NorSun - European wafers for IBC

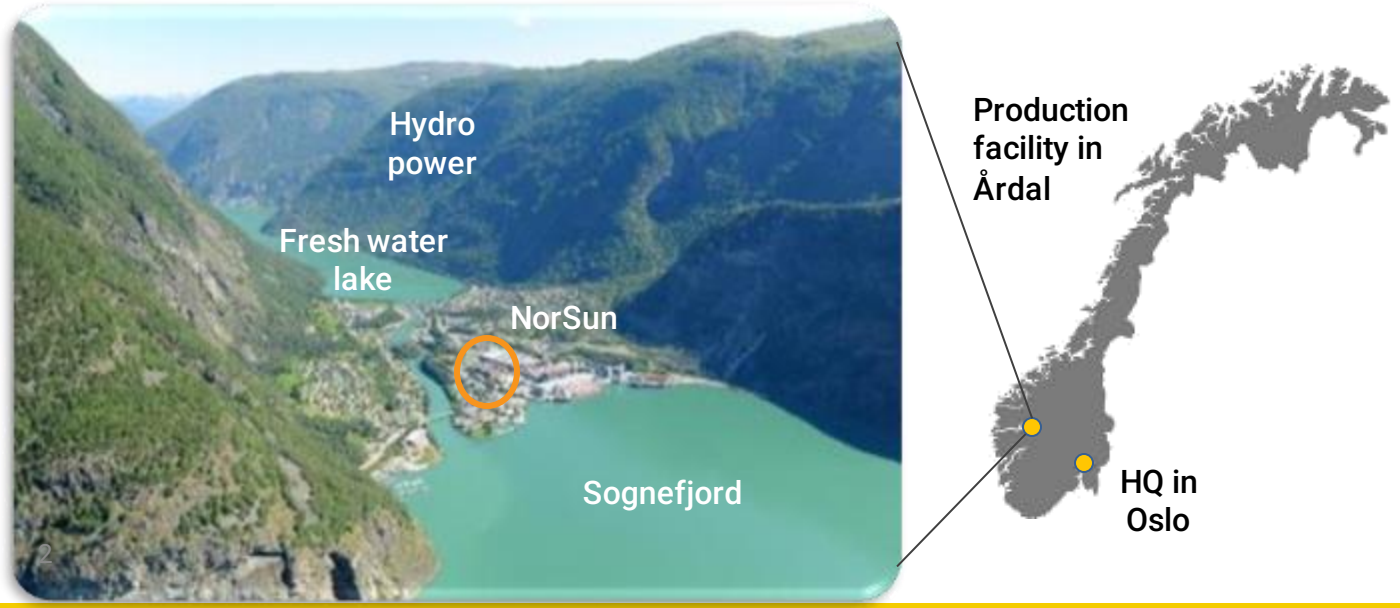
Arne K. Dahle

BC Workshop, Konstanz, 21.-22. November 2022

NorSun is the leading ingot and wafer manufacturer in Europe

Company overview

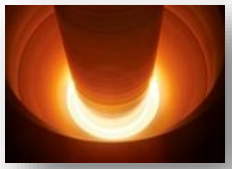
- Production of premium monocrystalline silicon ingots and wafers
- Long-time supplier to tier-1 solar cell manufacturers
- Uniquely low CO_2 footprint based on hydropower and natural cooling water
- Capacity approaching 1 GW



NorSun solar value chain position

Polysilicon

Ingots & Wafers



Cells & modules

Premium products:

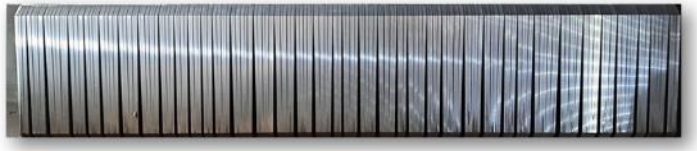
- Highest efficiency
- Lowest CO_2 footprint
- Extensive track record

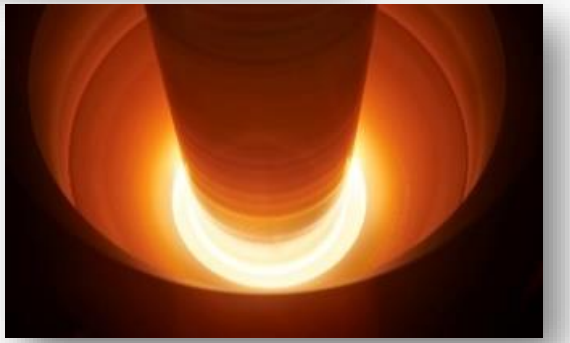
4 strong owners ~ 90%

- ABN AMRO Sustainable Impact Fund
- Nysnø Climate Investments
- Arendals Fossekompani
- Scatec Innovation

NorSun

Premium products based on 14 years of solar history





Planned expansion
to 4-5 GW capacity

Phase I expansion
to 1 GW

2019 – First ingot pulled from 28" crucible

2018 – First 50µ and 40µ wire cuts

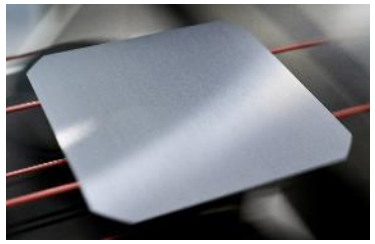
2016 – First cut with 60µ diamond wire

2011 – 100% conversion to diamond wire slicing (world's first)

2008 – First production, deliveries to Sanyo/Panasonic

2007 – SunPower long-term contract

2005 – Founded by Alf Bjørseth

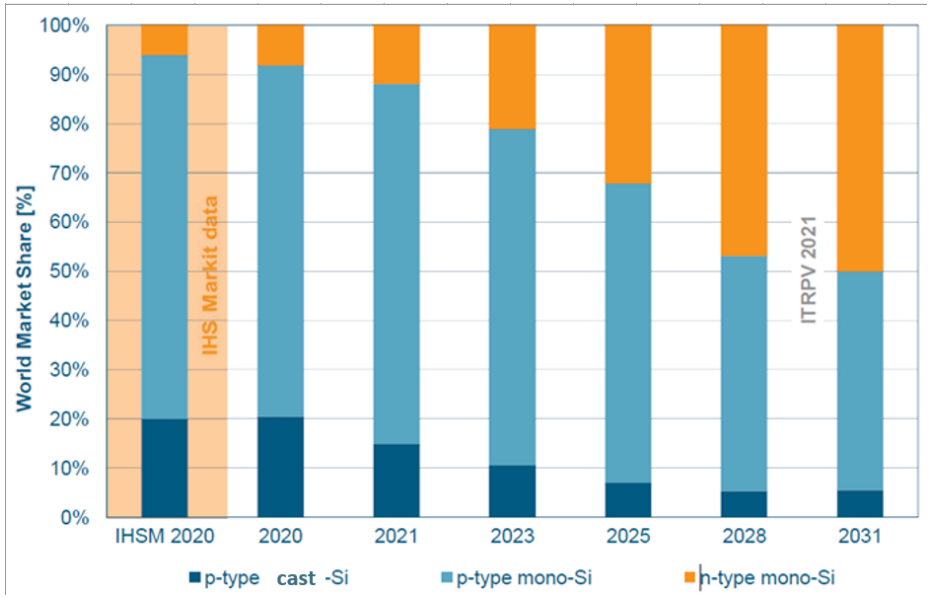


NorSun

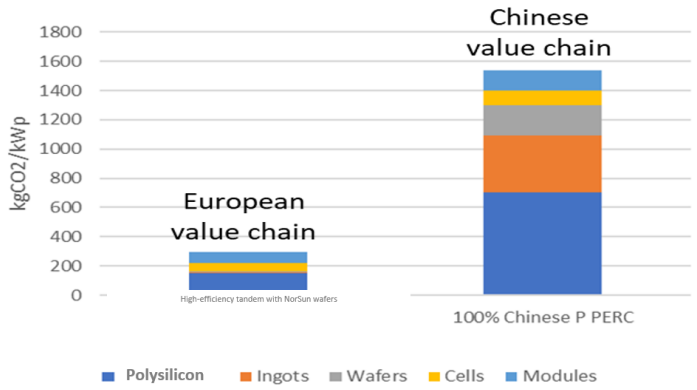
NorSun uniquely positioned in fastest growing segments

- 14 years of expertise on high-efficiency n-type material
  - Basis for next generation PV technology
- Only significant non-Asian wafer manufacturer
  - Could play a key role in re-establishing local manufacturing sites in Europe and the US
  - Full traceability and no exposure to forced labor
- Uniquely low CO_2 footprint, certified
  - French CO_2 market
  - Korean CO_2 market
  - Environmental Product Declaration (EPD) markets
- Continued growth of low CO_2 markets
  - France and South Korea
  - Europe EPD/EcoDesign markets
  - ESG reporting

N-type gaining market share

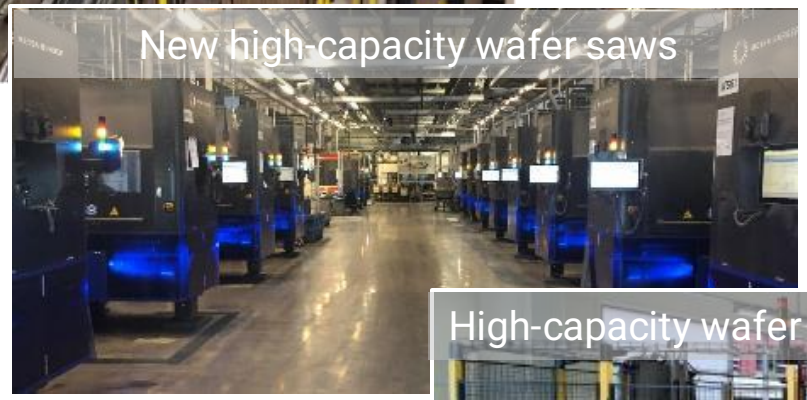


Low Carbon Footprint



NorSun

Current Phase 1 expansion

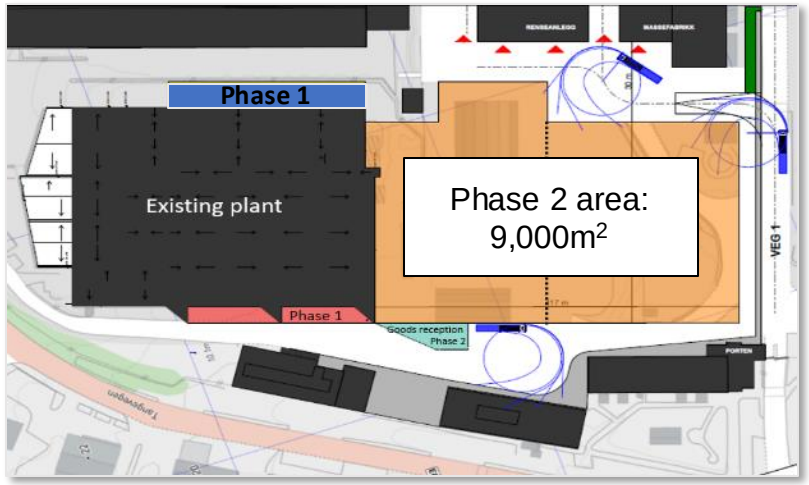


Increasing capacity to 1 GW and reducing unit costs through increased throughput and automation

NorSun

Expansion to multi GW will give NorSun scale

Site A: Existing facility at Årdalstangen +2GW



Site B: Alternative site in Øvre Årdal +5GW

Based on own technology and innovation

- Highest ingot productivity – highest material quality – safe operations
- Processing of ingots into wafers by use of latest diamond wire technology
- High degree of automation enabling reduced labour cost
- Recycling and reuse of waste (circularity)

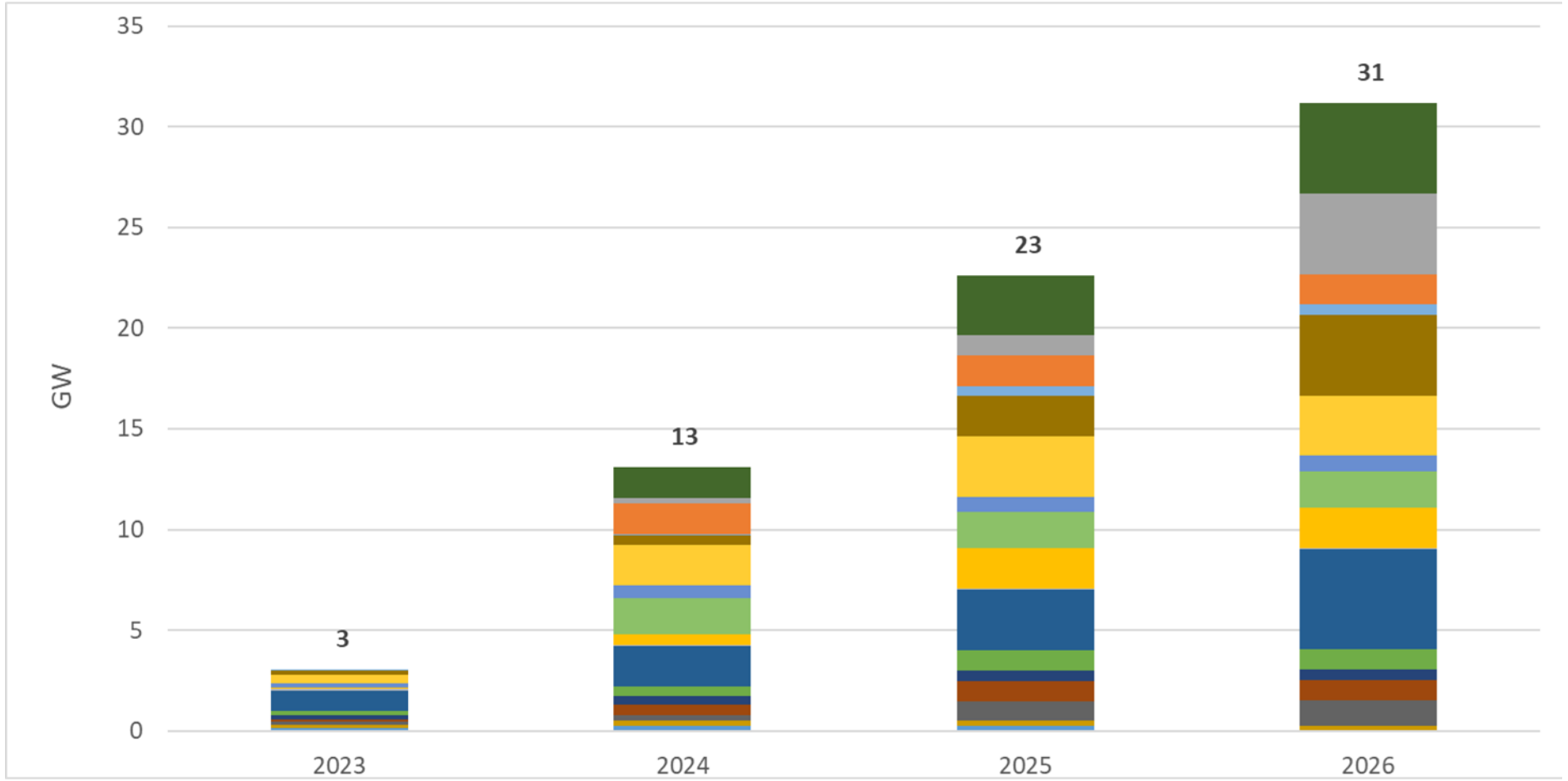
Competitive advantages

- Highest quality
- Clean products
  - Uniquely low environmental/carbon footprint
  - High social standards, no forced labour
- Western/European value chain

Confidential

NorSun

NorSun customers and leads want long term co-operation - Potential demand 2023-2026 (US and EU)



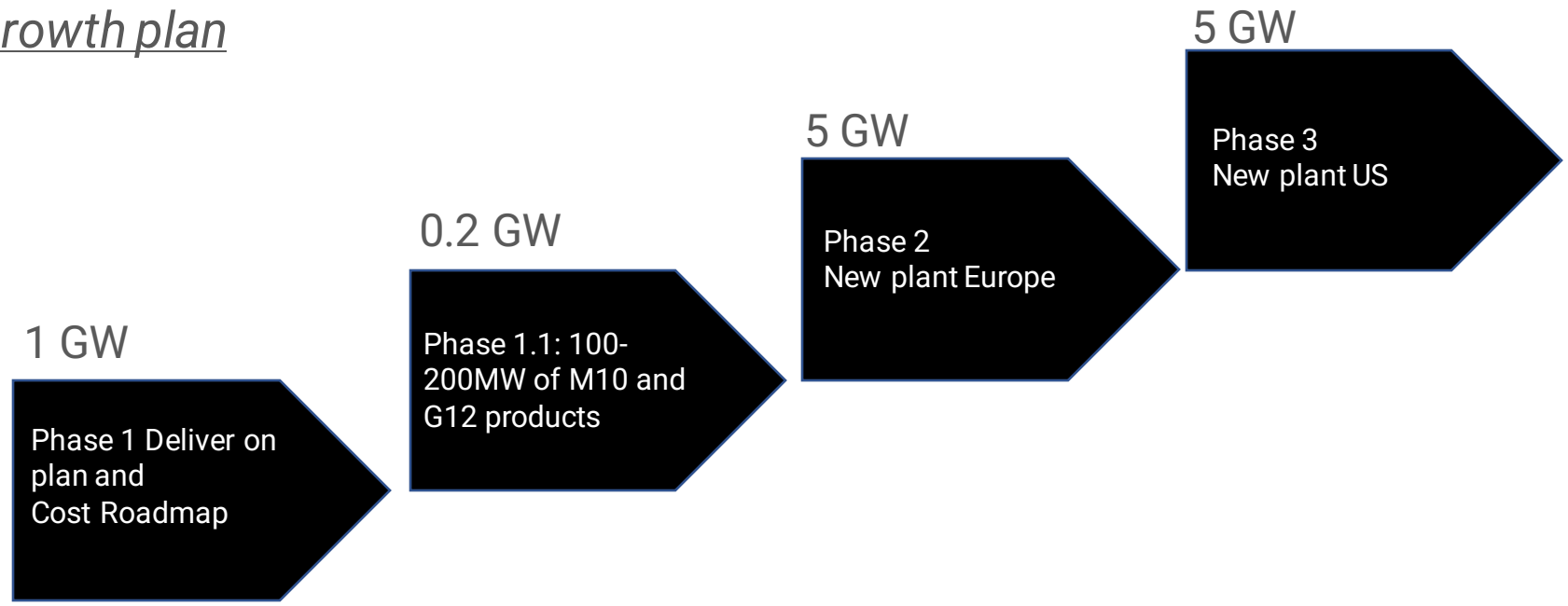
- Increasing potential customer demand from 3 GW in 2023 to over 30 GW in 2026
- New customers/partners with growth potential/plans → Strong interest for non-Chinese wafers
- Aim and potential to become largest non-Asian wafer producer supporting value chains in Europe and USA

NorSun

Business case: Window of opportunity for NorSun

Attractive market conditions both in Europe and the USA

Indicative growth plan



Required Capex NOKm	44	100-200	4.000-4.500	4.000-4.500
Schedule	2022-23	2022-23	2023-24 (*)	2024-25
Product	125mm – M6	M10, G12	M6, M10, G12	M6, M10, G12

Key factors

- Establish European/ US supply chain
- Product quality
- Carbon footprint
- Competitive cost position
- Potential wafering at customer sites
- Customers to support CAPEX projects
- Europe needs 45-50 GW capacity to support 600GW target in 2030
- Inflation Reduction Act (Solar Energy Manufacturing for America)

Potentially bring forward US expansion
=> parallel scaling

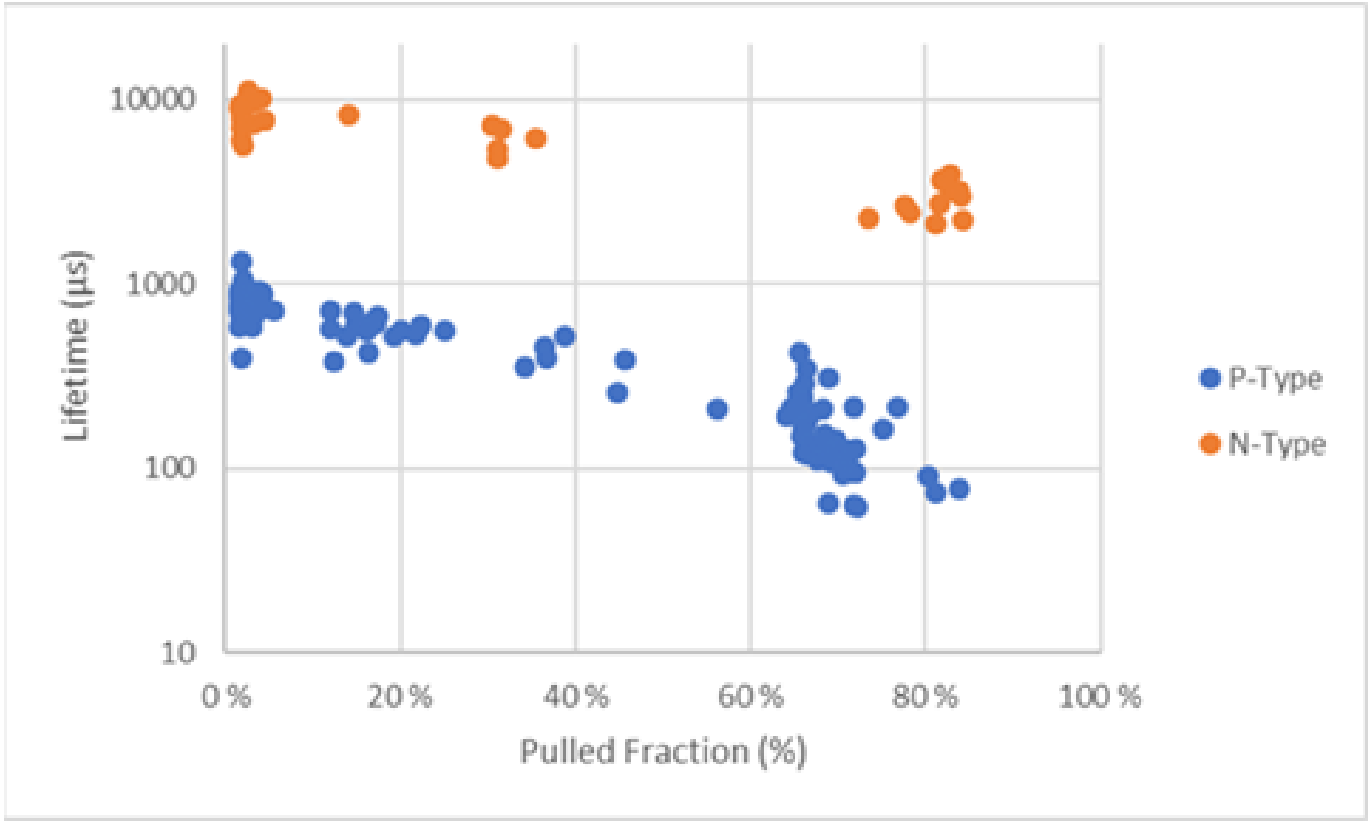
Notes:

- (*) – Concept study / pre-engineering in 2022

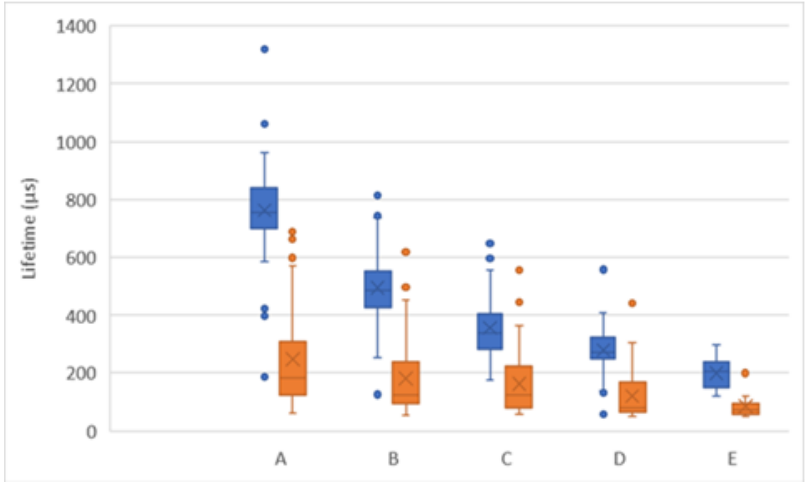
Confidential

NorSun

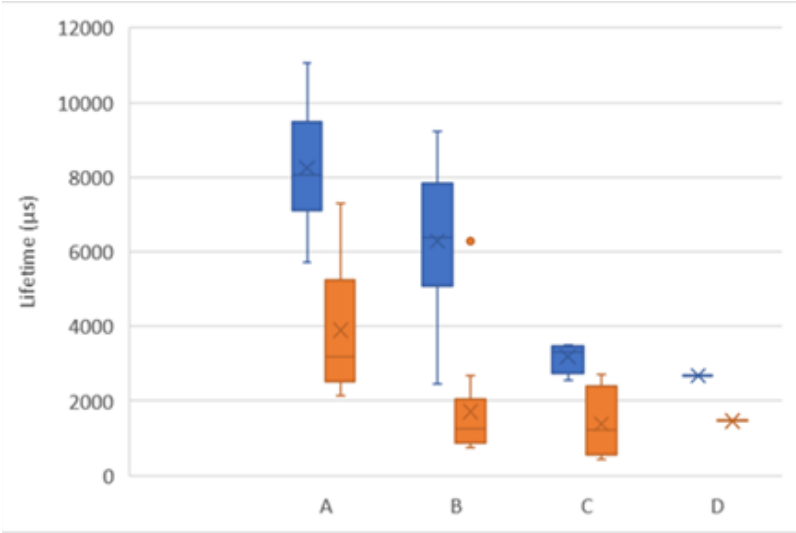
MCLT(μs)



P-Type



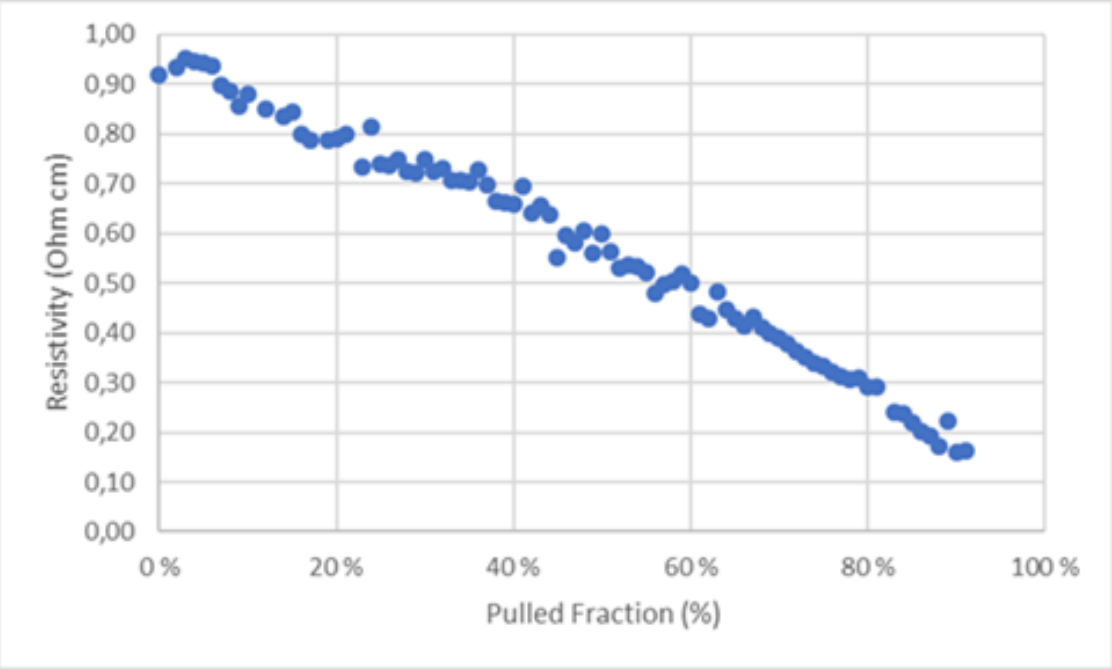
N-type



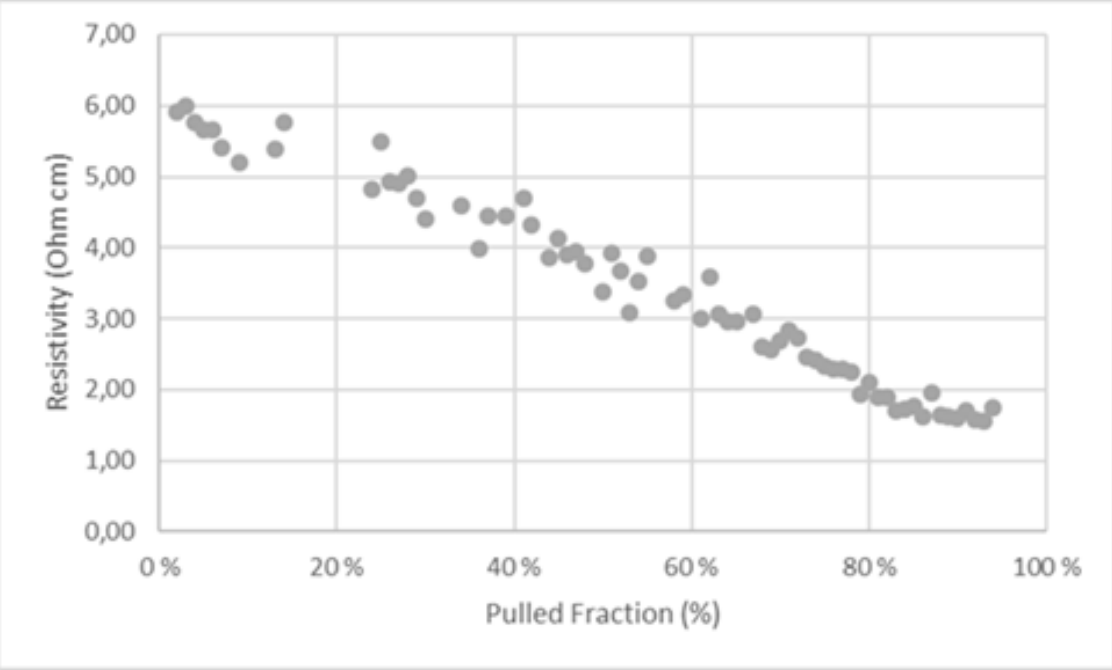
Confidential

NorSun

Resistivity (Ω.cm)



M6, P-type

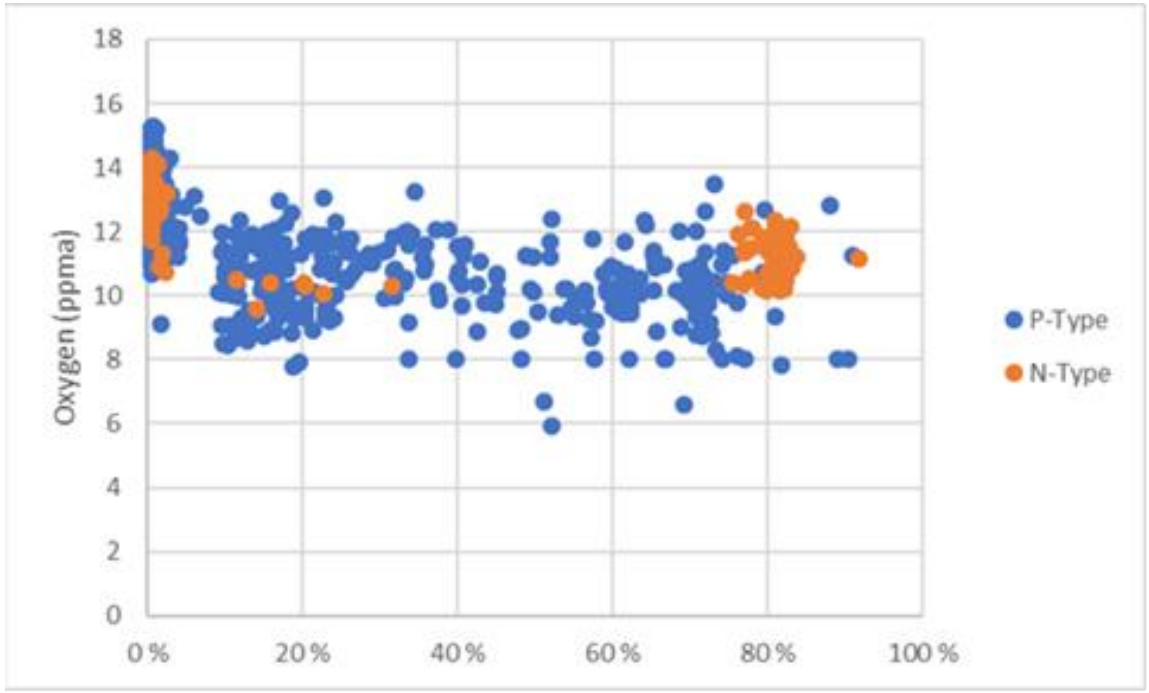


M6, N-type

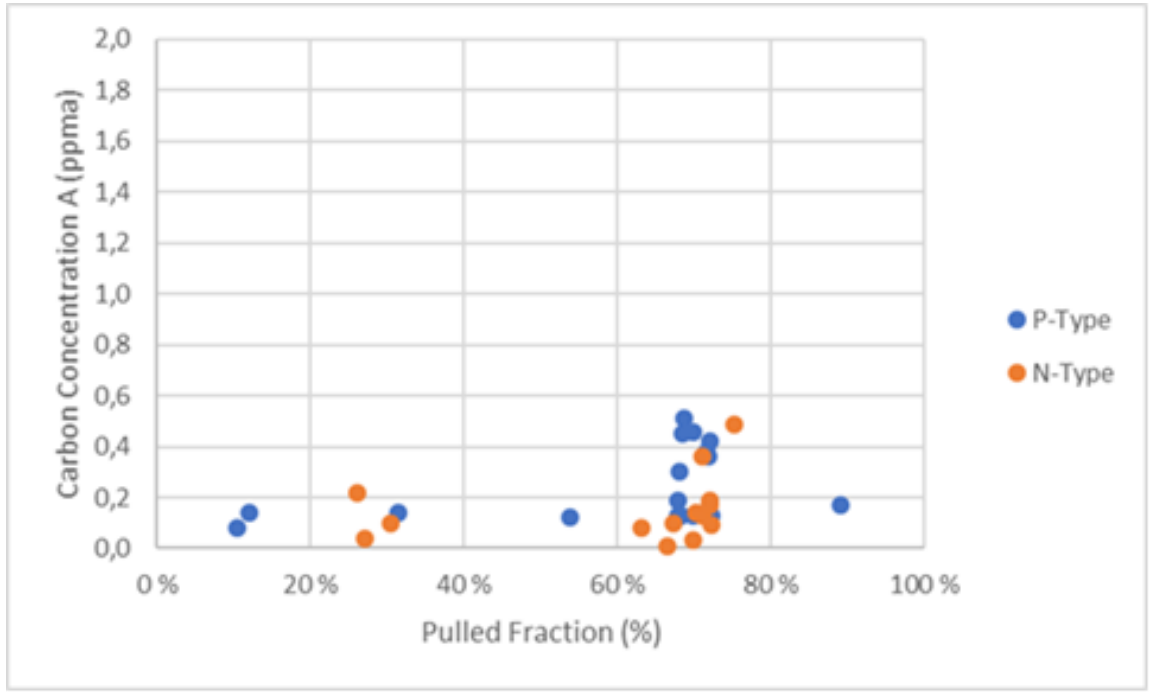
Confidential

NorSun

Oxygen(Oi) and Carbon(Cs)



Oxygen(ppma, M6 P and N-type)



Carbon(ppma, M6 P and N-type)

Confidential

NorSun

Our vision

is a sustainable future with clean energy for all.

Our mission

is to be a leading manufacturer of silicon ingots and wafers for premium solar cells, through innovative technology, sustainable production and operational excellence.

Our values

Dedication, Innovation, Inclusivity and Integrity

"It simply feels good to use hydro power to produce solar cell materials."

NorSun