COMPETITIVENESS OF EUROPEAN PV MANUFACTURERS

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PV Heading into the Terawatt Range – This is a Disruption!

- Rapid introduction of PV globally is fueled by availability of cost-competitive, distributed energy
- By 2018, about 500 GW\textsubscript{p} have been installed!

We are just at the beginning of the global growth curve!
Status Quo and Outlook
European PV Market

- EU represents the second largest PV market after China
- In order to meet climate goals, medium to high market development seems reasonable

Source: SolarPower Europe
Status Quo
Current European c-Si PV Manufacturing Landscape

- Distribution of small plants < 500 MW/a capacity
- Almost no cell production capacity left
- Silicon/wafer production in Scandinavia

Value chain step
- mc-Si / Poly-Si
- Ingot / Wafer
- Cell
- Module

Factory size
- > 500 MWp
- 100 – 500 MWp
- 50 – 100 MWp

Evolution of new cell fab size (Asia)

1Jörg Müller, Presentation Hanwha Q-Cells, PVCellTech 2019, Penang, Malaysia
Technology Selection
Guideline: Latest ITRPV Roadmap 2019

Factory size: 1 GW

Wafer
- p-type mono Si wafer (M2), 160 µm, DW cutting

Cell
- Half-cut PERC cell, average prod. Efficiency 22.3%

Module
- Glass-Backsheet, 380 W
- Aluminium frame
- 5-6 busbar stringing interconnection
Scope and Different Scenarios under Consideration

Scope:
- Can a European based vertical integrated PV manufacturing facility for a mainstream product be cost competitive against China?

3 different scenarios:

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<th>Scenario</th>
<th>Manuf. Location</th>
<th>Equipment</th>
<th>Supply Chain</th>
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Remark: Calculation made under the following assumption: Greenfield site, no upgraded building facilities or already depreciated process equipment
TCO Comparison of the Different Scenarios

- Transporting cost for modules from China has to be considered
  - 1.2 €ct/Wp add-on on All-in module cost
- Remaining Cost-Gap of 0.8 €ct/Wp
- Made-in-EU prize premium of ~1€ct/Wp possible?
- OPEX related difference of 3.8 €ct/Wp between EU und CN scenario
TCO Comparison of the Different Scenarios

OPEX Cost Shares

- Main contributors mainly from Module production: Glass, Al frames, Backsheet, EVA, Ribbons, Junction Box, Ag-Pastes
- Price differences mainly related to purchase quantity (economy of scale effect)
TCO Comparison of the Different Scenarios
Sensitivity Analysis – Example: Glass Price

- EU: Only a few supplier left for specialized PV glass
- Existing Glass producer in EU still large, but focussed on other products
  - Sufficient local (EU) demand might allow similar pricing than CN
  - More than 1.12 €ct/Wp cost reduction possible

![Graph showing the variation of input parameters on the TCO comparison.](https://via.placeholder.com/150)

\[ \Delta \sim 1.12 \text{ €ct/Wp (4.3\%)} \]
TCO Comparison of the Different Scenarios

- Development of supply chain in Europe can bring down cost below China benchmark
- Strong local EU market perspective necessary
Summary

- Strong future world-wide growth of PV expected, EU market development positive
- EU PV manufacturer landscape: Mainly remaining module manufacturing at relatively low production volumes (compared to China)
- Made-in-Europe premium (sustainable product) would fully compensate still existing cost difference between EU and CN based manufacturing scenario
- „Recovery“ of EU supply chain could lead to fully cost competitiveness even without premiums
  - Strong and sustainable EU PV market development necessary
- Further upside potentials:
  - Political support to achieve industrial level playing field for new entrants as well as PV promoting market conditions (no market caps, net integration)
  - Economy of scale effects for sustainable growing PV manufacturing landscape
  - Technology advancements: Fast integration of innovations into production
Thank you for your Attention!

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