Re-establishing an upstream solar manufacturing value chain in Europe

Key messages for European Commission and National Governments

Management summary

- For the next decades, Photovoltaics (PV) is and will remain the cheapest and most environmentally benign way to produce electric power, and a central element in the energy transition addressing climate change, as also recognized in the RePowerEU.
- Scale of the European PV manufacturing industry should be much larger than it is today to **mitigate vulnerability against supply chain disruptions and to ensure the success of EU energy transition**. Especially silicon wafers, which are one of the most crucial parts of a solar module, are not produced in Europe on a sufficient scale.
- The supporters of this initiative, which are key stakeholders in the PV upstream value chain[1] convened in October 2022 to discuss status and prospects towards a timely buildup of a massive European upstream manufacturing value chain.
- Supporters agreed that **the business risk for European companies in establishing a sustainable solar manufacturing value chain is very high, so investment decisions are very difficult to convey to shareholders and investors.**
- Supporters therefore **call on the political decision-makers to urgently adopt measures to create a fair level playing field on an international level**, which is suitable to mitigate business risks to an extent stakeholders can invest.
- Possible measures to support European solar manufacturing industry include, among others:
    - subsidies for investments in PV manufacturing and supply item production lines, as well as for respective operational expenses of new and existing capacities
    - warranties for a competitive energy price especially for energy intensive process steps of the solar manufacturing value chain
    - low interest-rate loans and credit guarantees
    - local-content schemes
    - tax related to CO_2 (eq) emissions in product manufacturing and faster deployment of renewables to decarbonize energy generation
- The supporters are convinced that a **sustainable European PV manufacturing industry can be revitalized** by public support of **EUR 0.10 - 0.15 per Wp of produced PV, spent over the next 10 years** on supporting the installation and operation of PV manufacturing facilities[2]**.**
  This would resolve Europe's severe energy dependence significantly, while increasing economic value and creating jobs.
- Key supporters of this initiative are, a.o.:
  ECM, Fraunhofer CSP, Fraunhofer ISE, MEYER BURGER, NorSun, NORWEGIAN CRYSTALS, WACKER

[1] "Upstream": manufacturing of metallurgical and ultrapure silicon, silicon crystals and silicon wafers

[2] in comparison: US Inflation Reduction Act alone currently provides an incentive of USD 0.11-0.18 per Wp

Key messages "Re-establishing an upstream PV supply chain in Europe"

Situation in Europe

- Europe's energy supply has to be and will be based on solar PV to a high share, with "crystalline silicon" as the predominant technology.
- **Equipment and consumable deliveries over the supply chain are to a high or very high extent dependent on imports.**
- Beyond cells and modules especially wafer supply depends currently on imports; there is no significant manufacturing capacity present in Europe.
- Any supply disruptions to source PV products will lead to a quasi-immediate stop of deploying solar power in Europe. Europe **DOES NOT HAVE ANY RESILIENCE AGAINST SUCH A SOURCING CRISIS.**
- The European Commission has stated its political will to reduce this severe vulnerability and to gain at least partial independence and control of the whole supply chain.

Wafer manufacturing stakeholder situation

- European stakeholders covering key positions of the upstream value chain and respective material supplies convened on October 12th/13th 2022 at Fraunhofer CSP, Halle/Germany to discuss requirements, bottlenecks and necessary boundary conditions to establish a 20-30 GW wafer manufacturing in Europe in short term.
- Key issue is – compared to other parts of the value chain – the **high cost to build up and operate upstream manufacturing capacity**[3]. This is also true for some essential supply chain items, like graphite.
- Most equipment and materials have to be sourced from abroad at least for the initial years. **Establishing a resilient supply chain needs 5-10 years of dedicated and continuous investment embedded in a sustainable economic and regulatory environment.**
- Stakeholders of the upstream value chain are **convinced that they have the ability to implement several dozens of GWp production capacity equivalent in Europe in the coming 5 years.**

- Key supporters are, a.o.:

ECM GROUP · Fraunhofer CSP · Fraunhofer ISE · MEYER BURGER · NORWEGIAN CRYSTALS · NorSun · TPRC · WACKER

[3] CAPEX per 10GWp of new factories for poly-Si and wafers: approx. EUR 3-4bn; Lead time up to 3 years. Payback times 4 years and more. OPEX becomes uneconomic with high electricity prices and an unstable or uncompetitive materials supply chain.

Problem statement

"Under present conditions, business risk for European companies in establishing a sustainable solar upstream manufacturing value chain is very high. Positive investment decisions are difficult."

Main reasons are:

- Unpredictable market environment.
- **High CAPEX expenses and long payback times**, with the risk of sudden and severe financial distress even for strong companies.
- The PV industry requires **highest standards of sustainability across the value chain, including environmental standards, CO2 footprint and human rights**, whose consequent implementation is leading to increased operational cost.
- An **unleveled playing field with respect to the availability of electrical power** at competitive prices compared with Chinese and US power prices and electricity market mechanisms, leading to higher operational cost & prohibiting capex due to uncertain planning base.
- To establish globally & internationally competitive framework conditions, competitive energy pricing for energy intensive production steps Si-metal, Polysilicon & Ingot/Wafer Production is paramount.
- **The US Inflation Reduction Act** heavily subsidizing US industry, thus creating strong competitive disadvantages for European production.

Within this environment it is very difficult for strategic, business, and financial investors to invest in the upstream business at significant scale.

Requirement

With the problem statement given above there is one major requirement politics needs to provide to kick-start establishment of a full PV value chain and in effect reduce dependency in energy production:

"Business risks must be mitigated to an extent stakeholders are able to invest in establishing and to competitively operate a sustainable solar upstream manufacturing value chain in Europe"

There is a manifold of possible measures which can be implemented to reach this requirement. It is of **utmost importance that measures are defined and implemented urgently** to not **lose our ability to gain control over our energy supply**.

A list of proposed measures is attached in the Annex.

The supporters are convinced that, regardless of what measures are taken in detail,

the revitalization of a sustainable European PV manufacturing industry can be triggered very effectively
by giving public support of EUR 0.1 - 0.15 per Wp of produced PV, for the operation ("OPEX support") and installation ("CAPEX support") of PV manufacturing facilities (new and existing), spent over the next 10 years, including a competitive energy price around 40 €/MWh.[4]

This would **massively reduce Europe's severe energy dependence**, while increasing economic value and creating jobs.

[4] in comparison: US Inflation Reduction Act alone currently provides an incentive of USD 0.11-0.18 per Wp

Annex

Proposed measures to trigger revitalization and stabilization of PV manufacturing in Europe

The supporters propose to consider implementation of the following measures:

A) Mitigate capital expenses and development risks

- Allow for significant CAPEX incentives of at least 50% for a limited initial production capacity of 30 GW throughout each step of the PV manufacturing and supply chain, independent on origin of the equipment.
- Install deficiency guarantees on national and European level for leasing schemes implemented by equipment providers.
- Implement CAPEX incentives for further 70 GWp of manufacturing capacity of initially 50% for European developed, manufactured and supplied equipment and consumables ("local content"), decreasing to 10% within 5 years. The local content incentive of 10% should be kept until 2033.
- Implement dedicated R&D funding programs specifically targeted at equipment development for upstream applications at substantial height. Funding rates should be at least 75% for companies, and 90-100% for R&D institutes.

B) Mitigate operational expenses and market risks

- Define a manufacturing support scheme including direct incentives per shipped goods (poly-Si, wafer, cells, modules) and tax reduction measures for producing companies.
- Establish globally & internationally competitive framework conditions – in particular competitive energy pricing – for energy intensive production steps Si-metal, Polysilicon & Ingot/Wafer Production to maintain existing capacities and to encourage new capacity expansion.
- Implement a local content support scheme incentivizing local content proportional to its value in the module.
- Define a mandatory CO_2 emission reduction roadmap to be achieved in the different sectors and countries. Incentivize over-fulfilment of targets, and make sure energy intensive industries are not burdened unilaterally.
- In parallel to the foregoing CO_2 related measures, massively expand installation of renewable power generation and storage to increase share of green power in the electricity mix as quickly as possible.

C) General measures

- Allocate budgets for incentives, subsidies, bank guarantees etc. as quickly as possible.
- Implement effective and quick decision processes on eligibility and grant of projects.
- Allow national governments to support local PV production, also state-of-the-art technologies, at significant shares by adjusting the state aid guidelines rules to allow member states for more and fast CAPEX and OPEX support of PV manufacturing projects.