBRAs



# 2023 - What's Cooking?

## EU Manufacturing and R&D





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Thank you for your attention

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**SAY IBC  
THINK ZEBRA**