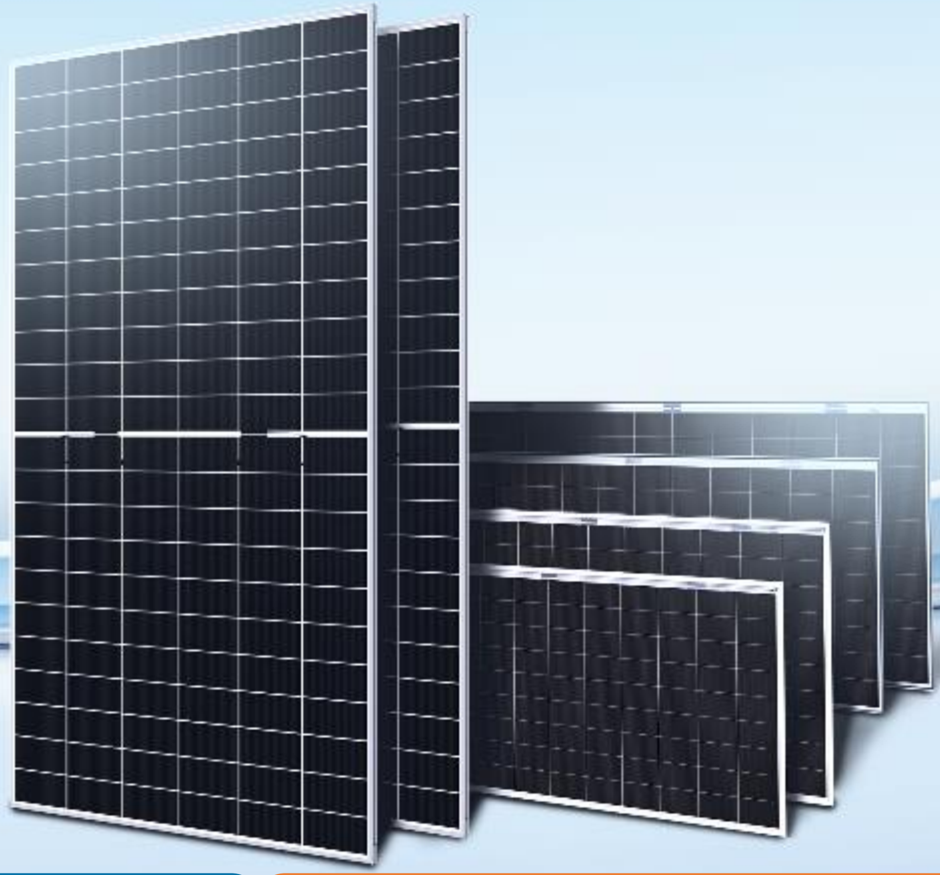
NO. 1 in Heterojunction

Vertical PV and Batteries
—
Maximizing the Market Value of PV in the Next Decade



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PART 1

Company Profile

About Huasun

Sales Center

Nanjing·Jiangsu

Headquarters

Xuancheng·Anhui

Manufacturing Facilities

Xuancheng·Anhui
Hefei·Anhui
Wuxi·Jiangsu
Dali·Yunnan
Yinchuan·Ningxia

20GW

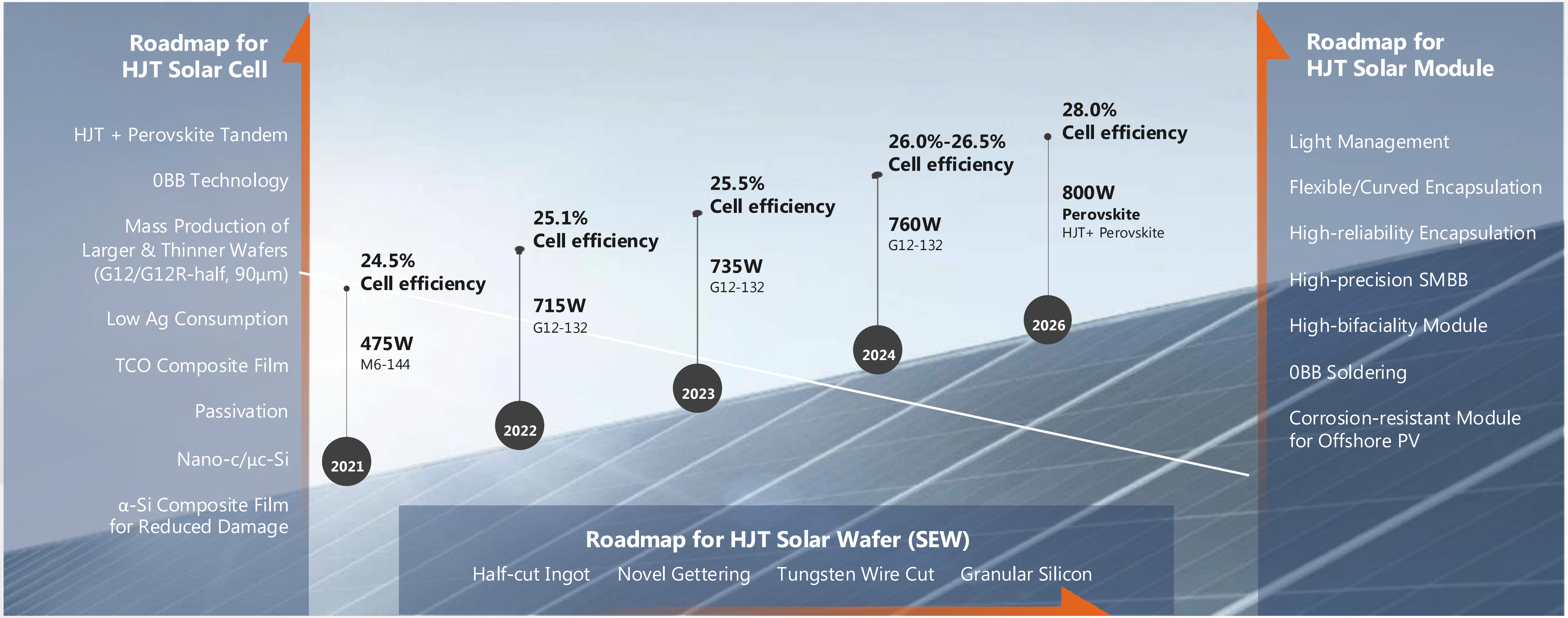
Annual Capacity of HJT Products

Roadmap

Huasun continuously innovates by integrating HJT with other advanced technologies, enabling us to enhance efficiency and reduce costs across our product lines.

800W+

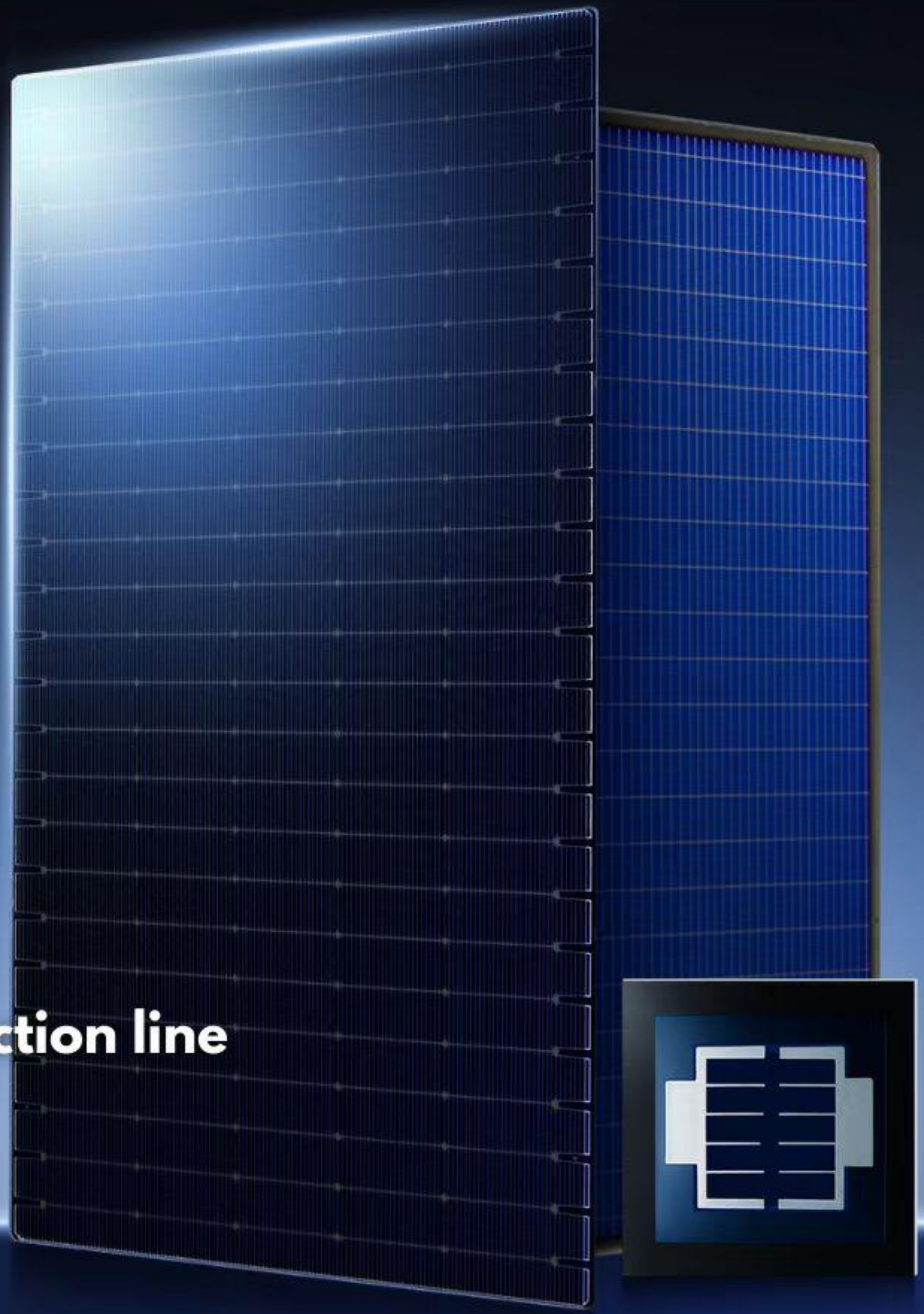
HJT + Perovskite + 210mm Wafer



HUASUN

- **34.02%** efficiency achieved in small-size laboratory HJT-perovskite tandem cells

- **29.01%** efficiency achieved in large-size HJT-perovskite tandem cells on the production line



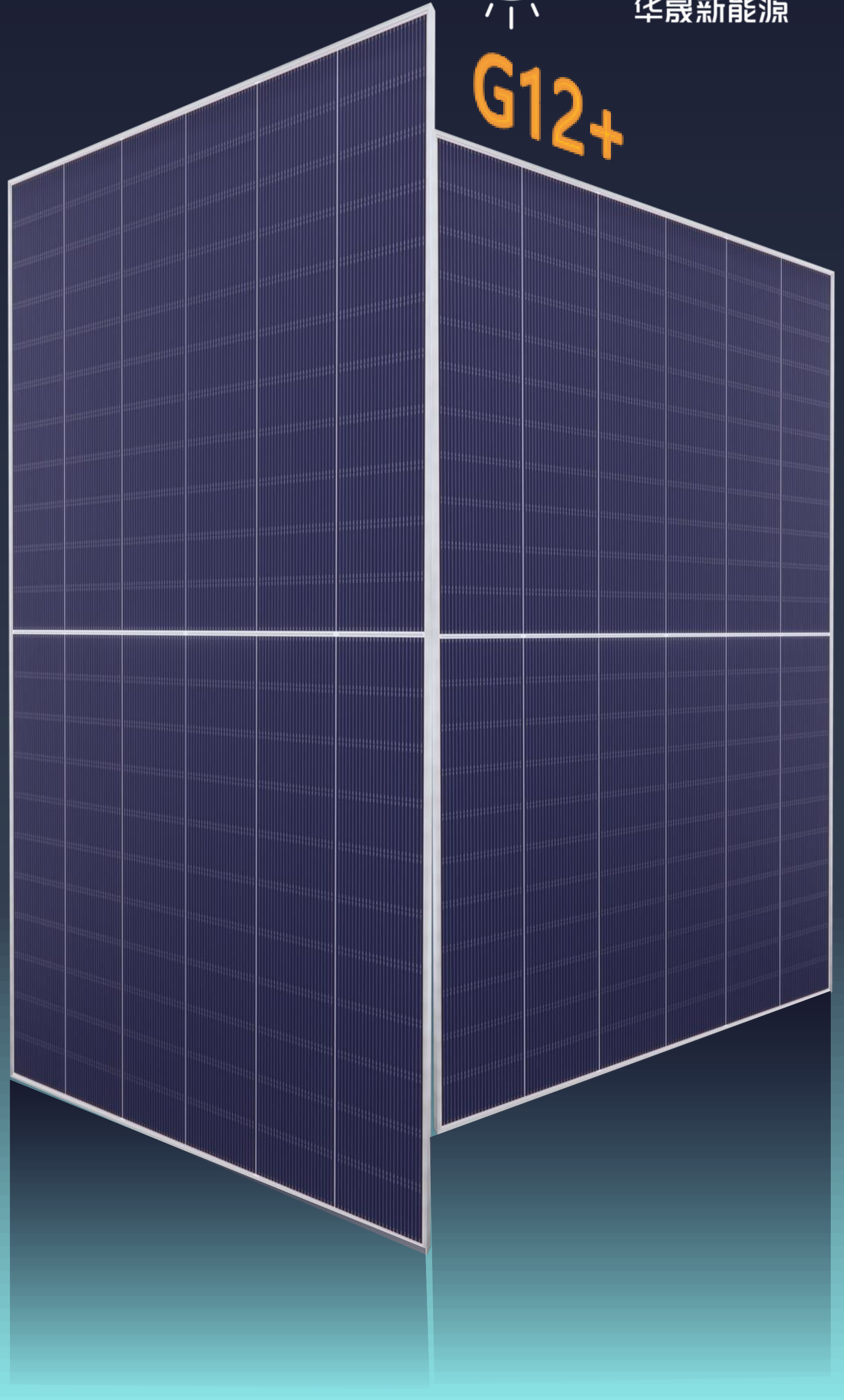
Himalaya PLUS 760HV

760W Module Power

24.5% Module Efficiency

2000V System Voltage

HUASUN
华晟新能源



- **Enhanced Reliability**
  - Anti-Migration & Light-Converting Film
- **Advanced Solution for Narrow Creepage Distance**
  - Butyl Rubber Encapsulation
- **High Density Cell Layout**
  - Maximized Active Area
- **Superior System Solutions**
  - Reduced Balance of System (BOS) Costs

PART 2

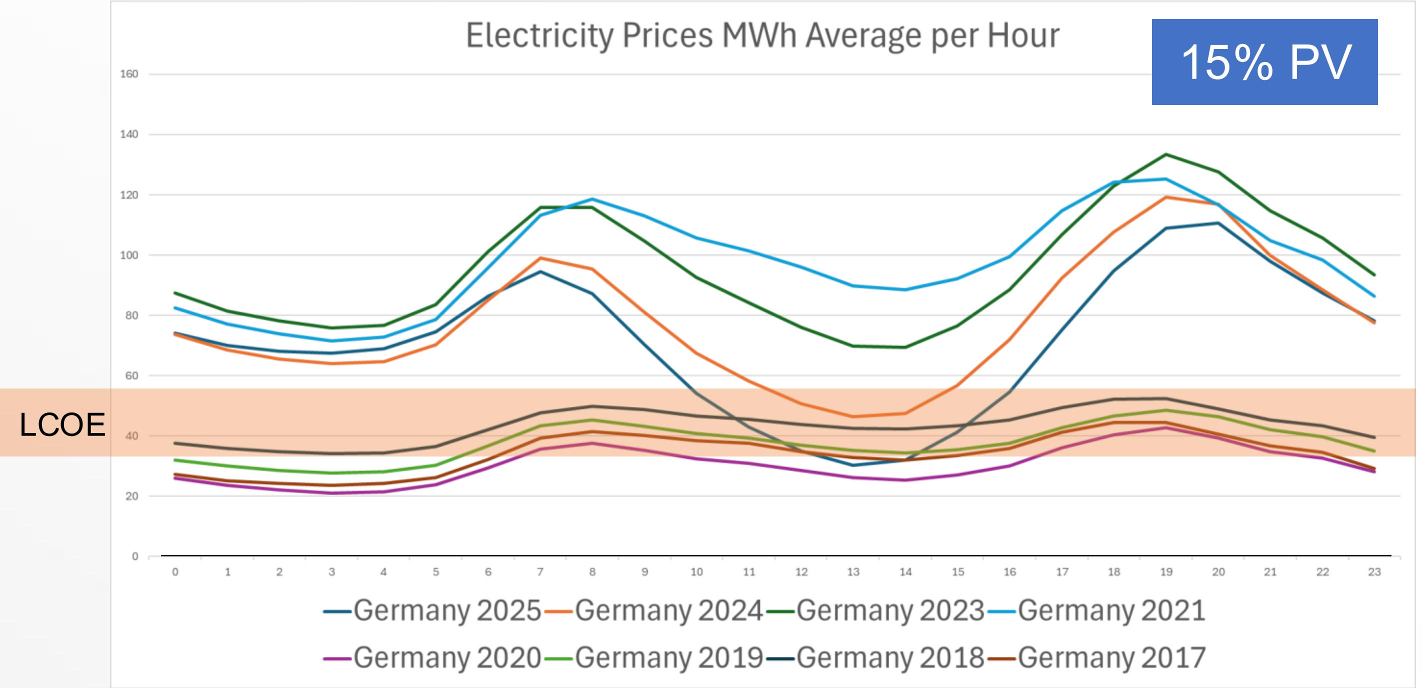
Motivation

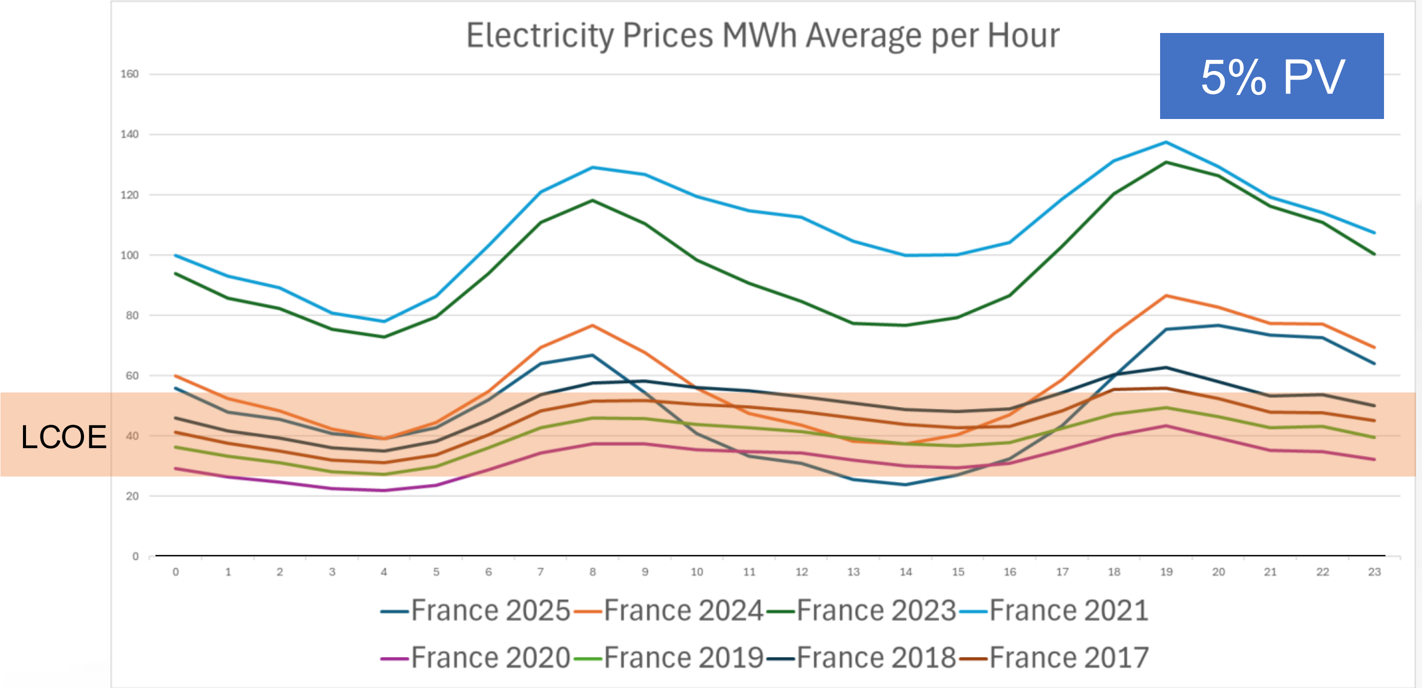
A success story leading to a complicated situation

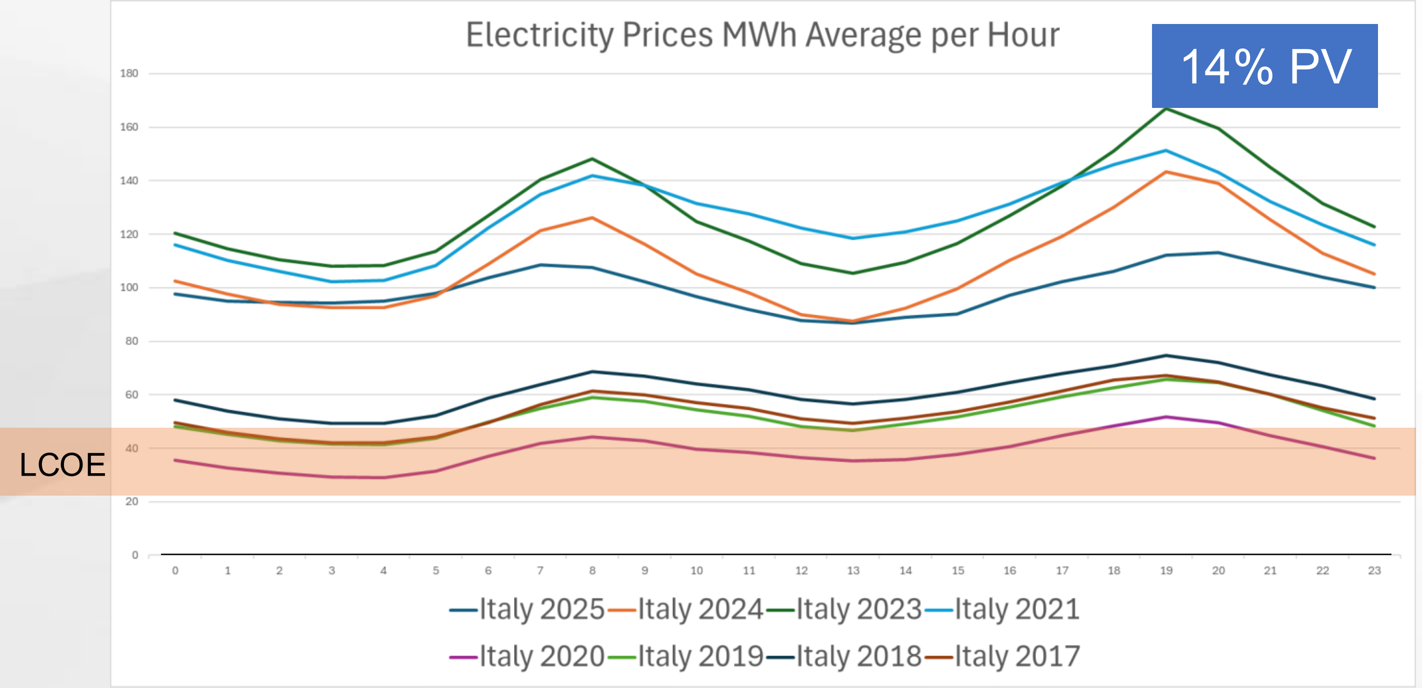
When PV started, it was a footnote in the energy mix.
In 2025, it is one of the most important contributors to energy consumption in some of the most industrialized countries.

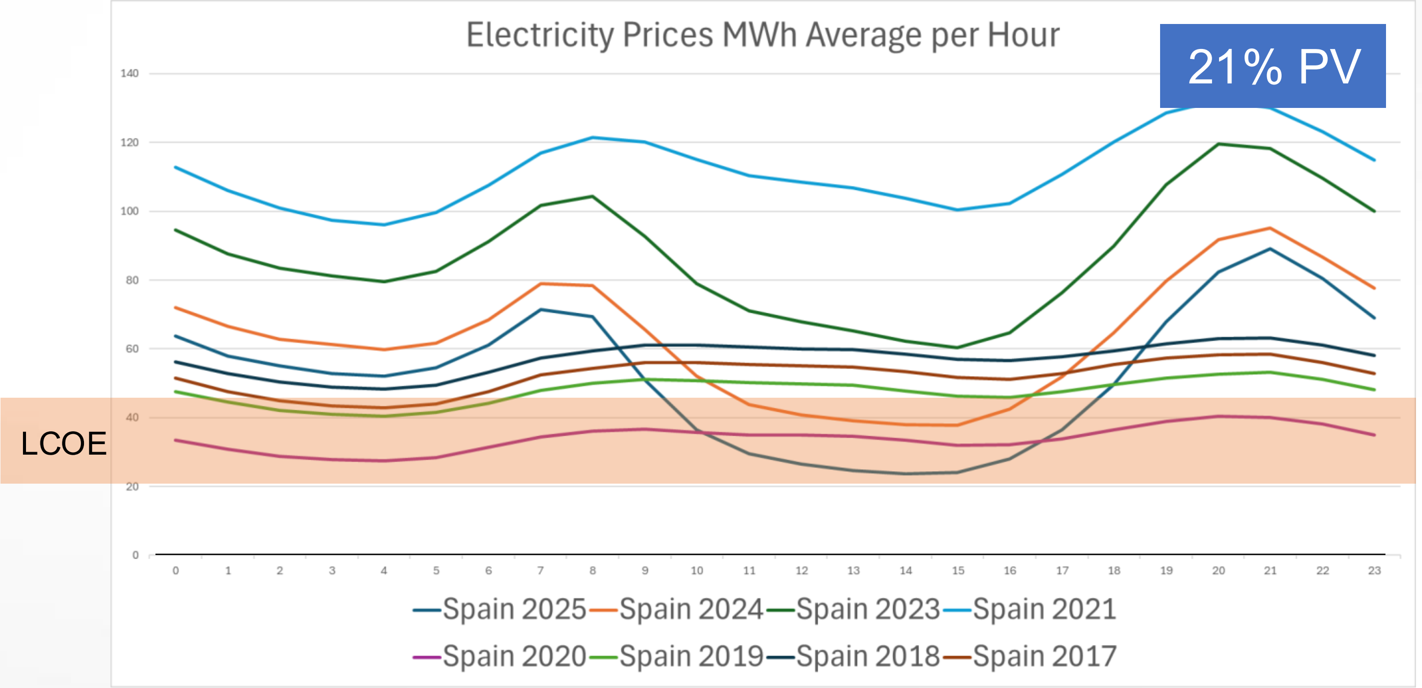
This has had a visible effect in electricity prices in the market.

Tough times for merchant PV in Europe



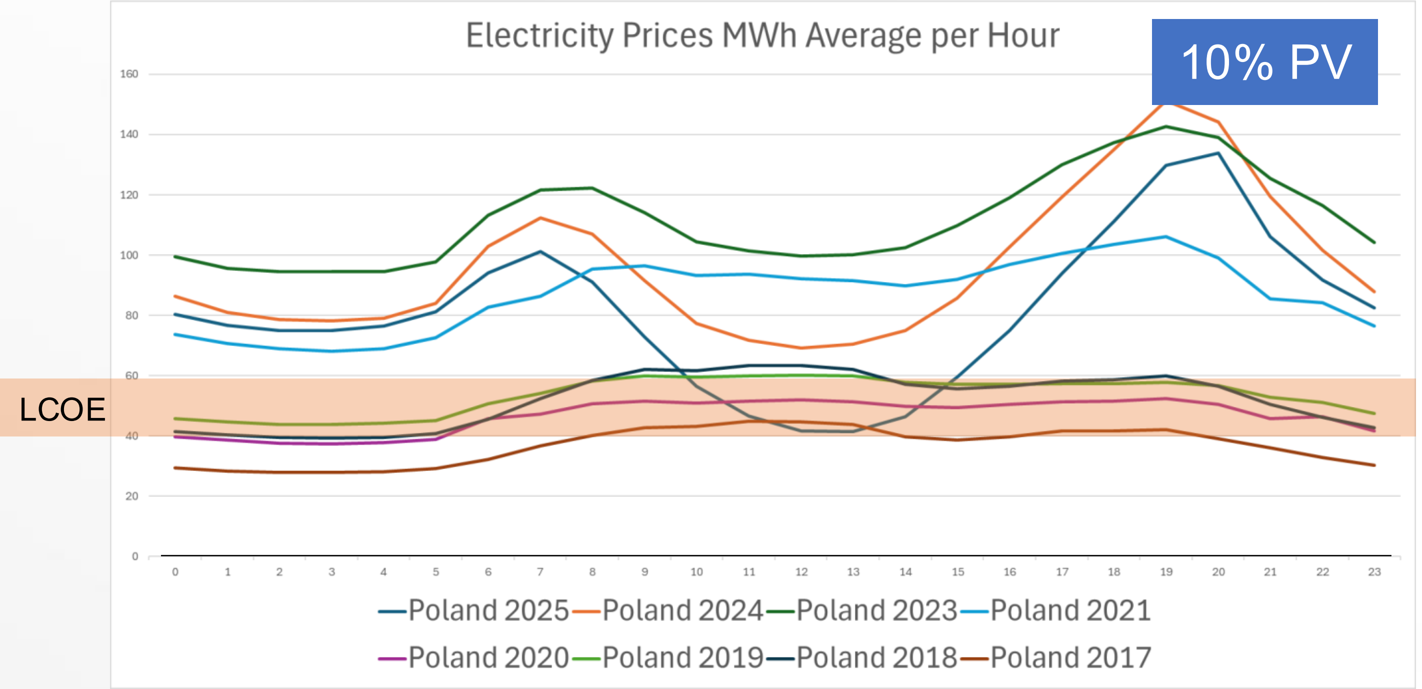


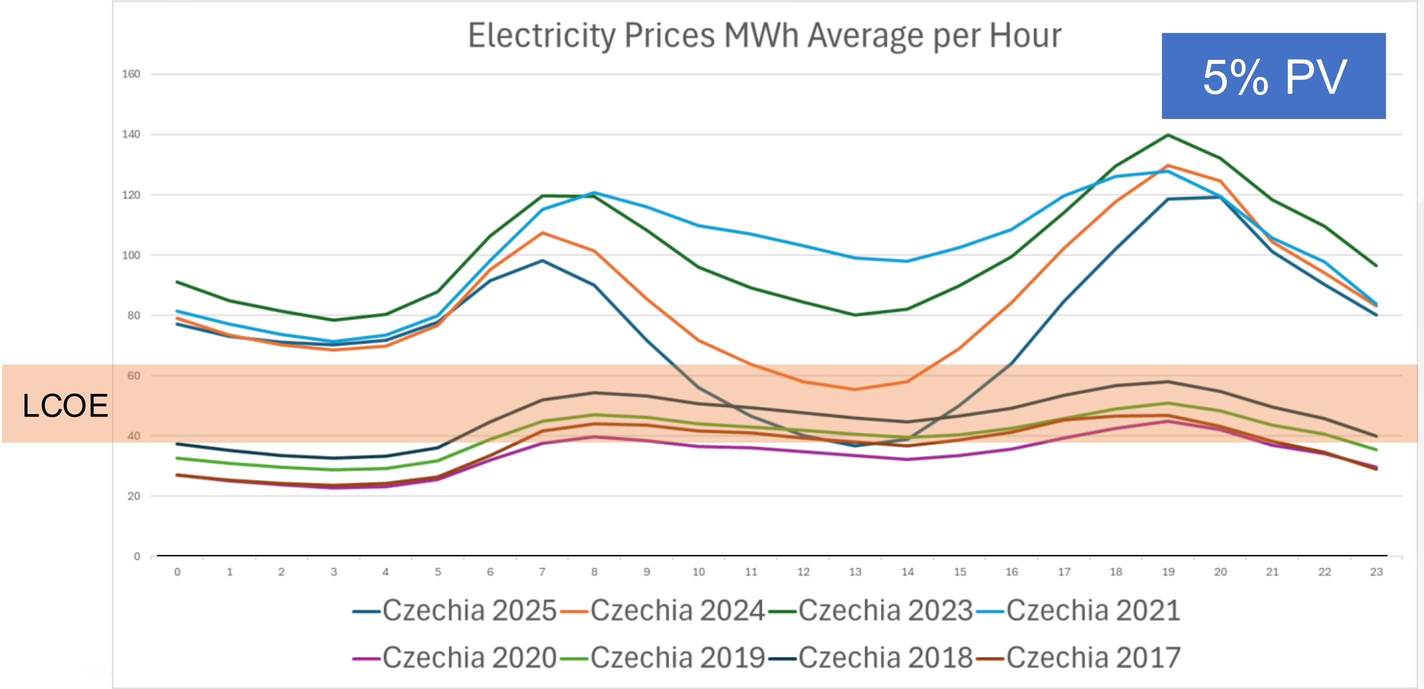


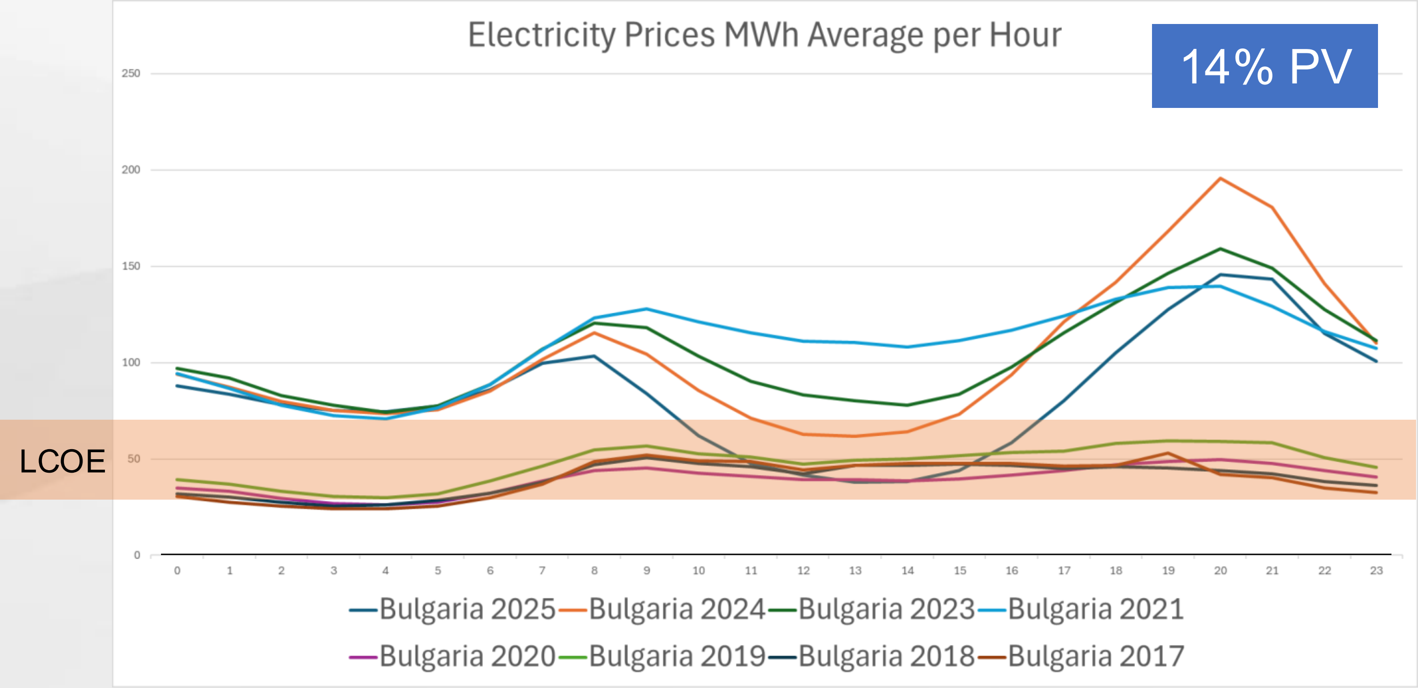


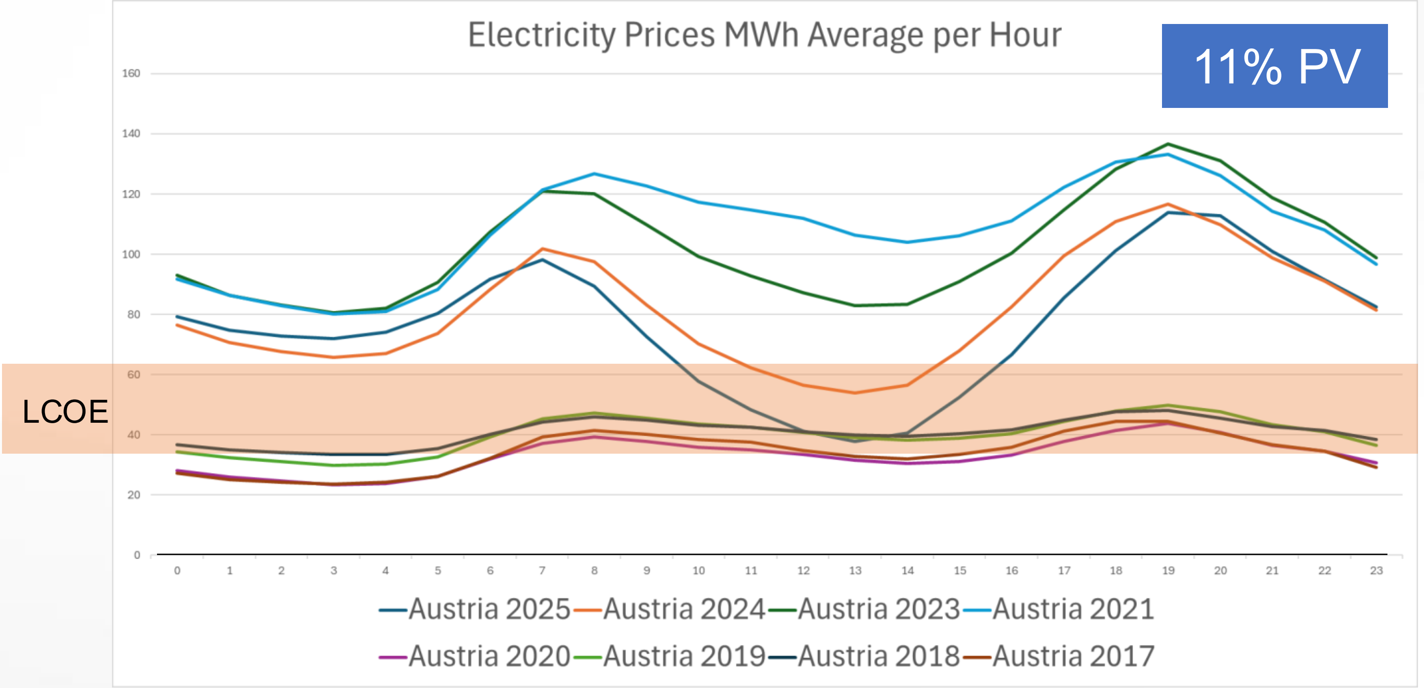
excl. 2022

Tough times for merchant PV in Europe

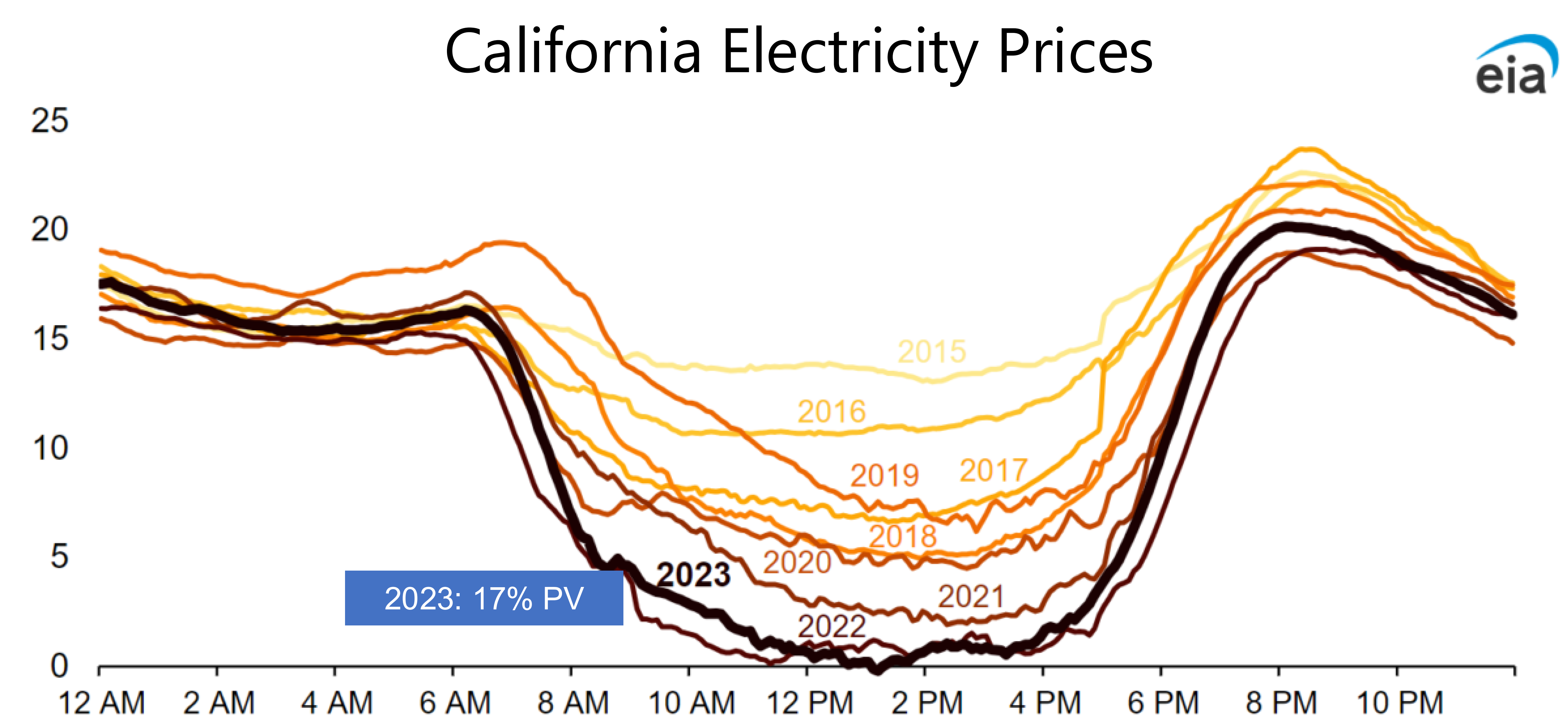








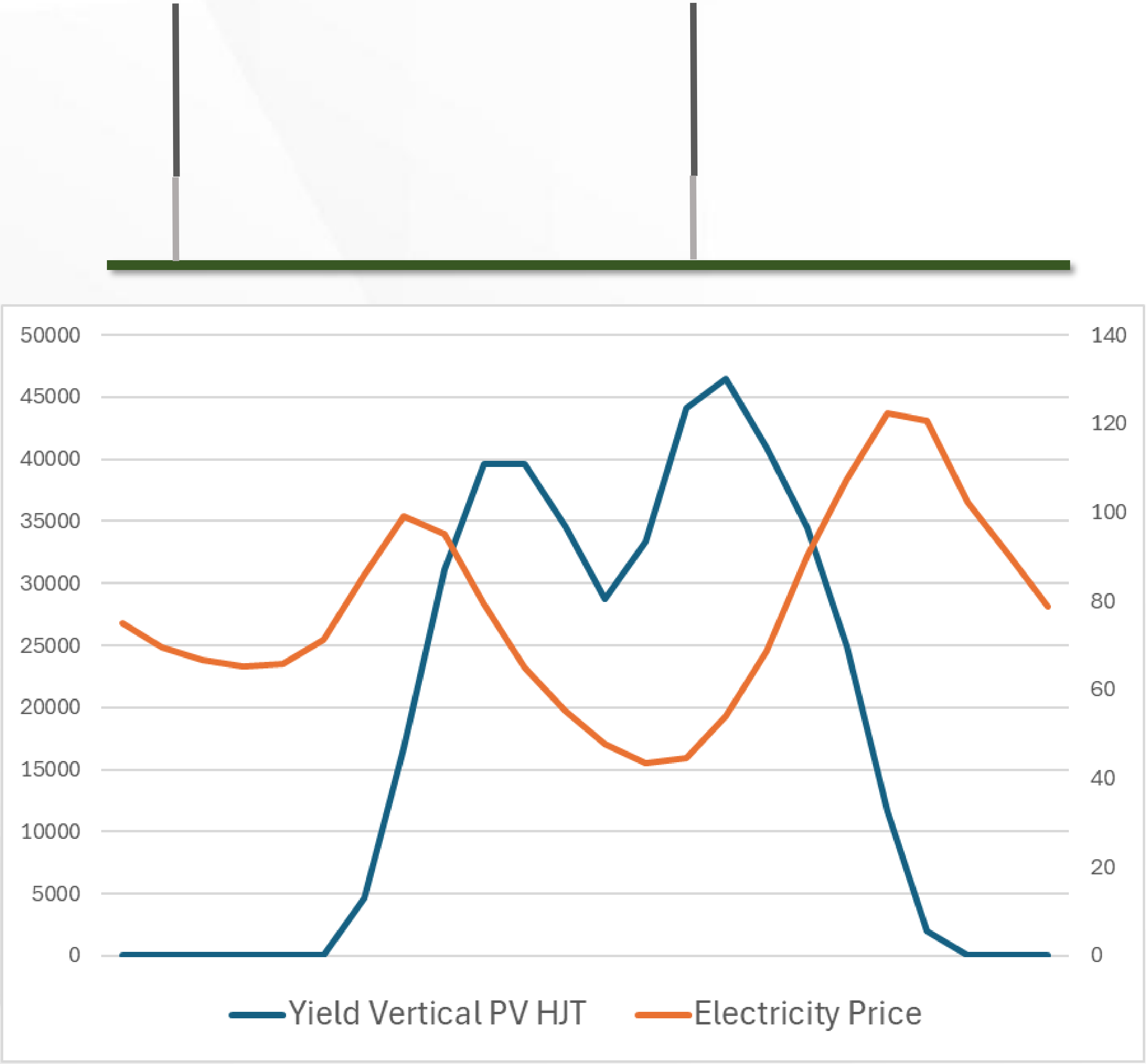
Electricity prices have dropped in the central hours of the day

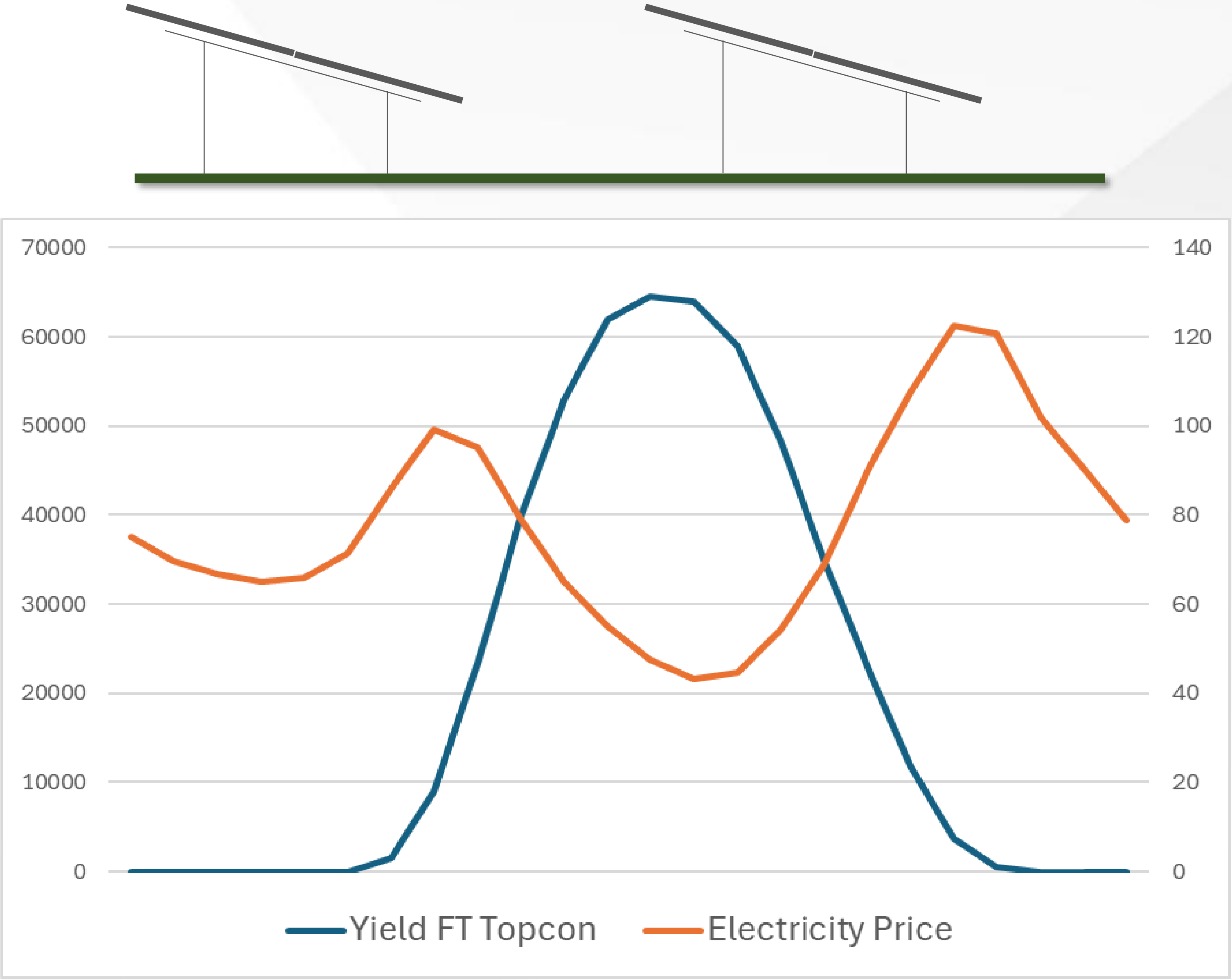


This effect is visible in **all mature PV markets**

California shows that battery adoption **does not change** this fundamentally

South-facing PV generates energy at low prices in the spot market





Spot Electricity Price in Germany 2024

Vertical Modules

Kunlun

97% bifaciality

Kunlun - Landscape Installation

Alloy Steel Frame or Frameless
G12R 0BB cell

G12R-120

Alloy Steel Frame

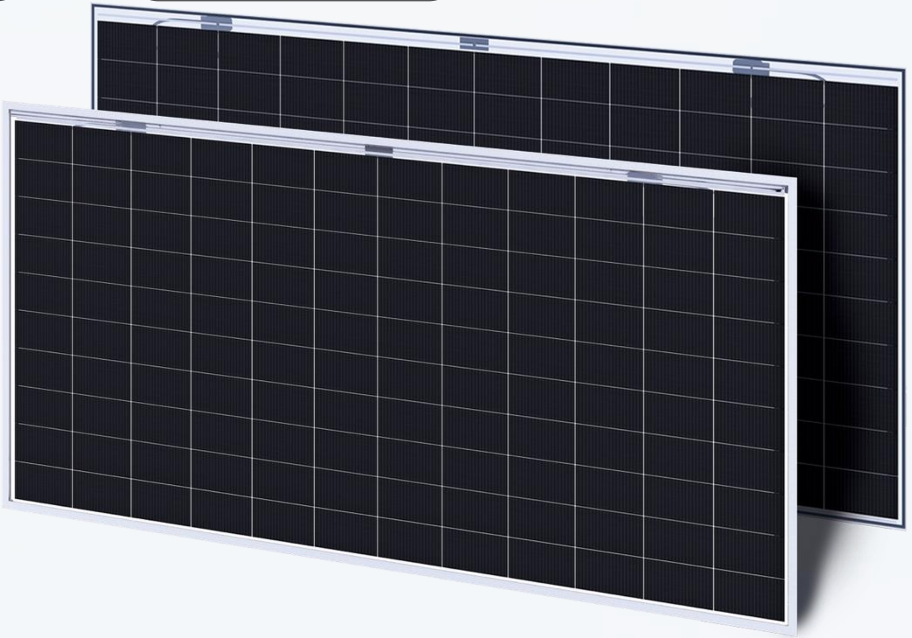
570W
Module Power

22.30%
Module Efficiency

Frameless

560W
Module Power

22.10%
Module Efficiency



G12R-108

Alloy Steel Frame

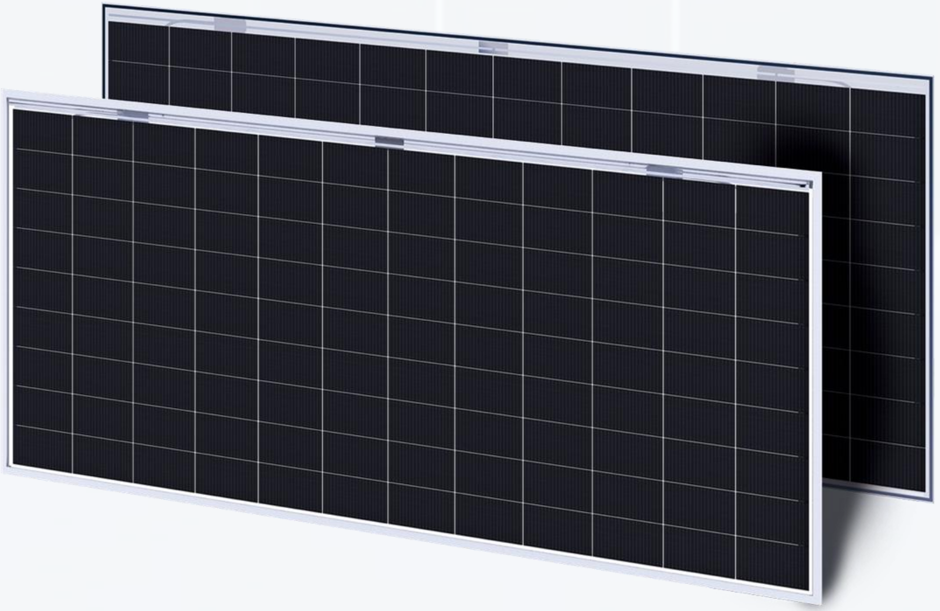
510W
Module Power

22.00%
Module Efficiency

Frameless

500W
Module Power

21.80%
Module Efficiency

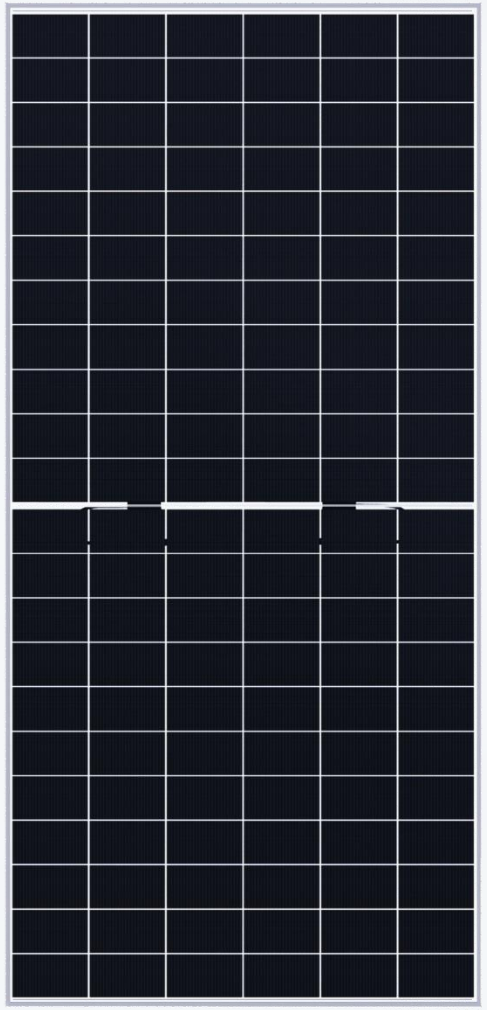


97%
Bifaciality

Kunlun - Portrait Installation

Alloy Steel Frame

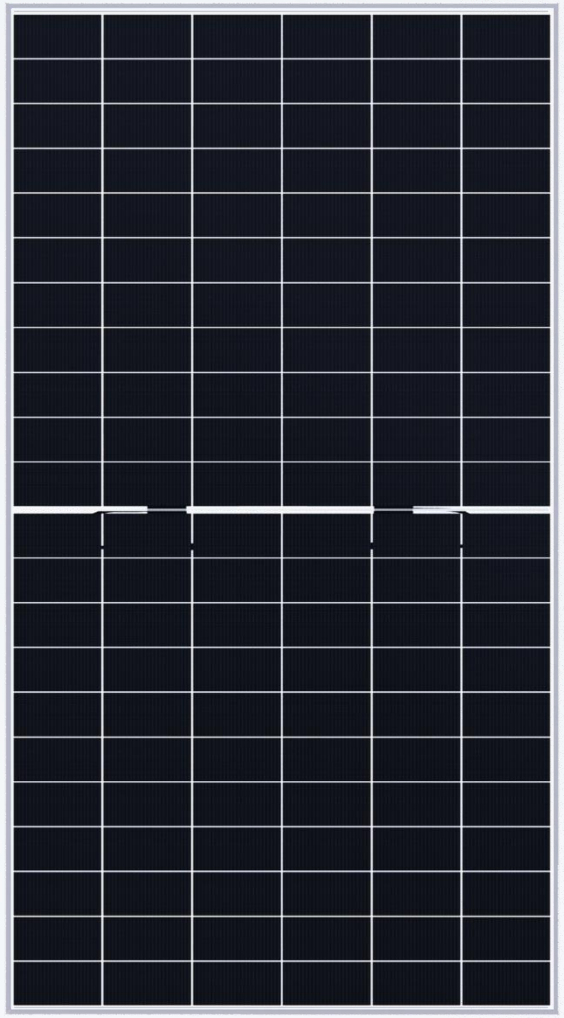
G12 and G12R 0BB cell options



G12R-132

615W **22.80%**

Module Power | Module Efficiency



G12-132

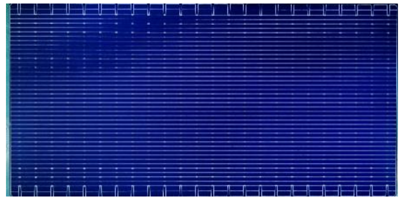
720W **23.20%**

Module Power | Module Efficiency

Differences at cell and module level

1

Improved Cell
Screen Printing



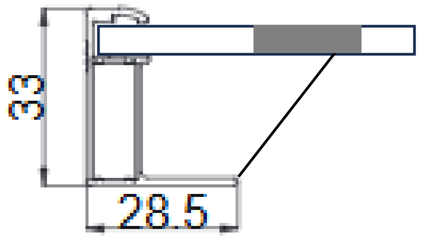
Fewer, thinner fingers

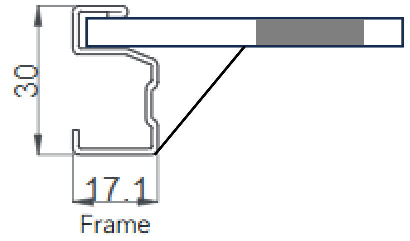
Lower front side efficiency
Better low light performance

BIFACIALITY, YIELD

2

Frameless or
Thin Frame

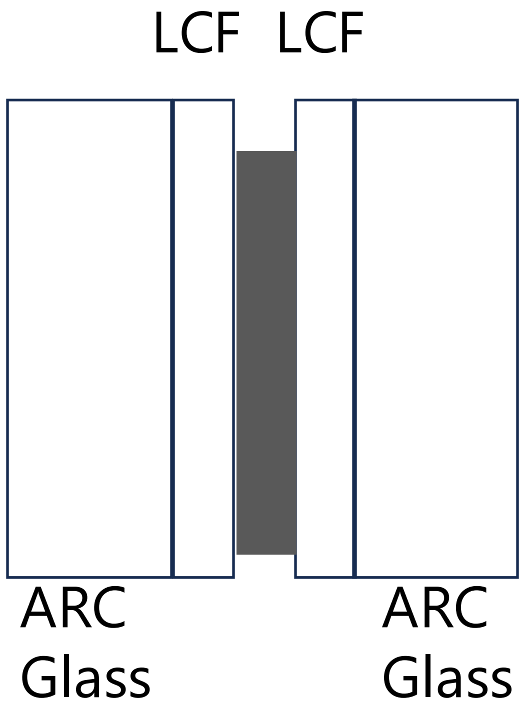




YIELD

3

LCF & AR Coating
Rear Side



YIELD, BIFACIALITY, RELIABILITY

PART 3

Topologies for the future

How can we increase the value of PV generation?

"Renewables give you the MWh. Batteries the MWp"
For a large penetration of renewables, BESS is a must.
For PV projects, it may improve the business case.

But is it the best solution?

The topologies

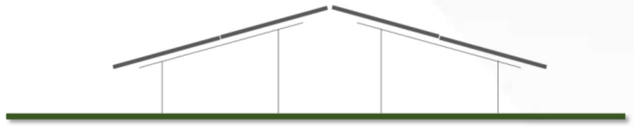
1

South Fixed Tilt - FT
GCR 64%

2

Trackers -SAT-
GCR 35%

3



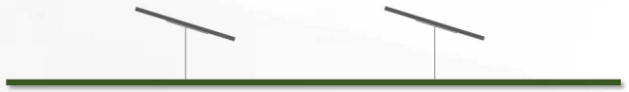
Dome East/West -EW-
GCR 64%

4

Vertical E/W -VERT-
GCR 24%

5

6



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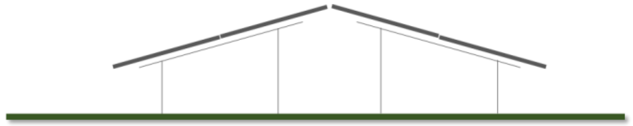
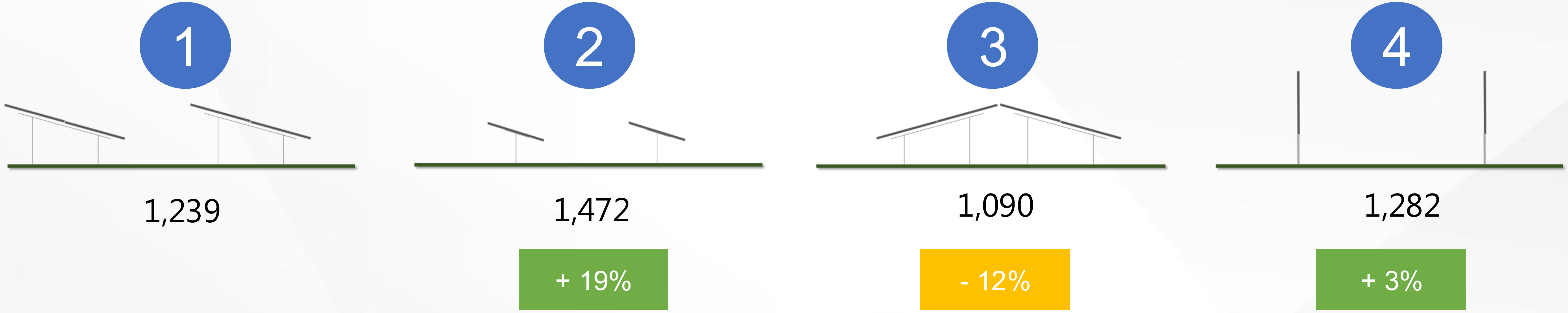


8

ADD Battery of capacity = 1/2 of the PV nameplate capacity (MWh) and 2h discharge

Energy Yield *(kWh/kWp)*

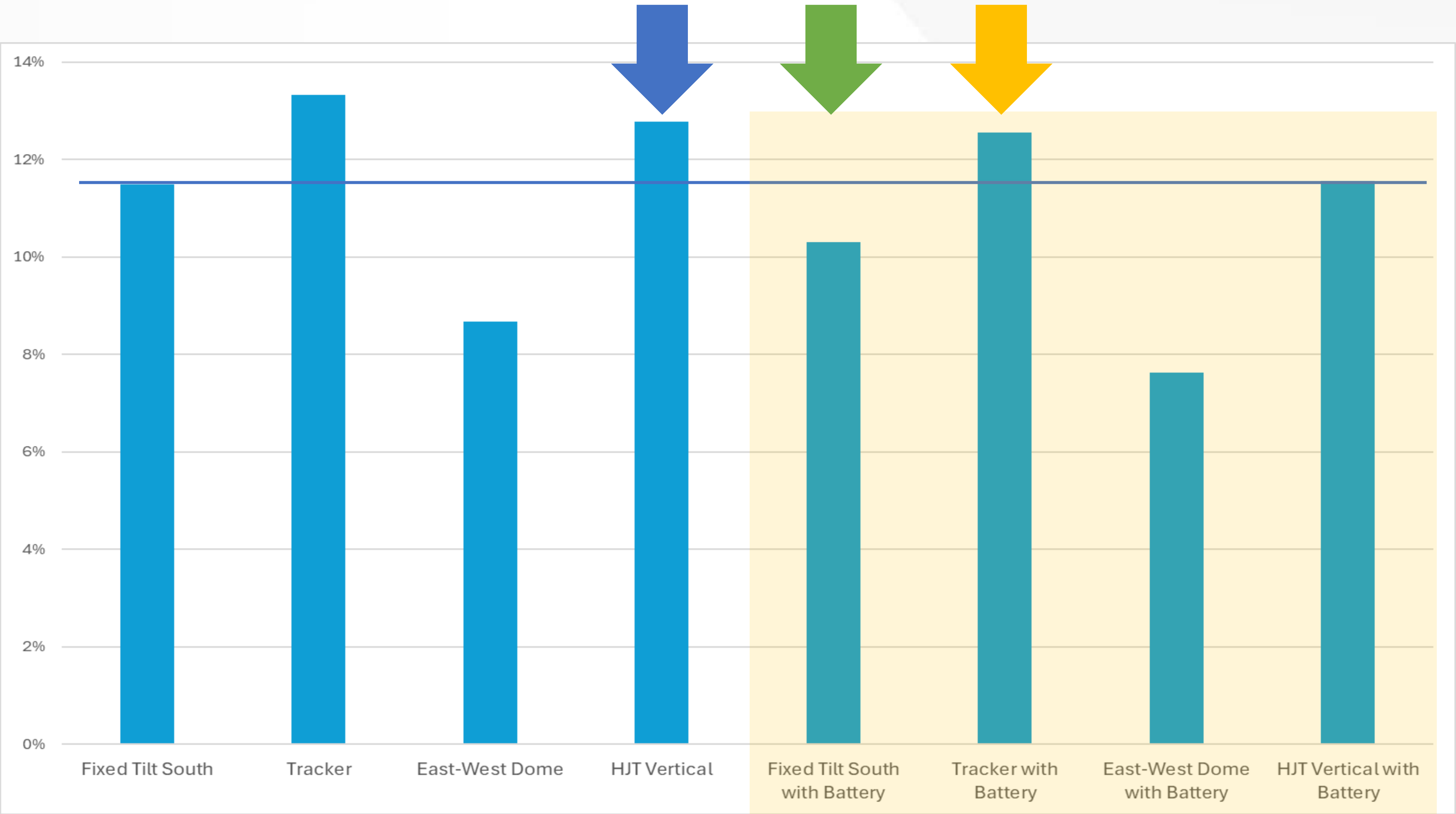
PV Syst v8.0, 2025



Vertical PV has roughly the same yield as South Topcon PV if using our Huasun Kunlun **97%** bifacial modules.

Vertical HJT with only 7.5m pitch has 10% lower yield.

Net Income *(in % of investment, yearly)*



Battery systems are not better investments for spot market income in 2025, but

- Arbitrage will become an additional business
- Grid Services and Capacity Bonuses may improve financial income
- Prices at noon will further erode

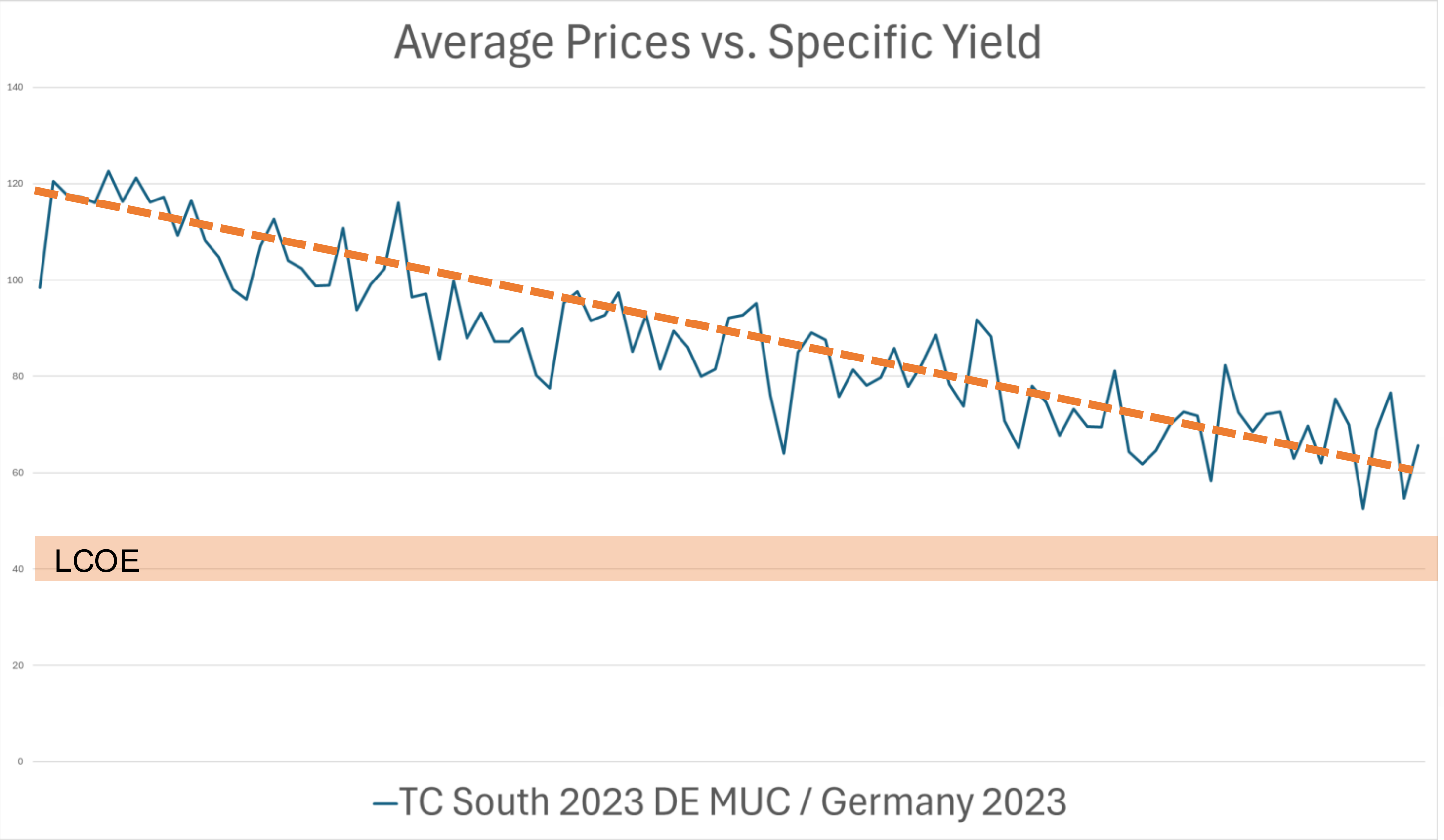
PART 3.5

What is going on?

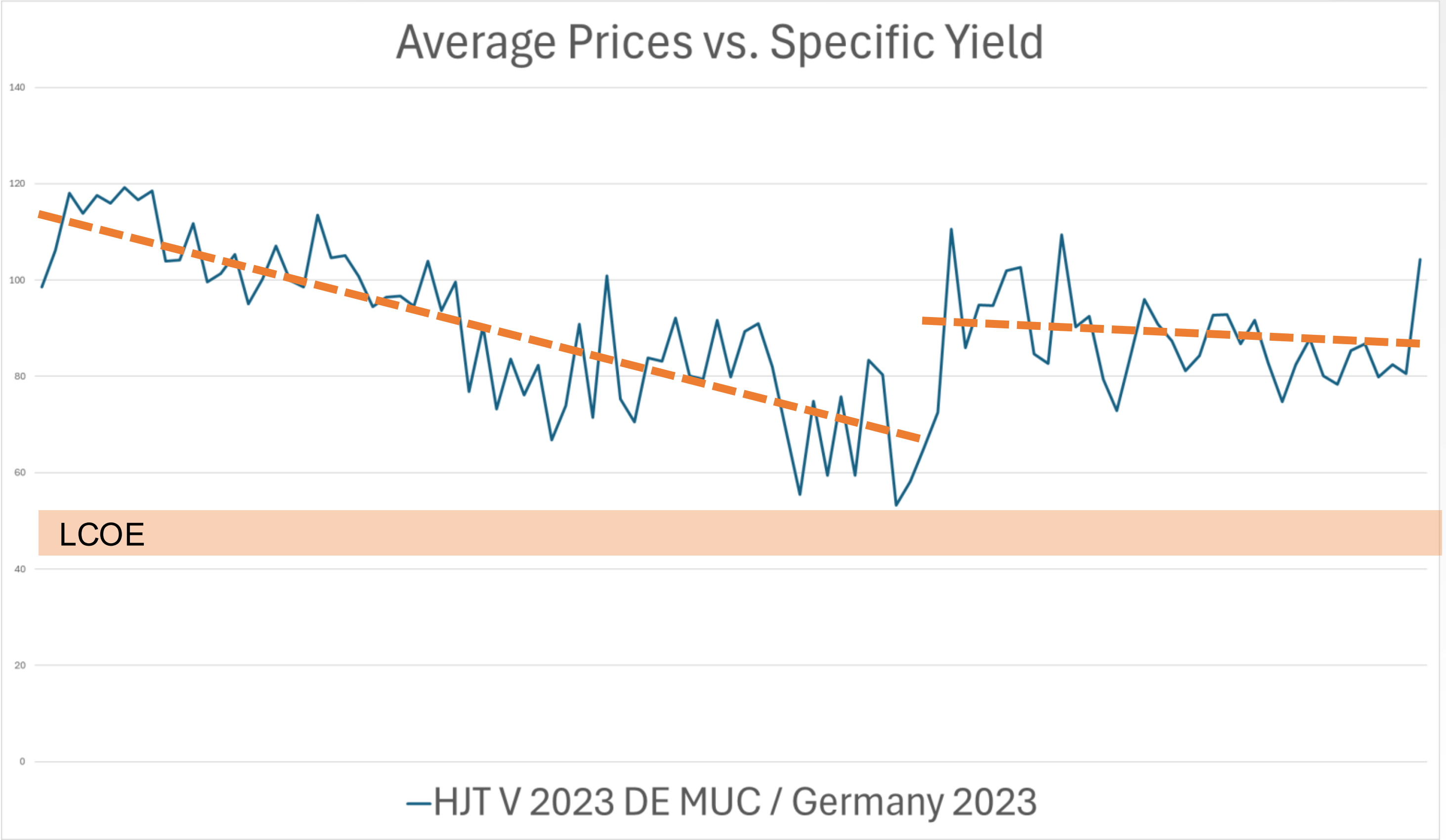
To learn anything, you need to learn how and why

There is a large correlation low price - sunny conditions

Topcon SOUTH - real data 2023

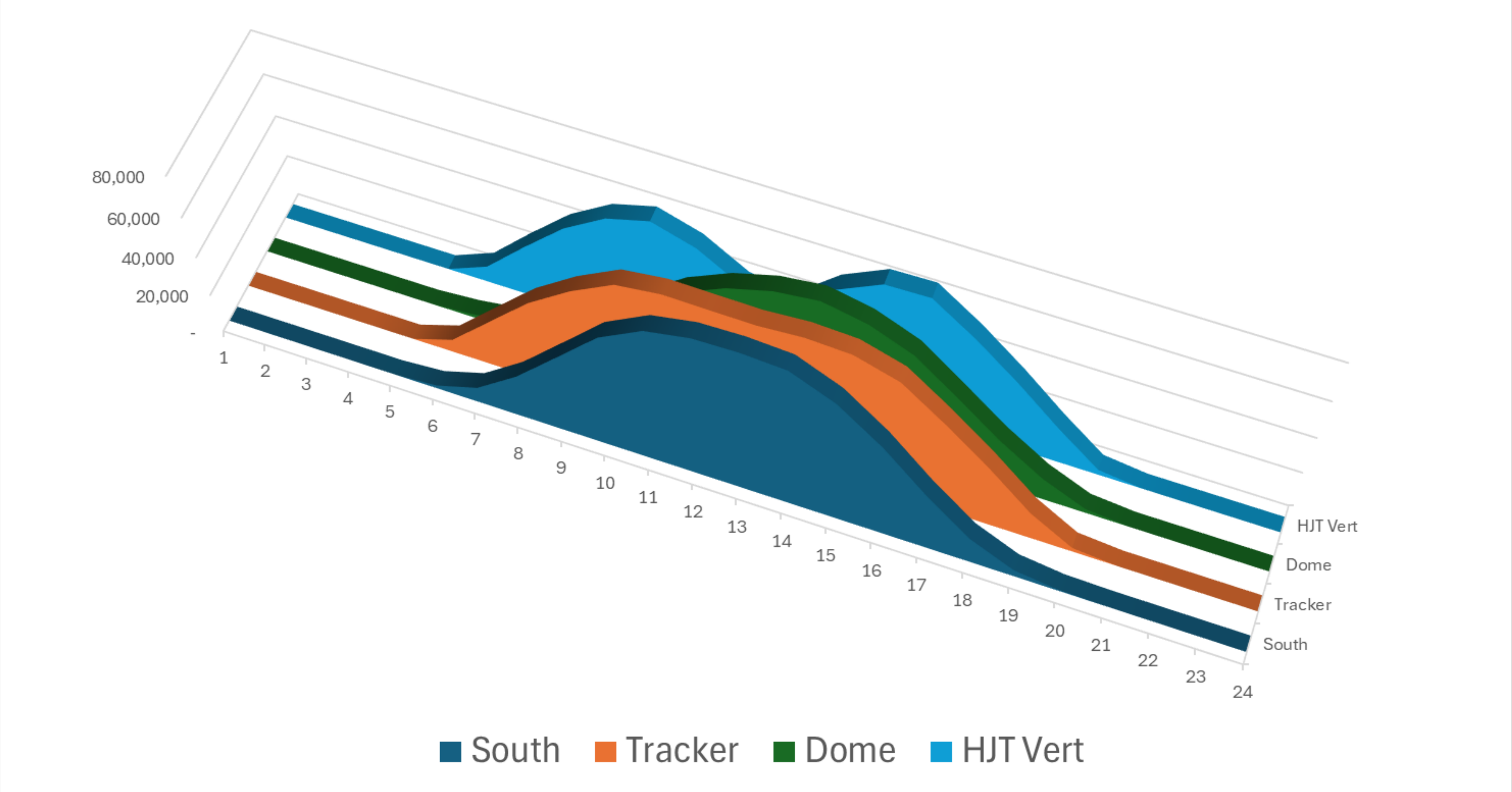


HJT Vertical - real data 2023

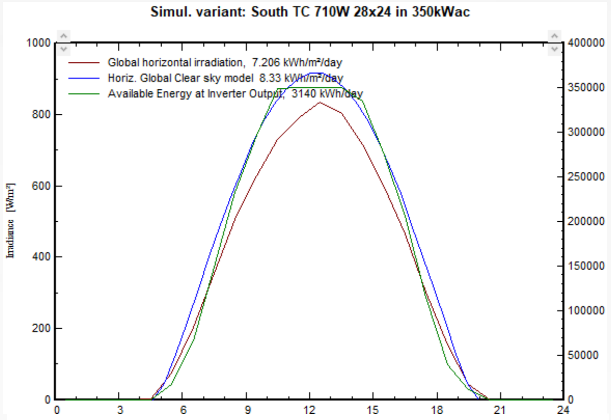


Vertical PV plants escape most of the negative price / yield correlation

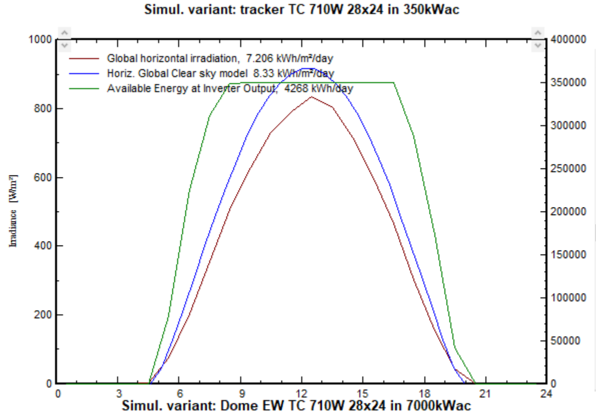
Hourly Yields



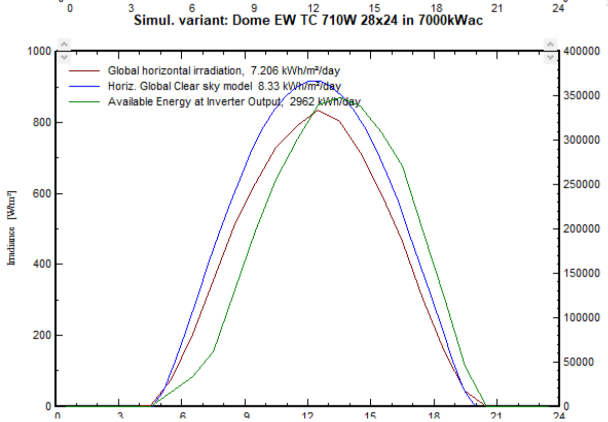
HOURLY AVERAGES FOR THE YEAR



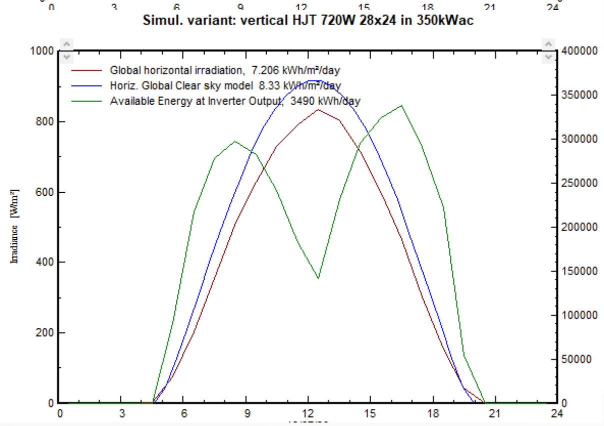
TC South



TC Tracker



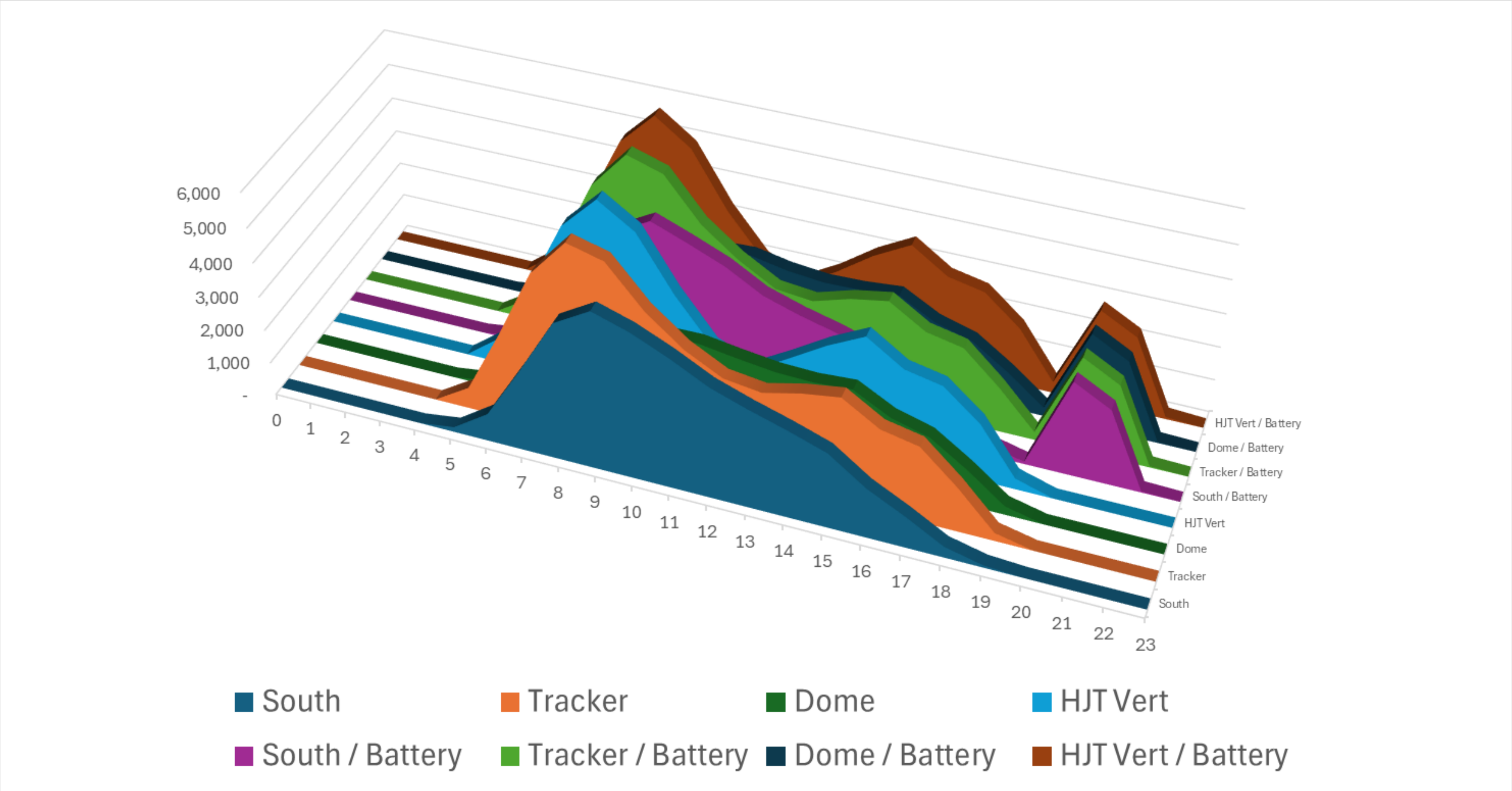
TC Dome

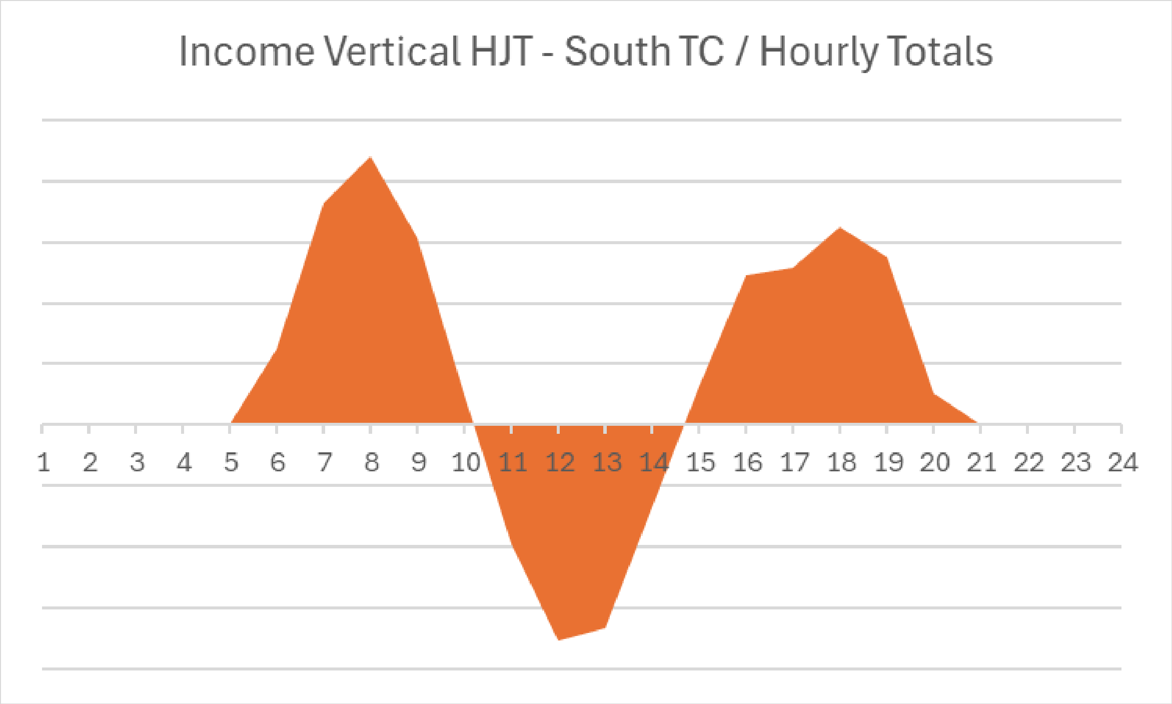


HJT Vert

Sunny Day Examples

Hourly Income





PART 4

Summary

Vertical PV as the winning topology

Vertical has **higher price protection** than Battery (2025)

Vertical has **lower CAPEX/OPEX** than trackers or batteries

Vertical has **higher profitability** already today

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