



ENERGY-RENEWABLE ECOSYSTEM: WIND ENERGY TECHNOLOGY

DEFINITION

Wind energy is defined as a key renewable energy source that harnesses the power of wind to generate electricity. This is achieved through the use of wind turbines, which can be installed onshore or offshore. Wind energy plays a crucial role in the EU's strategy to achieve its renewable energy targets and transition to carbon neutrality by 2050.

The EU aims to lead globally in renewables, with wind energy identified as a central component due to its potential for significant expansion and cost reductions through technological advancements and scaling effects.

SME SIGNIFICANCE



NUMBER OF SMEs IN THE EU27 VALUE CHAIN

ca. **150** in manufacturing only. The number of SMEs active in services, project development and especially deployment is unknown.

SHARE OF SMEs OVER TOTAL



in manufacturing only



EMPLOYMENT BY SMEs

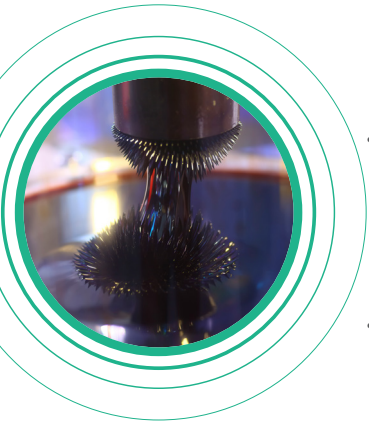
ca. **20,000** in manufacturing only.

ADDED VALUE OF SMEs OVER TOTAL



in manufacturing only

WIND ENERGY EU VALUE CHAIN



PHASE 1

RAW AND PROCESSED MATERIALS

- The dependency on third countries for raw materials is substantial. This includes rare earth elements essential for manufacturing powerful magnets used in wind turbine generators such as neodymium, praseodymium, and dysprosium. The supply of these elements is heavily concentrated in China.
- The EU is reliant on other materials necessary for production such as copper and aluminium, nickel and manganese, steel and glass-fibre fabrics, but is less dependent on a single supplying country.



PHASE 2

COMPONENT MANUFACTURING

- Current manufacturing capabilities in the EU easily cover the current EU demand in major wind energy components. This includes nacelles, towers, and blades.
- Most of the production is done by large firms with SMEs mostly present in niche applications.



PHASE 3

WIND TURBINES

- EU firms have a significant presence in the production of finished wind energy products, positioning the EU as a leader in the global wind energy market. The European Union is largely self-sufficient in manufacturing wind turbines, with several European companies leading in turbine production and technology development.
- Big firms dominate the market.

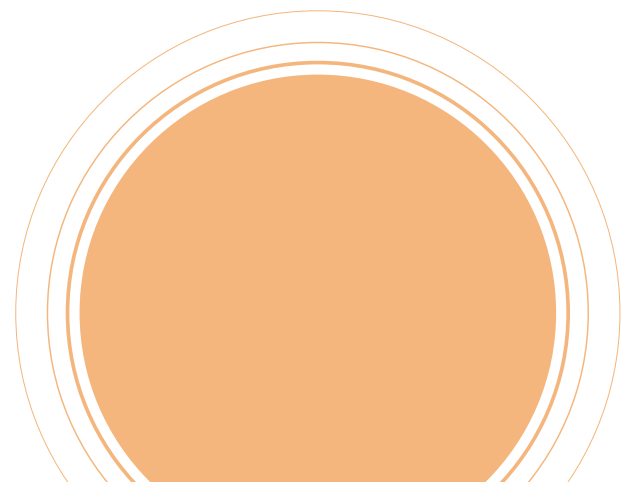
STRENGTHS AND VULNERABILITIES

EU STRENGTHS

- The EU has a notable capacity for **manufacturing wind power components**, which was stable at around 110-120 gigawatts (GW) in 2022, only behind China worldwide. This capacity includes the production of essential components like nacelles, towers, and blades. The forecast suggests that the EU's production capabilities could increase slightly to reach around 120-140 GW by 2025 due to expanding demand.
- The EU is at the **forefront of innovation** in wind turbine technology, with companies like Vestas, Siemens Gamesa, and Nordex leading innovations in turbine efficiency, durability, and cost-effectiveness.
- EU policies, including substantial subsidies, incentives, and supportive regulatory measures, have historically promoted wind energy development. Initiatives such as the **European Green Deal** further bolster this through ambitious renewable energy targets.
- The EU benefits from a **well-established infrastructure for wind energy**, including a strong supply chain and advanced grid systems capable of integrating high levels of renewable energy.
- The **public acceptance** is high in many EU Member States.
- Certain EU regions are particularly well-suited for wind energy production, including the North Sea, which is **ideal for offshore wind farms** due to its windy conditions and shallow waters.

EU VULNERABILITIES

- The industry relies heavily on **imported raw materials and components**, particularly from China. This includes critical materials like rare earth elements necessary for turbine magnets. The EU does not produce any rare earth elements itself and imports virtually all of its rare earth magnet demand from China, which supplies 98% of these materials.
- Despite supportive policies, the EU wind energy sector sometimes faces **bureaucratic hurdles** that can delay or complicate project approvals and grid connections.
- There is **increasing competition** from countries with lower production costs, particularly China, where manufacturers benefit from economies of scale and possibly less stringent regulatory environments and state subsidies.
- **Changes in subsidy schemes and financial incentives** can create uncertainties. As many EU countries start phasing out feed-in tariffs in favour of competitive auctions, the industry must adapt to potentially lower and more variable revenue streams.





EXAMPLES OF POLICY MEASURES INTRODUCED TO ENHANCE OPEN STRATEGIC AUTONOMY


EU


- The **REPowerEU Plan** indicated offshore wind as a significant future opportunity and emphasized that supply chains needed to be strengthened, e.g. using **Important Projects of Common European Interest (IPCEIs)**, and by accelerating **permitting procedures**.
- Several innovation schemes are relevant. This includes (i) **Horizon Europe**, providing support for SMEs, start-ups, and spinout companies to develop and scale-up green innovations, (ii) the **IPCEIs**, enhancing openness and facilitate SME participation and (iii) Support for investments in clean energy innovation projects and infrastructure from the **Innovation Fund**.
- The European Commission presented the **European Wind Power Action Plan** and the **European Wind Charter**, with the aim to accelerate wind energy and deployment in the EU. The Action Plan details eight streams of action, more precisely, Regulatory Streamlining and Permitting, Infrastructure and Grid Development, Research and Innovation, Market Integration and Flexibility, Skills and Training, Public Engagement and Acceptance, International Cooperation, Financial Instruments and Incentives.

MEMBERS STATES

- **Denmark:** Since the 1980s, Denmark has prioritised wind energy within its national energy strategy, providing stable guidance and governmental support. This includes incentives for R&D. Moreover, promoting citizen ownership has bolstered local and political backing, allowing communities to directly benefit from wind energy projects.
- The **Netherlands:** The SDE++ scheme subsidises wind power, by covering the cost difference between production and market value, enhancing the financial viability of wind projects. The Topsector Energy program funds innovations that address cost, efficiency, and technical challenges in wind energy. Additionally, streamlined permitting processes have been introduced to minimise administrative burdens and speed up project deployment. The government also promotes engagement with local communities and provides compensation mechanisms for those affected by wind farm developments.

EXTRA-EU

- **USA:** The Production Tax Credit offers a tax credit based on electricity generation from qualifying resources. The Investment Tax Credit serve as incentives for renewable energy. Many states have Renewable Portfolio Standards requiring utilities to source a certain percentage of electricity from renewables. Federal and state programs also provide grants for renewable energy research, development, and deployment.
 - **Australia:** the Wind Farm Development Guidelines streamline wind farm approvals, addressing environmental and community concerns. The Australian Renewable Energy Agency funds projects and shares knowledge to enhance renewable energy development and commercial deployment.
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POLICY RECOMMENDATIONS TO MAXIMISE SME OPPORTUNITIES AND REDUCE RISKS IN OPEN STRATEGIC AUTONOMY

Improve the material management in Europe, as promoted by the New Circular Economy Action Plan in combination with the EU Raw Materials Initiative and the Critical Raw Materials Act, will alleviate the dependency of SMEs active in the industry. Small-scale specialised component manufacturers often depend on single suppliers outside the EU, and they would benefit especially from these endeavours.

Financial leverage for scale-ups can be increased by combining EU funding and Member State funding schemes tailored to the SME business segment of the wind energy sector (multiplier effect). Cascade funding schemes are instrumental in this respect.

While the current policy focus is mainly oriented towards installing additional onshore and especially offshore capacity, **decommissioning, repowering, and recycling** are gradually gaining importance due to the end-of-life phases of the first wind turbines installed. There is a need for Member States to support SMEs that are active in these markets.

SMEs in this sector face considerable **regulatory burdens**, such as access to the power grid, and getting permits on time. Governments are encouraged to streamline the necessary procedures. To accelerate the transition to renewable energy, the EU must also ensure full transposition and implementation of rules set by the Clean Energy for all Europeans Package, creating regulatory frameworks that support energy communities.

Energy cooperatives work well in some Member States, while are virtually absent in others. EU countries may want to explore encouraging cooperatives in their country.

Finally, more **evidence and data** regarding the involvement of SMEs would improve policy making.

Data sources:

https://setis.ec.europa.eu/wind-energy-european-union_en

[doi:10.2760/618644_JRC135020](https://doi.org/10.2760/618644_JRC135020)

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