



aleo  **sunrise**
aleo

High efficiency cells and modules –
made in Germany



Solar Fab-1 / Chunan, Taiwan



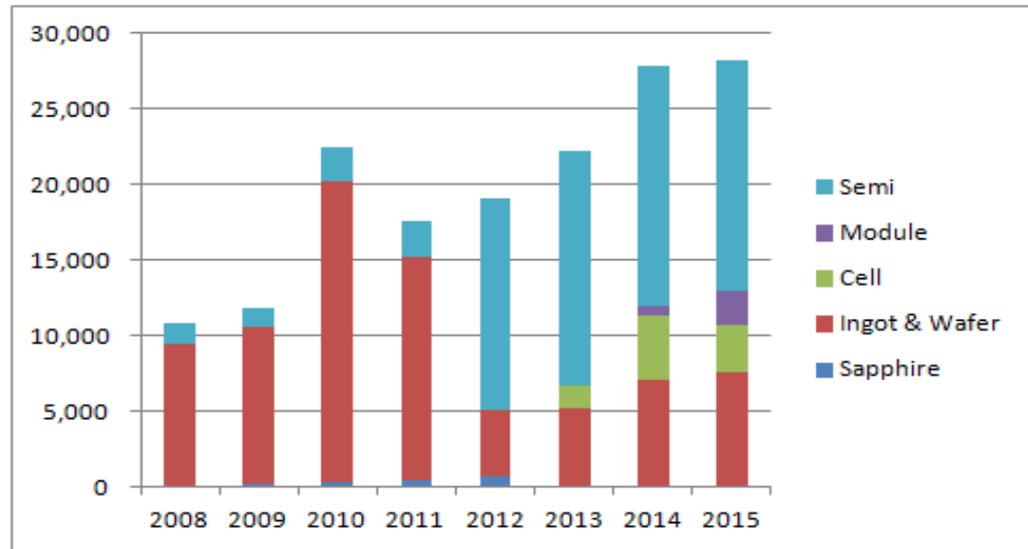
Solar Fab-2 / Chunan, Taiwan



Solar Fab-3 / Yilan, Taiwan (Sunrise)



aleo solar / Prenzlau, Germany



Main products:

- Semiconductor wafers (3" ... 12")
- Solar wafers / cells / modules / power plants
- Solar ingots/wafers: 1.2GW capacity

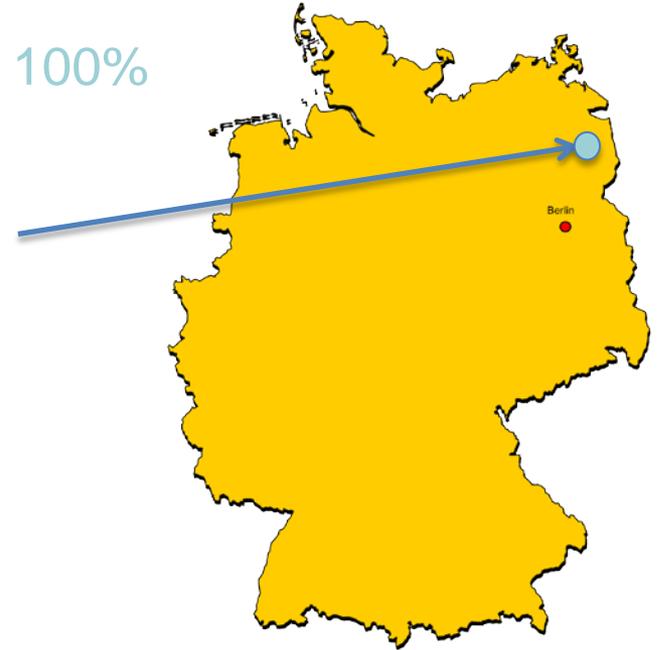
Employees: > 4,500

2014: Merged Sunrise Global Solar Energy Co., Ltd. and acquired aleo solar GmbH (wholly owned subsidiary)

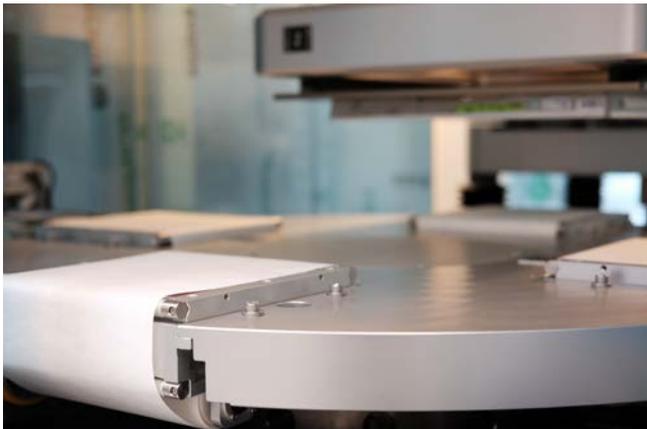
Sep 2015: aleo Sunrise GmbH founded as 100% subsidiary company of aleo solar GmbH

Mar 2016: First cell produced in Prenzlau

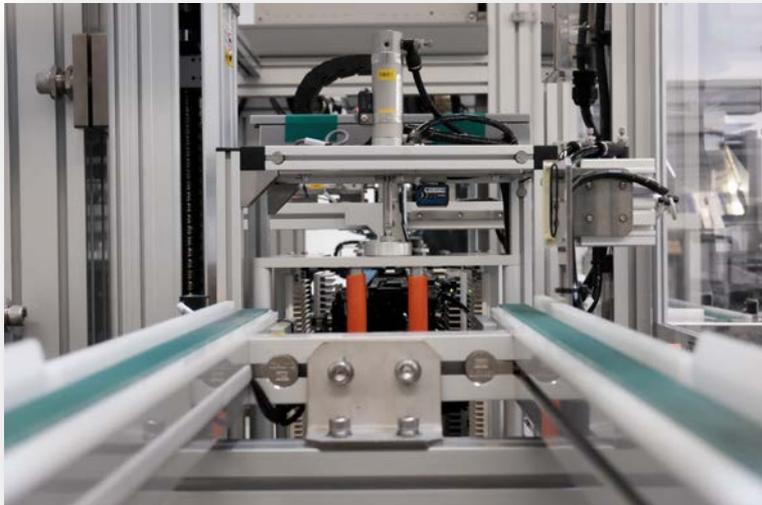
Sep 2016: Official inauguration



- Supply own module manufacturing
- Easily adapt to the needs of module manufacturing
- PV Know How in Prenzlau since 2001 & technical expertise from SAS since 1981
- Share resources at the same site
- German certificate of origin



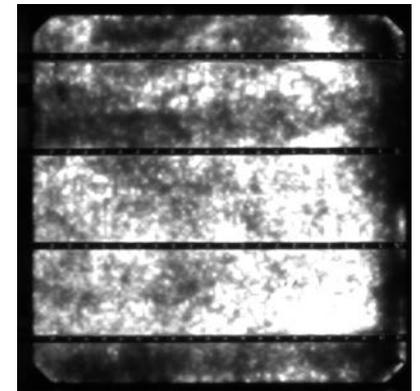
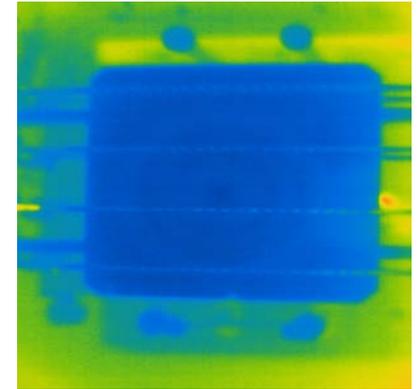
- Portfolio: Monocrystalline PERC cells
- Average output: >60.000 cells per day
- Average efficiency: ~21.5 %
- Staff: Approx. 60 in three-shift system
- Production capacity: 80 MW/year on two lines
- Certifications: DIN EN ISO 9001:2008, DIN EN ISO 14001:2009, DIN EN ISO 50001:2011



- Cutting-edge η using standard PERC processes
 - High mechanical stability
 - Hot-spot free
 - Color homogeneity
 - No oxidation
-
- High yield / low B and C grade rate
 - Low inline cell breakage / low hold rate
 - Small efficiency distribution
 - Smooth and efficient processes



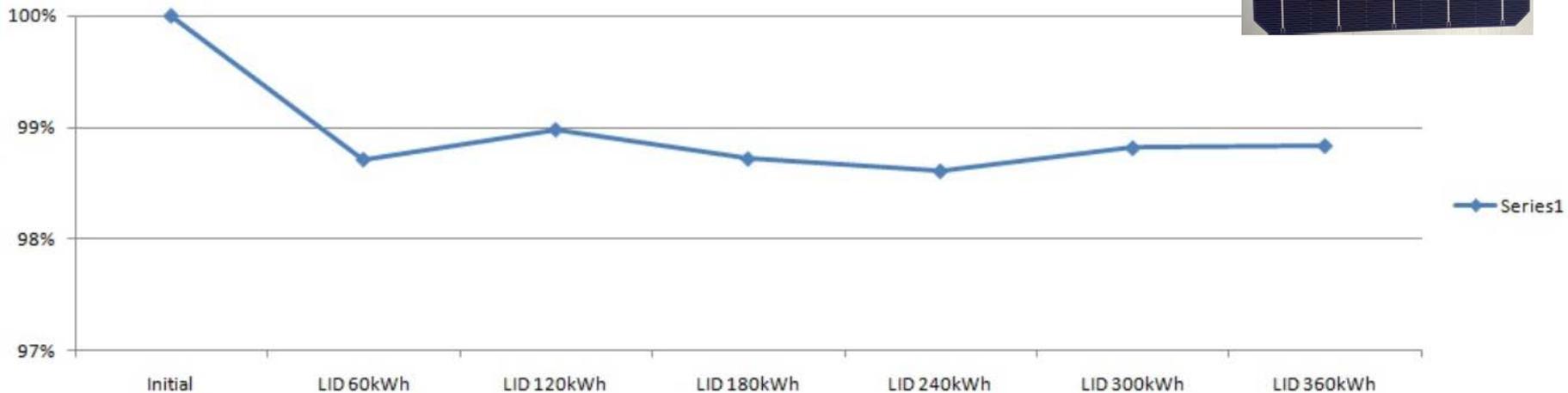
- Careful supplier and model selection
- Comprehensive incoming goods inspection:
e.g. 100% screen test
- Thorough in-process control: e.g. 100% AOI, weight measurement every 2h
- Tight electrical and visual sorting criteria
- Strict final quality control: e.g. ribbon peel-off test once a shift, IR thermography, EL
- Reliability tests: LID, PID, DH, TC
- Continuous improvements
- Zero-defect policy



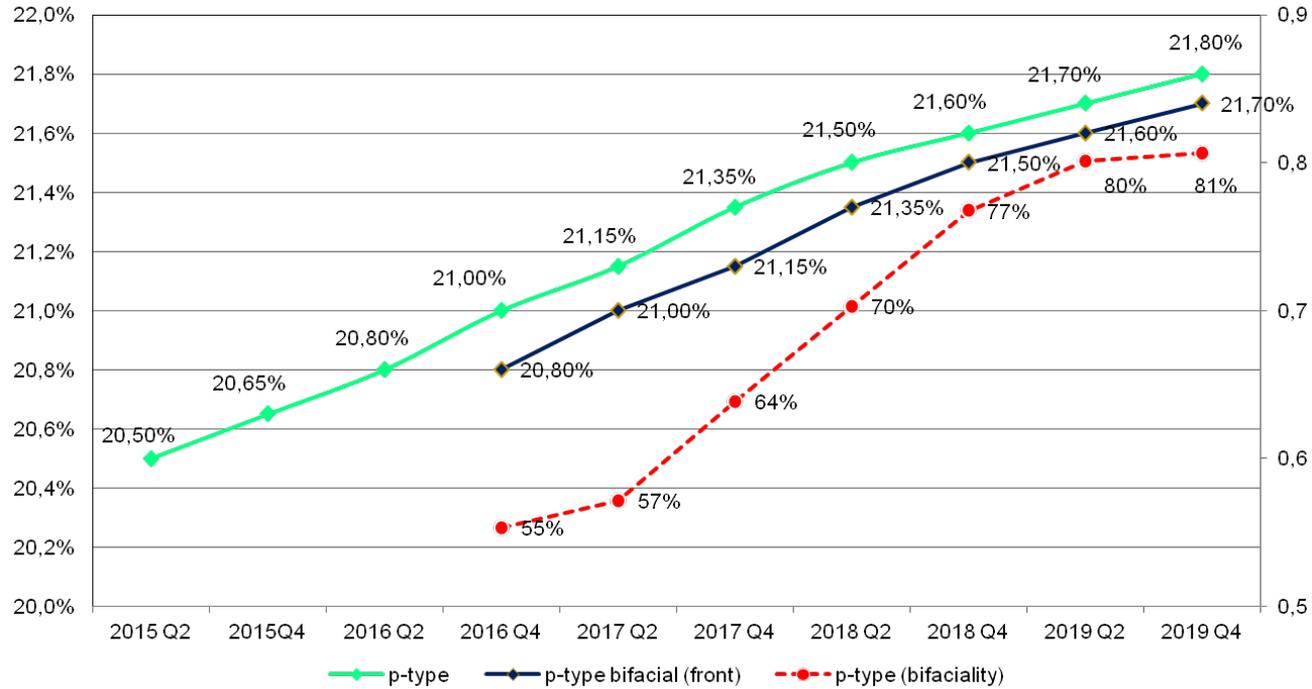
- High productivity
- Low VA costs
- Meet customer requirements: premium module manufacturers
(residential roof top, BIPV, automotive)

Monocrystalline PERC cells

- Size: 156,75 mm *156,75 mm, d = 210 mm
- Terminals: 4 | 5 Busbars
- Type: p-type, monofacial
- Technology: CELCO PERC
- Features: Best-in-class LID performance, strong PID resistance



Efficiency roadmap



- Continuously increase η
- Go bifacial to increase module yield
- Implement 2 more production lines?

HE series up to 310W in series production, i.e. module $\eta = 18.9\%$

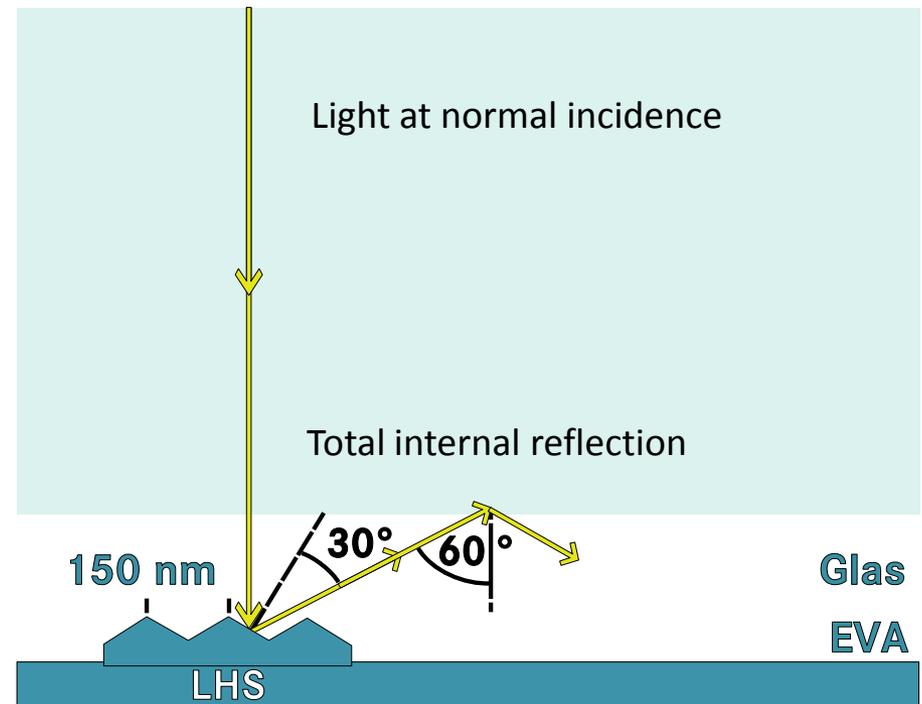
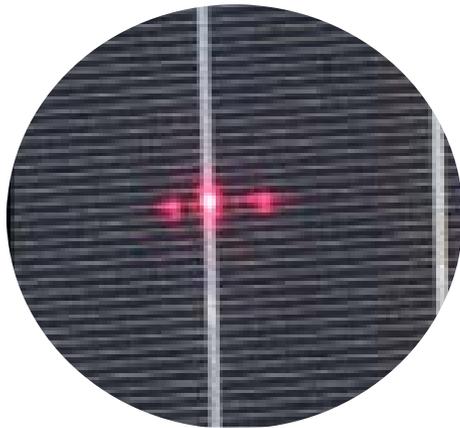
Max. power 317W



- High cell efficiencies
- Low CTM loss (or even gain)
- Avoid manufacturing faults (e.g. finger disruptions, cell cracking)

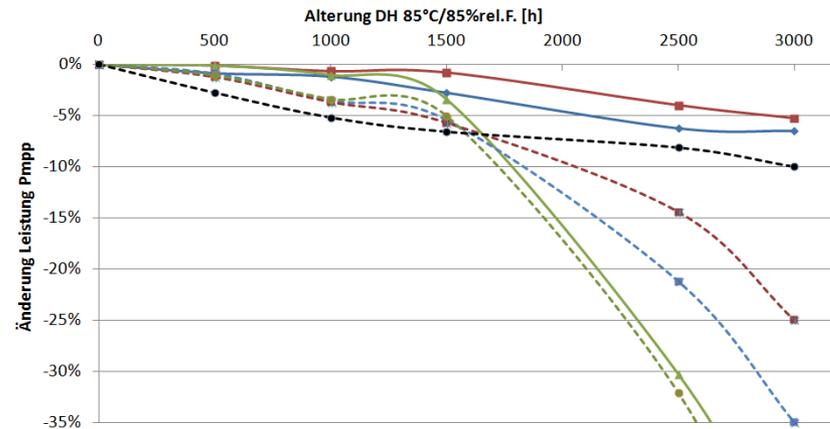
Reduce optical and electrical losses

- LHS technology
- Low-UV cut off EVA
- High glass transmission
- Highly reflective back sheet

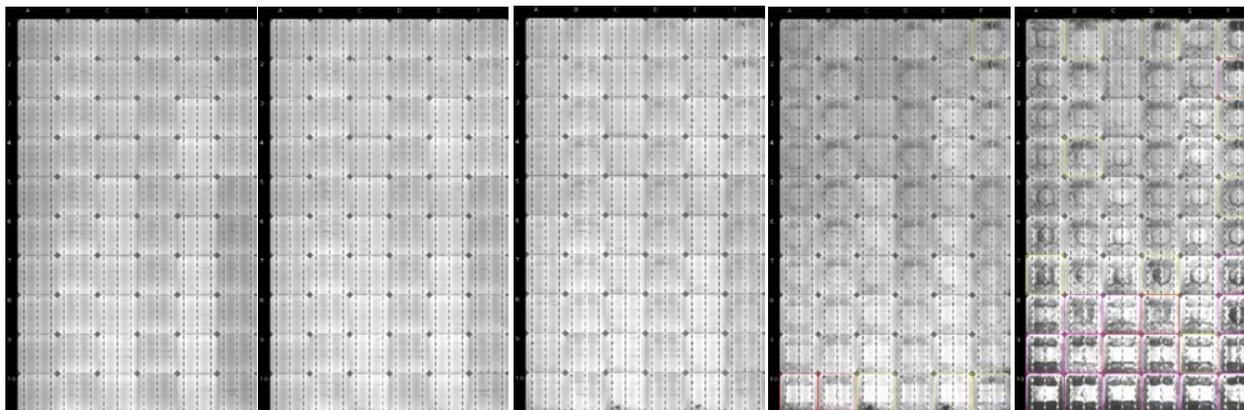


Thorough test of material combinations before series production:
at least 2x IEC 61215

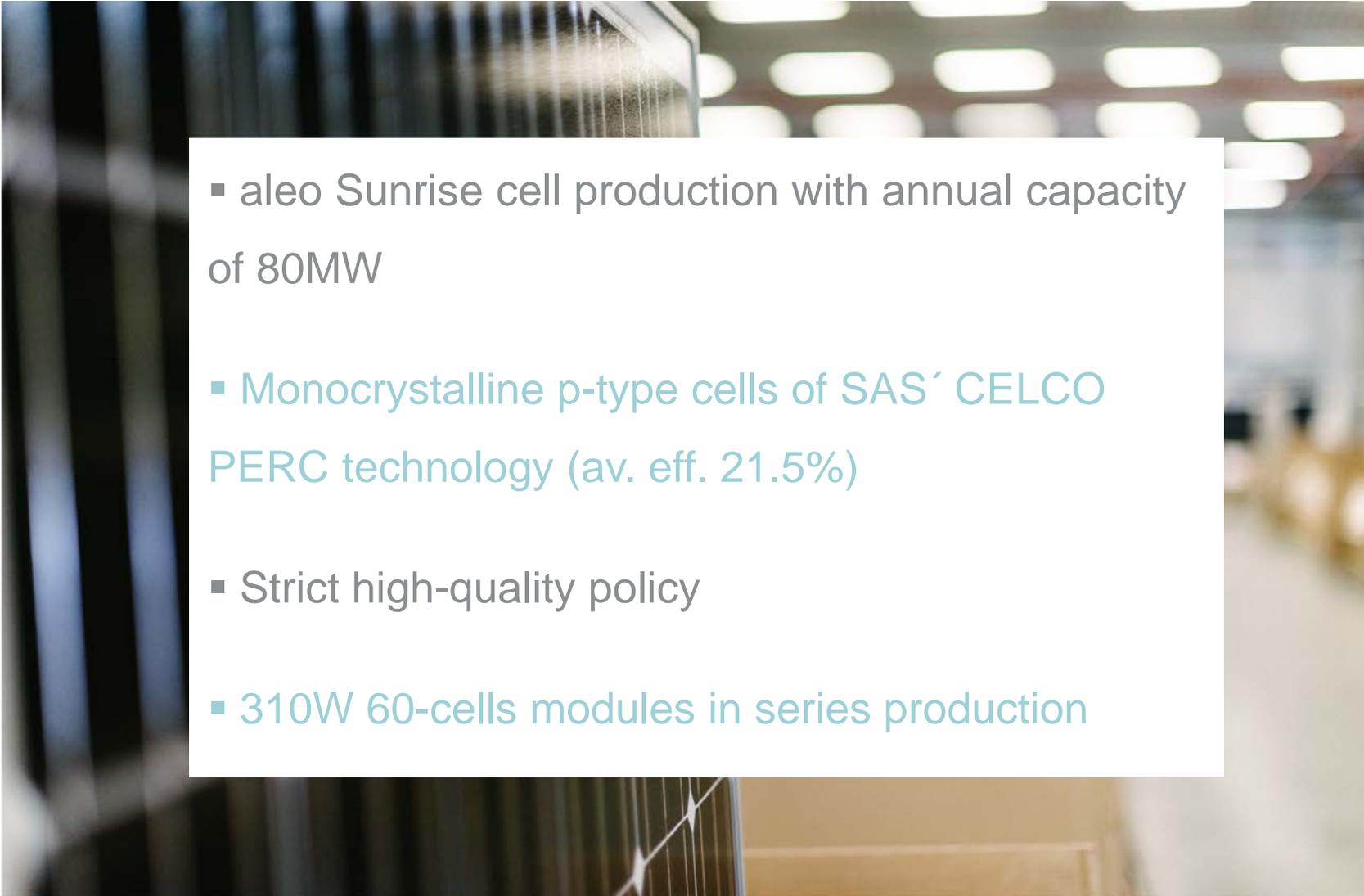
- DH2000
- TC400
- HF20
- UV20



Study of failure mechanisms, end-of-life tests



→ DH time

- 
- A blurred background image showing a factory setting with rows of solar cells being processed. The cells are arranged in a grid pattern, and the lighting is bright, creating a sense of industrial activity.
- aleo Sunrise cell production with annual capacity of 80MW
 - Monocrystalline p-type cells of SAS' CELCO PERC technology (av. eff. 21.5%)
 - Strict high-quality policy
 - 310W 60-cells modules in series production