Identifying Potential Challenges for Developing Solar Industry Manufacturing Capacity in the European Union (EU) within the EU Green Deal Industrial Plan

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INTRODUCTION

- The EU aims for **nearly 600 GW of solar PV by 2030**
- Solar energy is pivotal for climate goals and energy security, contributing **about 5% of EU electricity consumption in 2022 (220 TWh).**
- The Green Deal Industrial Plan (GDIP) emphasizes solar expansion for climate neutrality and economic resilience.
- **The Disparity** : Despite strong demand, Europe's manufacturing share for PV components (polysilicon, cells, wafers, modules) is currently **negligibly small (0-2% in 2024)**.
- **China dominates over 80% of global PV manufacturing capacity** across all stages.

RESEARCH QUESTION

What are the challenges impeding the EU's ability to scale its solar manufacturing capacity under the Green Deal Industrial Plan?

METHODOLOGY

Systematic Review :Utilized **PRISMA framework** for rigorous subject selection

5 EU Initiatives: REPowerEU Plan, Net-Zero Industry Act, Critical Raw Materials Act, Innovation Fund (under EU ETS), Horizon Europe. These cover deployment, industry alliances, manufacturing capacity, raw materials, and R&D financing.

2 Representative EU Solar Manufacturing Companies: Wacker Chemie AG (Upstream - polysilicon) and Meyer Burger Technology AG (Downstream - modules/cells).

SWOT Analysis : Applied to each selected initiative and company to identify internal (Strengths, Weaknesses) and external (Opportunities, Threats) factors.

KEY FINDINGS: SWOT Analysis

A EU Initiatives: Strategic Vision vs. Implementation Gaps

STRENGTHS

- **Clear and Ambitious Targets:** Initiatives like REPowerEU (600 GW solar PV by 2030) provide strong strategic direction.
- **Robust Financial Support:** Substantial EU-level funding (e.g., Innovation Fund ~€40bn ; Horizon Europe ~€93.5bn) backs R&D and deployment.
- **Strategic Prioritization:** Solar energy is officially classified as a key net-zero technology under the Net-Zero Industry Act.

OPPORTUNITIES

- **Surging Global Green Investment** : Record-breaking $2.1 trillion in 2024 presents co-financing opportunities.
- **Reshoring and Localization Trends** : Heightened interest in domestic manufacturing due to geopolitical tensions
- **Technological Breakthroughs:** Innovations (e.g., tandem perovskite cells, bifacial modules) enable higher efficiency and lower costs.

S W O T

WEAKNESSES

- **Lack of Binding Obligations** : Many targets are non-binding, leading to fragmented national-level implementation.
- **Administrative Complexity:** Lengthy and complex funding and permitting procedures (e.g., 12+ months delays).
- **Limited Scope of CRM Act** : Key materials like silver and indium are under-addressed despite high strategic importance.

THREATS

- **Severe Global Price Competition:** Chinese modules priced up to 50% lower due to overcapacity and subsidies.
- **Supply Chain Risks:** Heavy reliance on China (>60%) for solar components exposes the EU to disruptions.
- **Macroeconomic Instability:** Volatile carbon pricing and rising interest rates can threaten solar project viability.

B EU Firms: Innovation Amidst Structural Vulnerabilities

STRENGTHS

- **Leading-Edge Technology** : Wacker produces premium-grade polysilicon ; Meyer Burger develops 22% efficiency heterojunction cells.
- **Strategic Fit & EU Backing** : Firms align with EU clean-tech goals and benefit from major public funding (e.g., €200M for Meyer Burger).

WEAKNESSES

- **High Import Dependency:** Key inputs like wafers and glass are sourced mainly from Asia, weakening supply chain autonomy.
- **Limited Production Scale:** Firms operate smaller factories (~1.4 GW) compared to China's 10–18 GW, increasing per-unit costs.
- **Operational Fragility:** Meyer Burger faced €225M EBITDA losses in 2024 and plans factory closures due to market pressures.

OPPORTUNITIES

- **Growing Domestic Demand:** EU targets (e.g., 40% local production) fuel demand for European-made solar components.
- **Policy and Permitting Support:** Streamlined permitting (9–12 months) and access to Horizon/Innovation funding ease expansion.
- **Tech Momentum:** Advancements in automated recycling and next-gen PV cells provide competitive innovation pathways

THREATS

- **Aggressive Global Competition:** Chinese price advantage and US Inflation Reduction Act threaten EU market share.
- **Geopolitical Volatility:** Material supply chains remain vulnerable to international tensions and trade restrictions.
- **Fast Tech Cycles:** Rapid innovation (e.g., TOPCon cells) risks outpacing EU firms' R&D timelines.
- **Environmental Regulation Burden:** Strict EU emissions rules raise costs, especially for energy-intensive producers like Wacker.

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INSIGHTFUL NUANCE

The contrast between **Wacker Chemie AG** (diversified product lines, polysilicon for solar and semiconductors) and **Meyer Burger Technology AG** (solely solar panel manufacturing) starkly highlights that **vertical integration and diversified revenue streams are crucial for EU firms' resilience against market volatility and intense global price competition.**

RECOMMENDATIONS FOR EU POLICYMAKERS

01 **Secure the Full Solar PV Supply Chain & Critical Materials in Europe**

02 **Implement Resilience & Sustainability Criteria in Public Procurement**

03 **Establish a Dedicated Solar Manufacturing Scale-Up Fund**

04 **Foster Innovations for Next-Generation Solar Technologies**

05 **Establish Binding Requirements for National Policy Implementation & Cross-Country Collaboration**

CONCLUSION

The EU's solar manufacturing ambitions face systemic challenges : fragmented national policies, fierce global competition, and supply chain vulnerabilities.

Individual firm-level strategies alone are insufficient to overcome these structural issues.

Realizing solar sovereignty and meeting ambitious targets requires decisive, coordinated EU-level interventions and binding national commitments.