

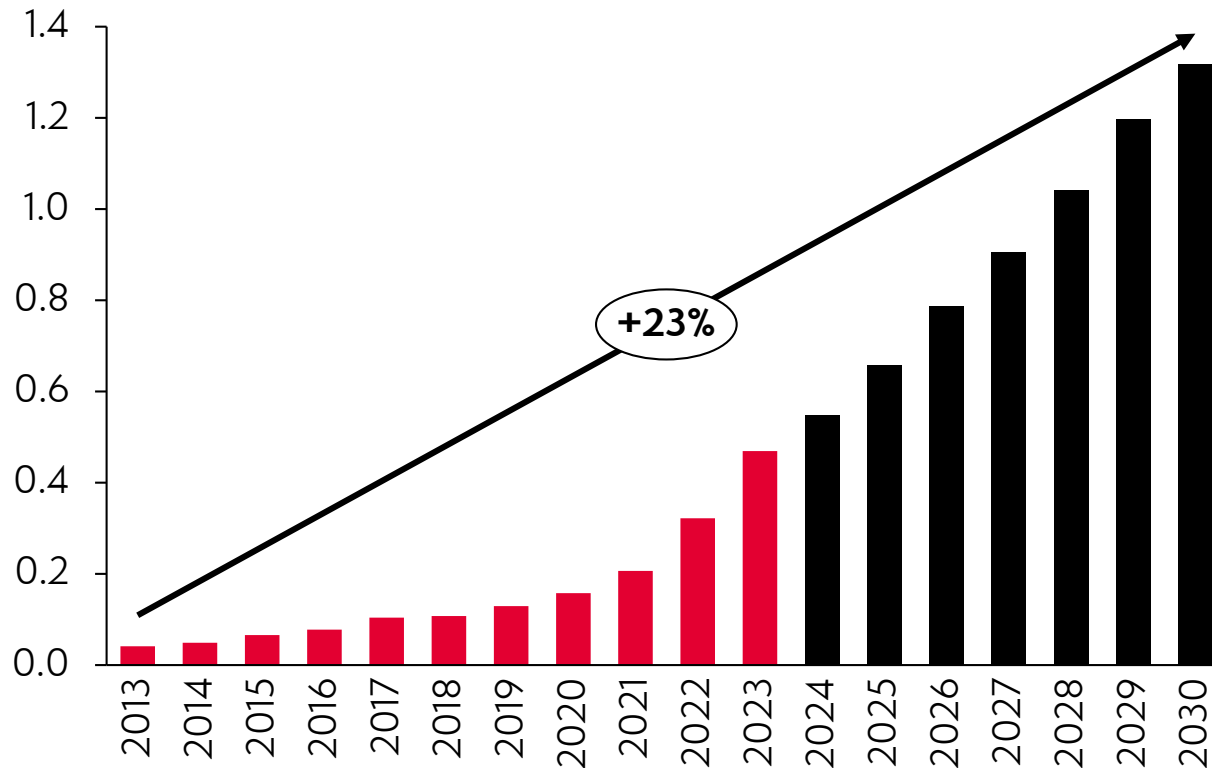


# Re-establishing of advanced manufacturing of silicon solar cells and modules in Europe

Dr Gunter Erfurt, CEO Meyer Burger Technology AG  
Becquerel Prize Winner 2023 Keynote Speech, Lisbon, Portugal  
September 18, 2023

# The establishment of the up-scaled solar industry is a unprecedented success story

## Global supply of solar modules and outlook<sup>1</sup> [TW]



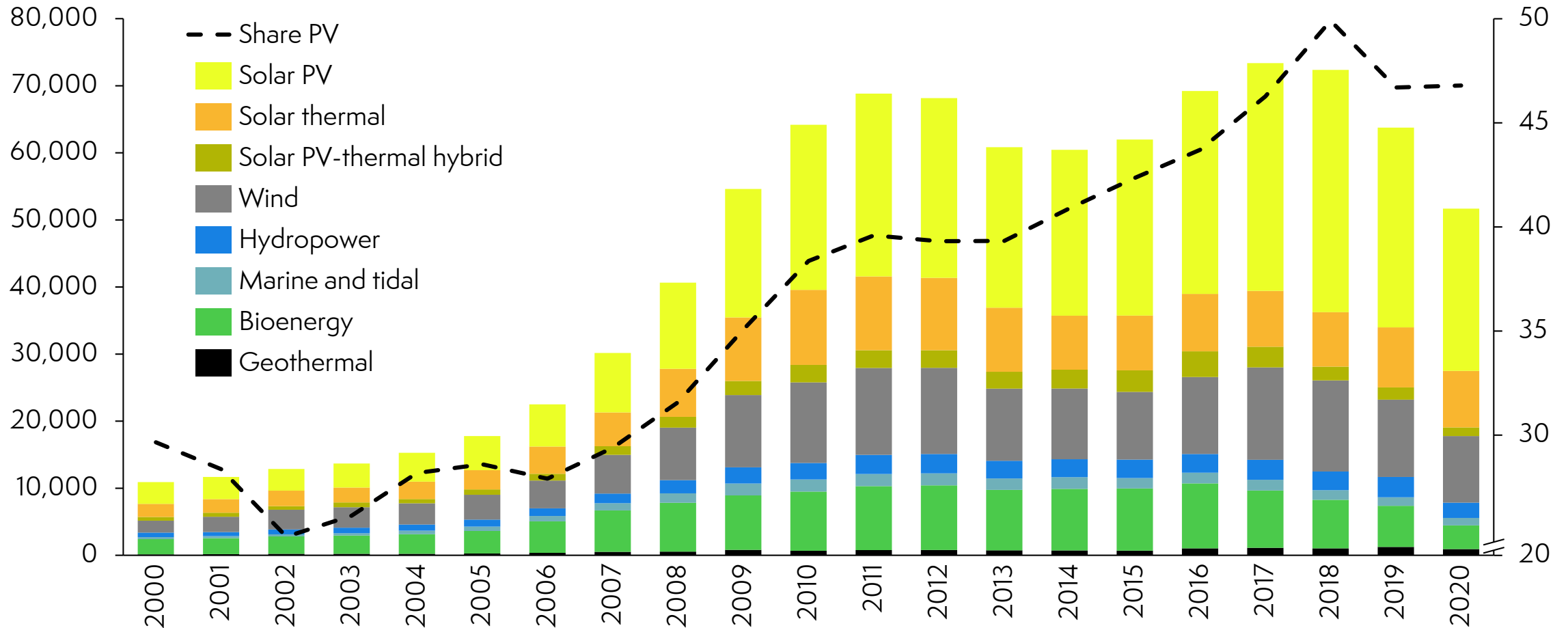
## Hardly any technology has been so successful

- **1.541 TW<sup>2</sup> of estimated installed PV** power globally by end of 2023
- **4.29 mn direct employees globally** in solar by end of 2022 and most fast growing sector in terms of job creation<sup>3</sup>
- **422 bn cumulated revenues<sup>4</sup>** in solar in 2022
- **377,728 patents filed** between 2000 and 2022
- **Module efficiency CAGR of c. +3% rel.** (+0.4% abs.) since 2000

# Global research and innovations are the basis of this success

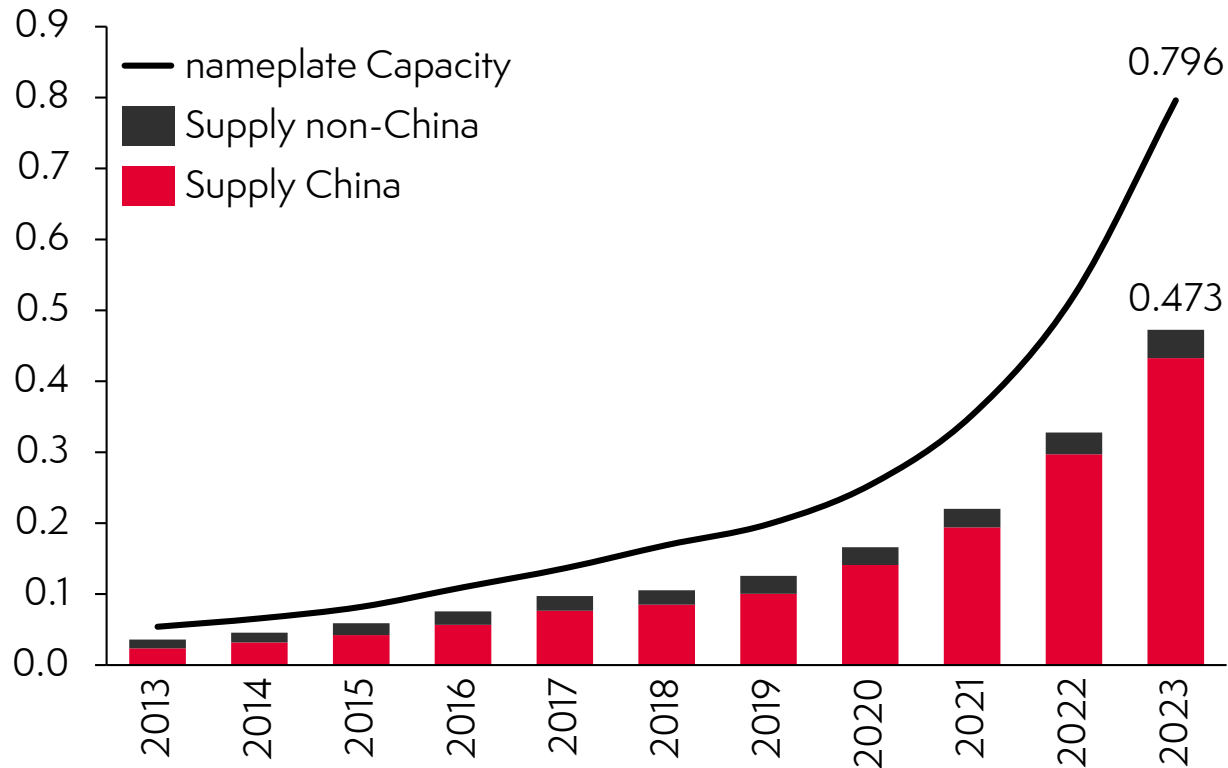
Annual patents filed for renewable energy technologies globally

Share of Solar PV [%]

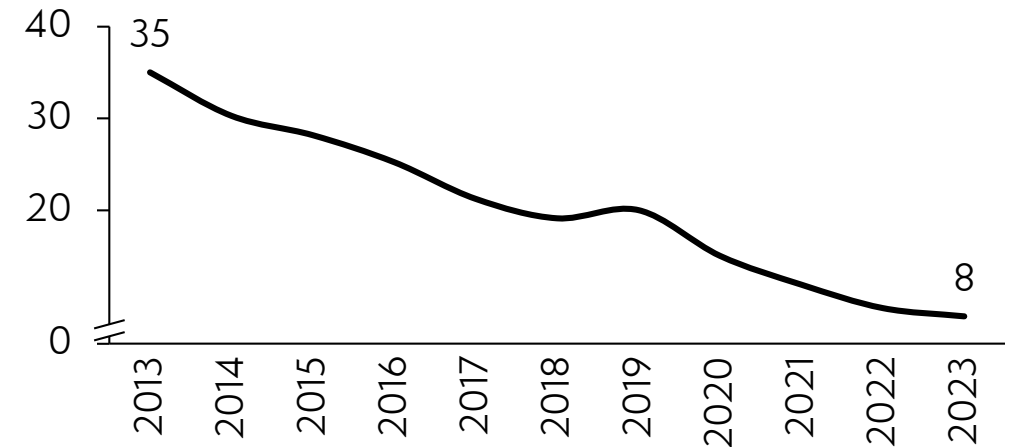


# Due to very early strategic considerations in China, the industrial solar powerhouse is located there today

## Production of solar modules vs. nameplate capacity<sup>1</sup> [TW]



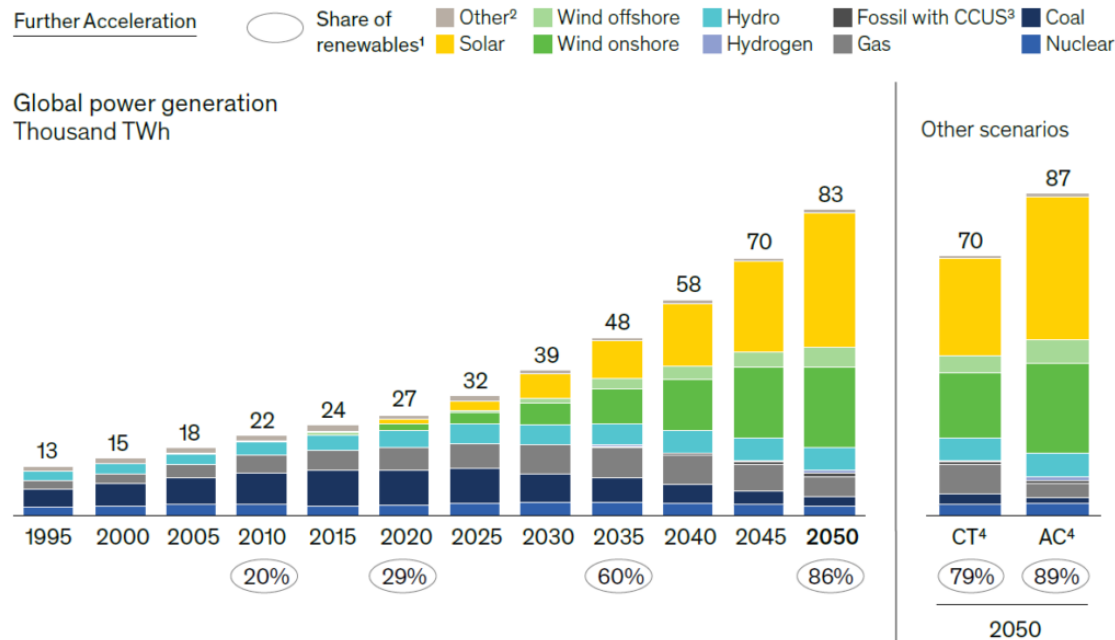
## Share of non-China production [%]



- **Share of Chinese (or China controlled) solar module production is expected to reach a record high c. 92%<sup>1</sup> by end of 2023**
- **Idle capacity ratio expected to reach c. 40%<sup>1</sup> by end of 2023**

# The secure implementation of the global solar expansion targets is only possible with a resilient, globally positioned solar industry

## Macroeconomic and strategic reasons speak for a less oligopolistic global solar industry in the future



1. Includes solar, wind, hydro, biomass, BECCS, geothermal, and marine and hydrogen-fired gas turbines  
 2. Other includes bioenergy (with and without CCUS), geothermal, marine, and oil  
 3. Includes gas and coal plants with CCUS  
 4. CT refers to the Current Trajectory scenario; AC refers to the Achieved Commitments scenario

- Without regional solar industry, regional research and development will also disappear sooner or later
- (Fossil) logistics of solar modules is not only unsustainable, but also very expensive and lengthy
- Inviolable access to solar technology is a right of every country
- There are no significant cost differences (with scaled-out production) as a function of the production location
- Contribution to value creation, prosperity and job generation at the local level

# The global solar production landscape is changing

## Strategic initiatives have been launched

- U.S. Inflation reduction has to date<sup>1</sup> attracted projects of 85 GW module, 43 GW cell, 20 GW ingot/wafer and 7 GW inverter
- India has imposed tariffs that have led to a 76%<sup>2</sup> YoY decline in imports from China in the first half of 2023 and massive expansion projects (for example, Reliance Industries)
- European Union has allowed its member states to incentivize investment in new local solar factories and is aiming for a 40% share of local value by 2030 via the proposed Net Zero Industry Act



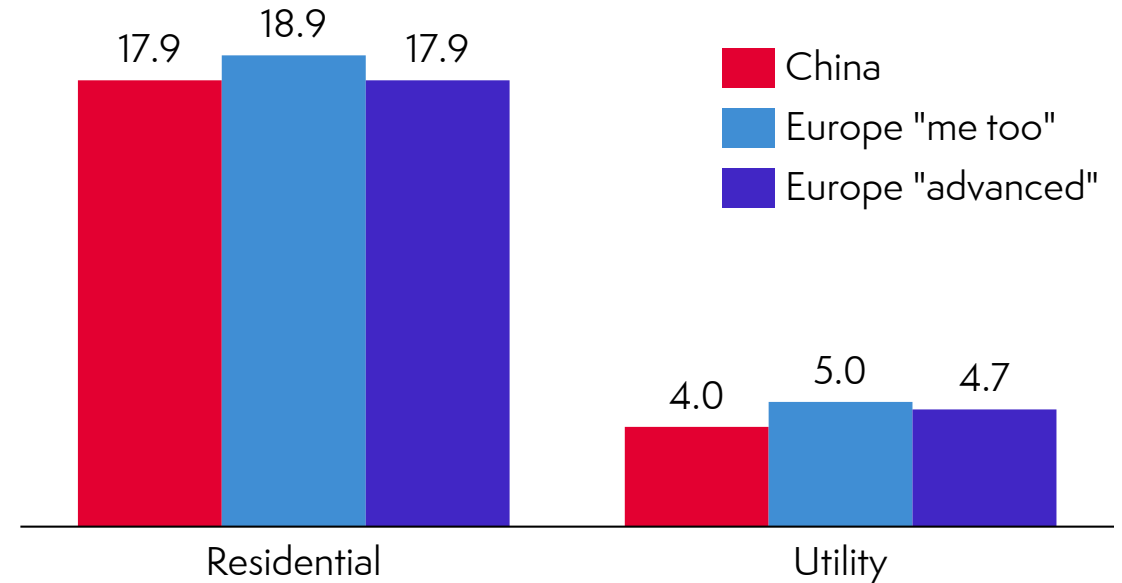
# Can we afford modules "Made in Europe"?

From where we came: Adolf Götzberger's 1997 Becquerel Prize acceptance speech<sup>1</sup>

Yield per year	0.9 kWh/W <sub>p</sub>
<b>Case 1</b>	
Investment	DM 15.-/W <sub>p</sub>
Life of generator	25 years
<b>Cost of electricity (at 0% interest rate)</b>	<b>0.67 DM/kWh</b>
(at 8%)	1.56 DM/kWh
<b>Case 2</b>	
Investment	DM 12.50/kWh
Life of generator	30 years
<b>Cost of electricity (at 0% interest rate)</b>	<b>0.46 DM/kWh</b>
(at 8%)	1.23 DM/kWh

Table 1: Nondynamic Calculation of Electricity Cost

Solar energy electricity cost (LCOE) today is not or only slightly affected by solar module origin [€/ct/W<sub>p</sub>]



Method: Non-dynamic LCOE calculation by DCF assuming residential capex of 2963 €/kW incl. storage (source: Enpal 2023) or 600 €/kW for utility (without storage), 150 €/kW higher capex for products from Europe, 4% interest, 0.5% of the investment as annual maintenance/operations costs, -3% degradation 1<sup>st</sup> year and -0.3% degradation 2<sup>nd</sup>-30<sup>th</sup> year for "Europe me too" resp. -1% degradation 1<sup>st</sup> years and -0.1% degradation 2<sup>nd</sup>-30<sup>th</sup> year and additional 2% higher energy yield for "Europe advanced", all examples 1000 kWh/kW/year and 30 years lifetime

Sources: 1) 1997\_Goetzberger.pdf (becquerel-prize.org)



# It is worth rebuilding Europe's solar industry

## European cutting-edge technology at work

- Investors are backing Europe's renewable energy companies, Meyer Burger successfully raised >1 bn EUR in private capital since 2020
- Europe is a perfect location for solar mass production as labor costs are "negligible" with highest level of automation, research and industry are most innovative and can produce leading and long-lasting highest quality products
- 15 years of Heterojunction research and development at Meyer Burger and Swiss CSEM have now been transferred to mass production under Meyer Burger's captive business model
- 1000 direct jobs have been created since 2020 <sup>8</sup>



# European cutting-edge solar research

- Thanks to strong support from the European Commission, German government, Swiss government, European research continues to lead in research and development
- **Phase I:** Current technology generation is undergoing continuous improvements (increased efficiencies, patented "Smart Corner" (prevention of soiling/moss formation for sustained high yields), glass-glass, M10 upgrade, etc.)
- **Phase II** (see photo): Process development for patented, indium- and (planned soon) silver-free, ultra-low degradation and manufacturing-cost-reduced back-contacted heterojunction solar cells for planned SWCT® module efficiencies of >24% without showstoppers ready for M10 wafers completed, now industrialization for fast manufacturing implementation (expected 2025) has started
- **Phase III:** Perovskite tandem development with industrialization focus in the works with 29.6% cell efficiency achievement<sup>1</sup>

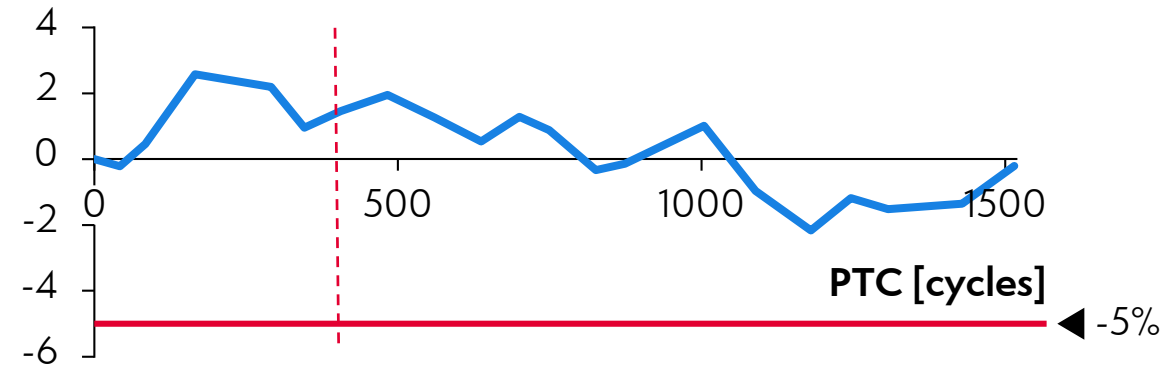
<sup>1</sup>) Meyer Burger | Perovskite technology's potential to boost Europe's solar energy supply (csem.ch)



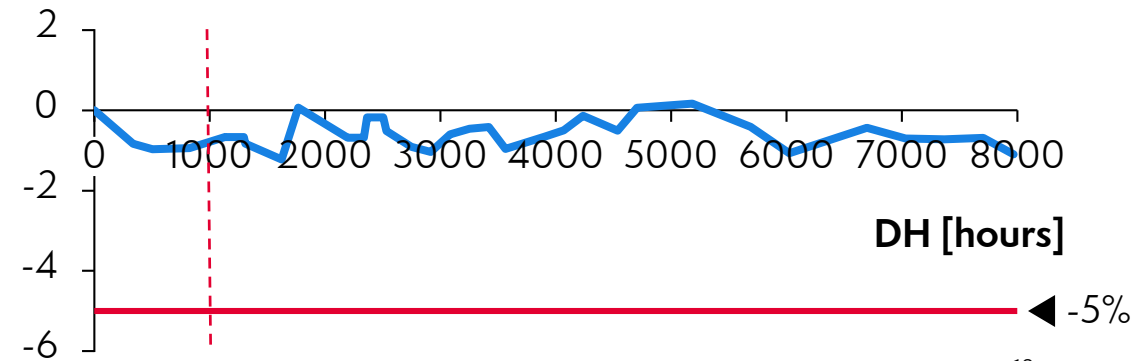
Photo: Meyer Burger Tile with IBC cells

# Meyer Burger Generation II (IBC) "without" degradation

PTC induced degradation [%]



DH induced degradation [%]



# Summary and Postulate

## Solar industry in Europe needs a new start

- Europe must act quickly because the renaissance of the local solar industry is currently in great danger
- For this, effective measures must be taken in the short and long term (e.g. use of European modules for Ukraine aid, introduction of resilience bonus and resilience auctions to promote Made in Europe, investment incentives)
- Continued R&D support programs (EU and national levels) as very successful tool to keep technological leadership
- **The European solar industry can thus make a decisive contribution to European prosperity, peace and the promotion of innovation and research in the coming decades - from Europe for the world**

# My heartfelt thanks go to...

- The Becquerel Prize Committee for the selection and award appreciation
- The European Commission for the award and the strategic support in the past and especially the near and long-lasting future of a strong solar industry renaissance in Europe
- All research partners, such as CSEM, FhG, HZB, CEA INES and many other for your strong support and outstanding achievements
- To the terrific and storm-proof Meyer Burger team for their hard and not always easy work
- All my teachers and professors who gave me the foundation for my professional career
- All companions, former colleagues, friends, competitors in the solar industry for the always good fruitful exchange and challenge
- And most importantly, my wife and children and my entire family, who have not only patiently tolerated my solar obsession for the past >20 years, but have also supported it strongly throughout all the years



With the right energy, anything is possible.