

**aleo**  **sunrise**  
**aleo**

High efficiency cells and modules –  
made in Germany



*Solar Fab-1 / Chunan, Taiwan*



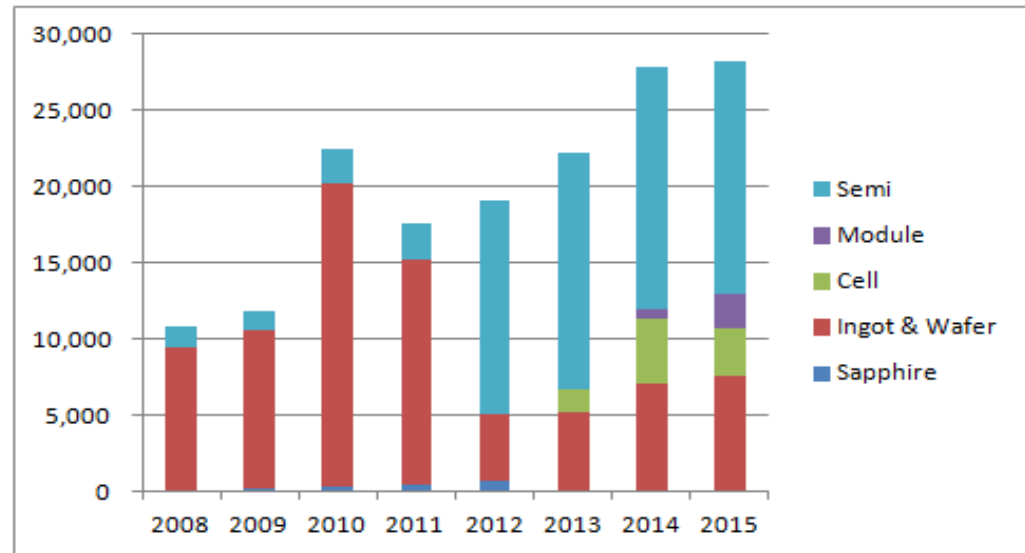
*Solar Fab-2 / Chunan, Taiwan*



*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

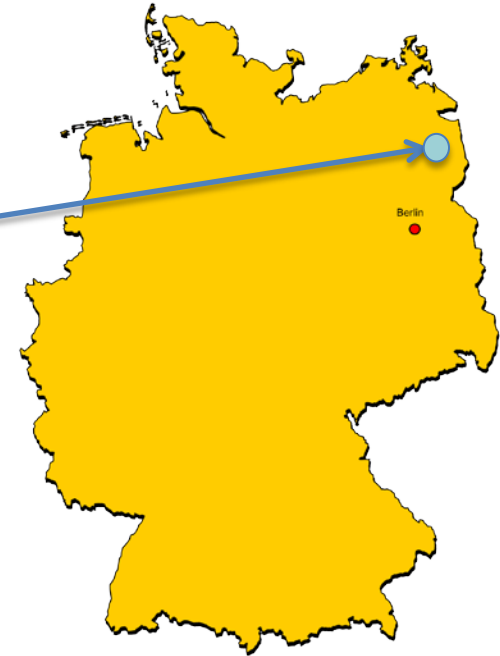
**Employees:** > 4,500

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

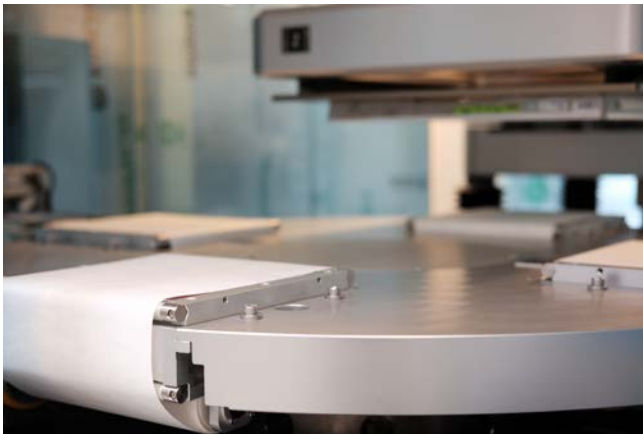
**Sep 2015:** aleo Sunrise GmbH founded as 100% subsidiary company of aleo solar GmbH

**Mar 2016:** First cell produced in Prenzlau

**Sep 2016:** Official inauguration

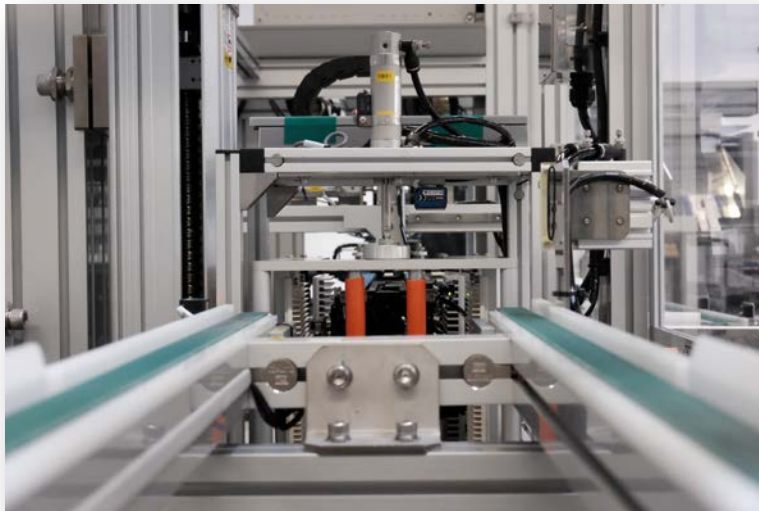


- Supply own module manufacturing
- Easily adapt to the needs of module manufacturing
- PV Know How in Prenzlau since 2001 & technical expertise from SAS since 1981
- Share resources at the same site
- German certificate of origin





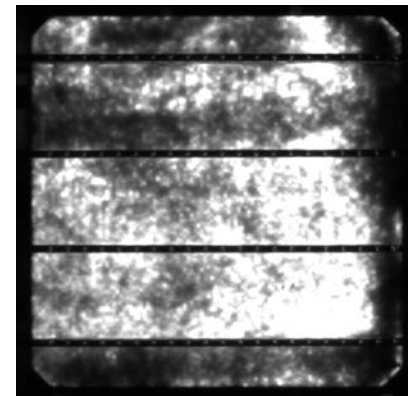
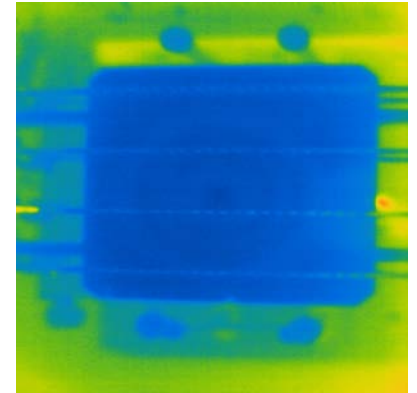
- Portfolio: Monocrystalline PERC cells
- Average output: >60.000 cells per day
- Average efficiency: ~21.5 %
- Staff: Approx. 60 in three-shift system
- Production capacity: 80 MW/year on two lines
- Certifications: DIN EN ISO 9001:2008, DIN EN ISO 14001:2009,  
DIN EN ISO 50001:2011



- Cutting-edge  $\eta$  using standard PERC processes
  - High mechanical stability
  - Hot-spot free
  - Color homogeneity
  - No oxidation
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- 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

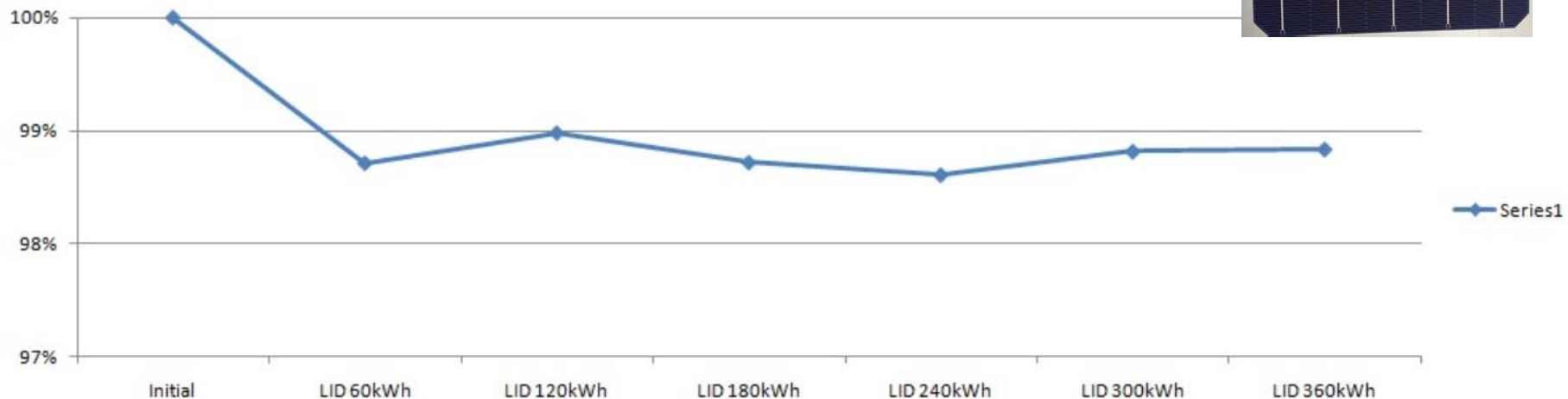


- High productivity
- Low VA costs
- Meet customer requirements: premium module manufacturers  
(residential roof top, BIPV, automotive)

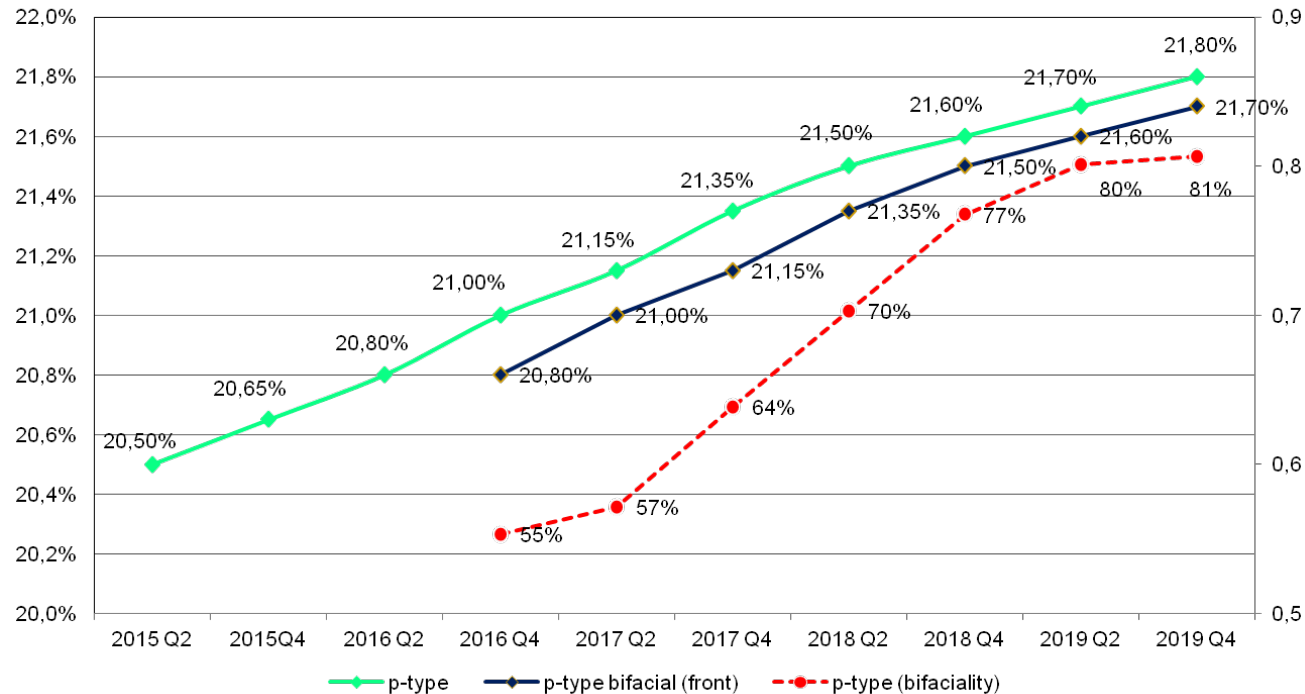


## Monocrystalline PERC cells

- 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



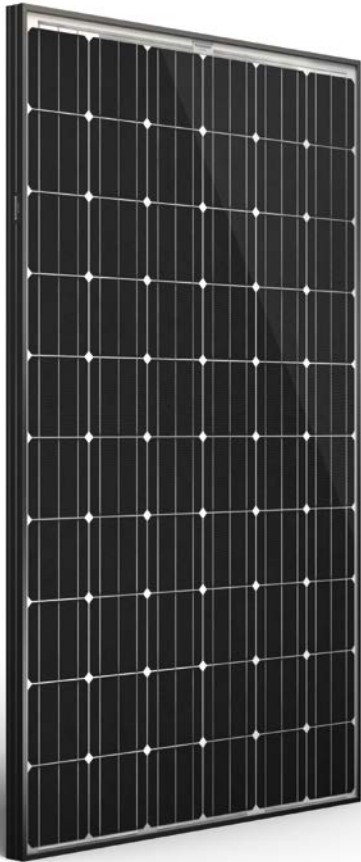
## Efficiency roadmap



- Continuously increase  $\eta$
- Go bifacial to increase module yield
- Implement 2 more production lines?

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

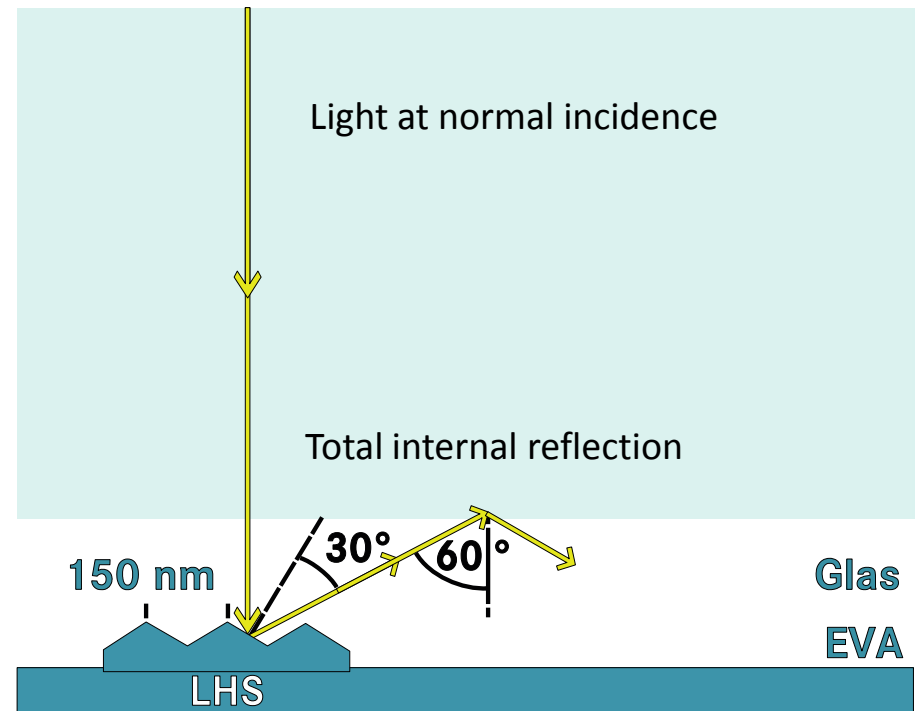
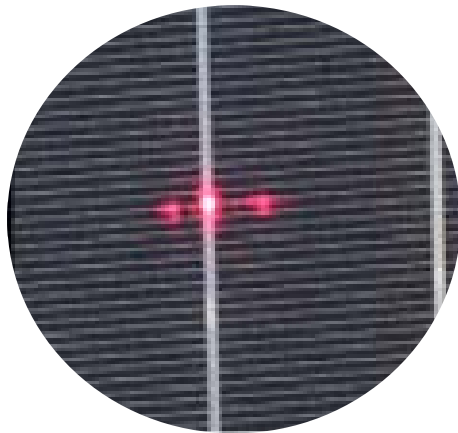
Max. power 317W



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

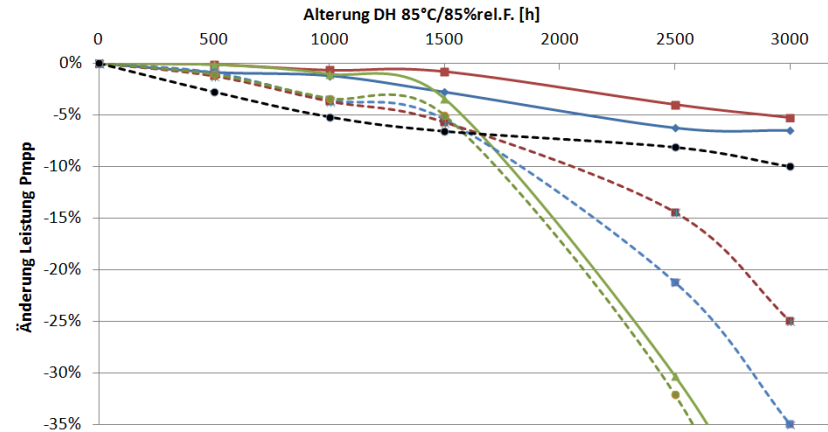
Reduce optical and electrical losses

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

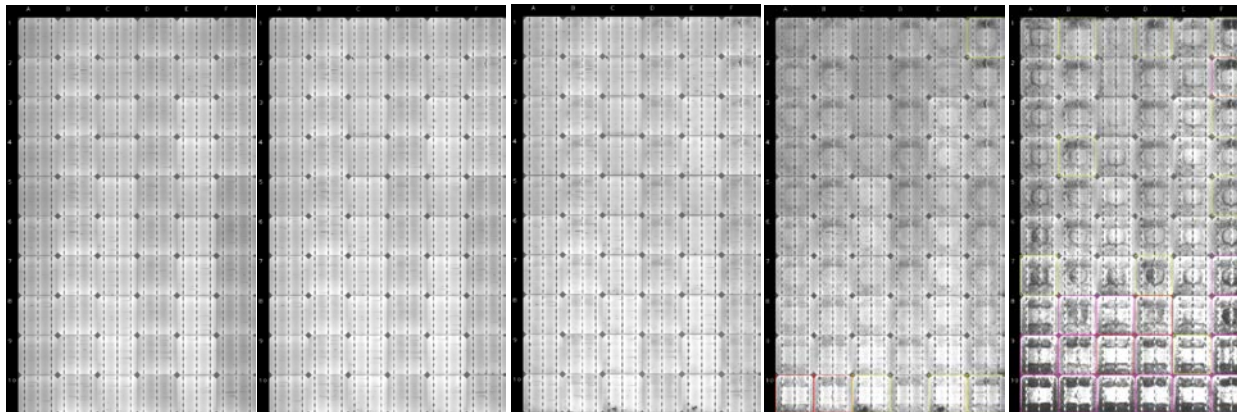


Thorough test of material combinations before series production:  
at least 2x IEC 61215

- DH2000
- TC400
- HF20
- UV20

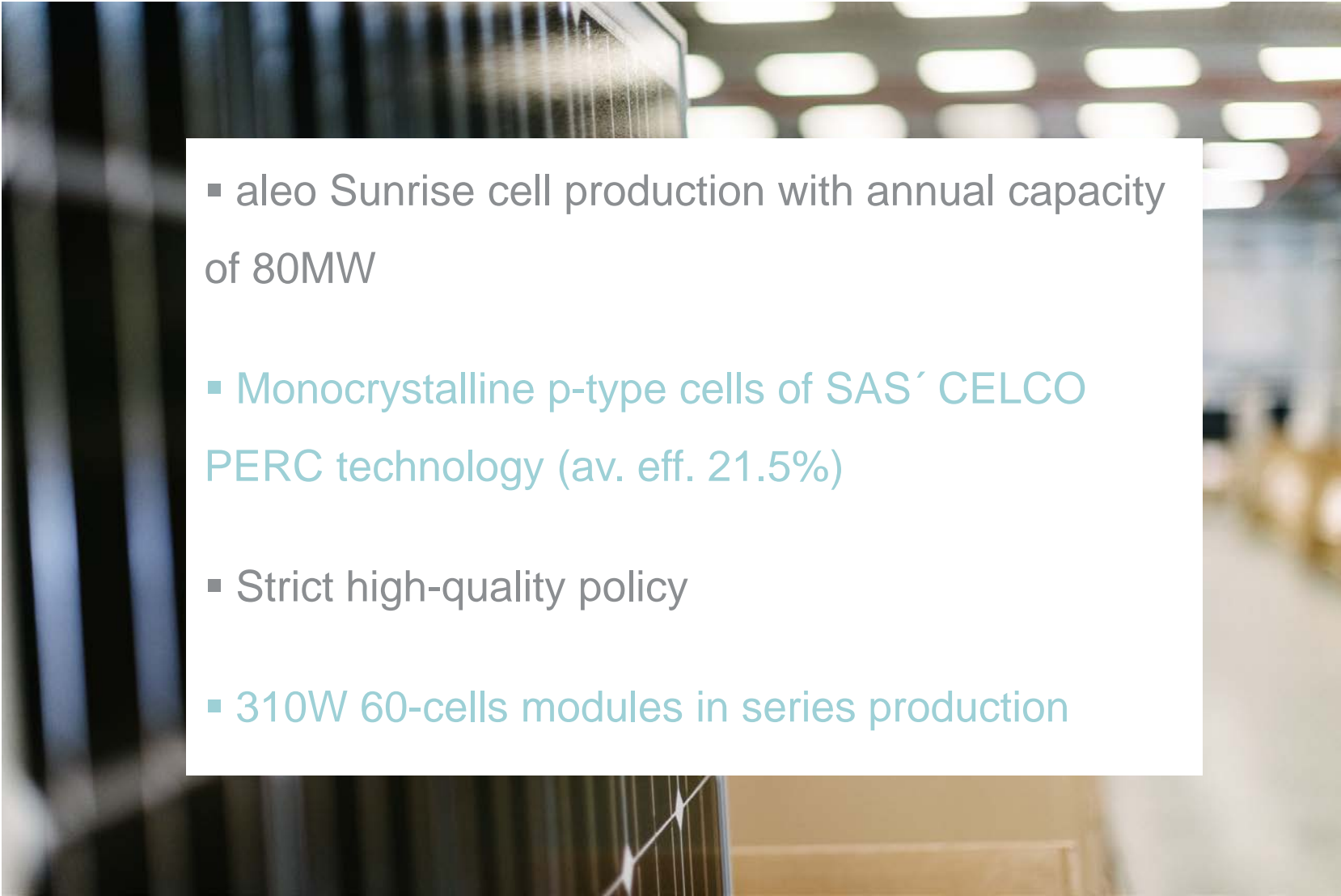


Study of failure mechanisms, end-of-life tests



→ DH time



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- A blurred background image showing rows of solar panels in a factory or installation site, with bright light reflecting off the surfaces.
- 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