

Wind energy in the EU

SUMMARY

Renewable energy plays a crucial role in the context of EU climate targets and energy security needs. Wind energy will be central to accelerating the roll-out of renewables and the green transition outlined in the European Green Deal and the REPowerEU plan.

In 2022, the total installed wind power capacity in the EU reached 204 GW (gigawatts), most of which was onshore (92%). The European Commission estimates that new EU target of at least 42.5 % renewable energy in energy consumption by 2030 will require installed capacity to grow to over 500 GW by 2030.

Although the EU is a global leader in some offshore technologies, the wind sector struggles with many challenges. These include insufficient and uncertain demand, slow and complex permit application processes, supply risks linked to raw materials, high inflation and commodity prices, more pressure from international competitors and limited availability of a skilled workforce.

The EU has made several regulatory responses to these challenges. The recently revised Renewable Energy Directive not only raised the target for the renewables share in EU energy consumption but also introduced provisions streamlining permit application procedures. The revised TEN-E (Trans-European Networks for Energy) framework supports cooperation on cross-border projects, while the newly announced wind power package seeks to strengthen the EU wind industry and further develop offshore wind. The electricity market reform and the grids action plan are helping boost the integration of renewables into electricity networks. The net-zero industry act will improve the manufacturing capacity of wind as a net-zero technology; and the critical raw materials act addresses some of the issues linked to EU dependency on supply from third countries.

The successful deployment of wind energy will also have to take into account public acceptance (which is higher for offshore wind), the impact of wind installations on biodiversity and the environment, and co-existence with other economic activities such as fisheries. In addition, more investment is needed in new technologies, such as floating wind and hybrid projects (combining wind with solar, hydrogen or battery production).



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Introduction

Renewable energy has grown in importance in the context of EU climate goals and the need to boost energy security. As wind energy is abundant, domestically sourced and increasingly more affordable, it will be an important element of the EU's green transition and its efforts to reduce dependency on imported fossil fuels.

However, the EU wind energy sector faces several [challenges](#). According to the European Commission, these [include](#) insufficient and uncertain demand, slow and complex permitting processes, supply chain risks, high inflation and commodity prices, unsupportive design of national tenders, limited access to finance, more pressure from international competitors and limited availability of a skilled workforce. Bottlenecks and supply [risks](#) exist mainly with regard to critical raw materials (especially rare earth elements used in turbine generators and towers), processed materials (such as balsa wood used in blades) and components such as permanent magnets. The EU is highly reliant on imports from third countries, particularly China (raw materials, manufactured magnets) but also Ecuador (balsa wood).

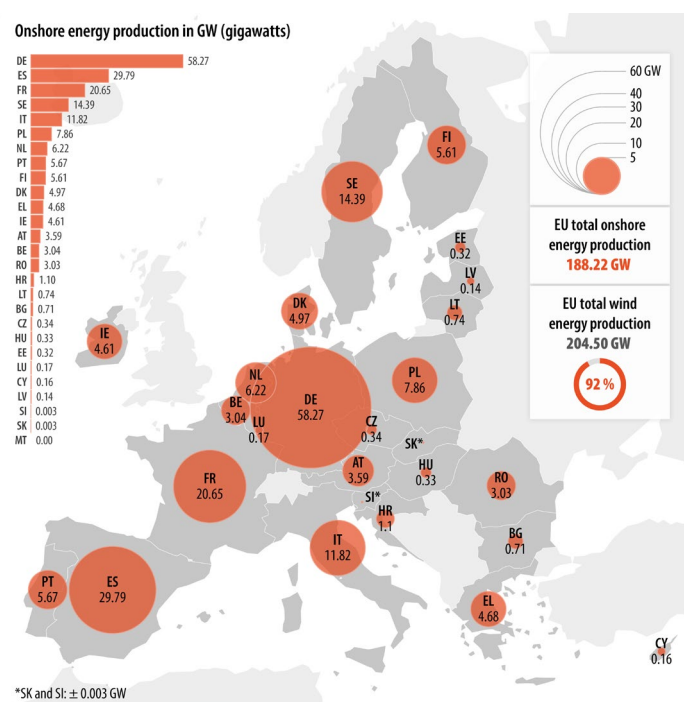
The EU has adopted several regulatory measures relating to wind energy. An offshore renewable energy strategy was launched in 2020. More recently, the revised Renewable Energy Directive and the new wind power package (both adopted in 2023) provided a new impulse for the development of wind energy and addressing some of the above challenges.

Wind energy statistics

In 2022, renewable energy accounted for [23%](#) of overall energy consumed in the EU. The share of renewable energy in electricity consumption was even higher, at 41.2%, while wind power accounted for 37.5% of the total electricity generated from renewable sources (a significant [increase](#) from 4.9% of all renewables in 2000). The [share](#) of wind in overall electricity production was 16% (14% onshore and 2% offshore).

According to a 2023 Wind Europe [report](#), in 2022, the total installed wind power capacity in the EU reached 204 GW (gigawatts), with 188 GW onshore (92%) and 16 GW offshore (8%). The installed capacity varies across EU countries. The largest onshore wind capacity is located in Germany, Spain, France, Sweden, Italy and Poland (see Figure 1). The countries with the largest offshore wind capacity are Germany, the Netherlands, Denmark and Belgium (see Figure 2). In 2022, the new capacity installed in the EU was 16 GW, whereby 92% of new wind installations were onshore and most of them built in Germany, Sweden, Finland, France, Spain and Poland. Wind makes up the highest share of electricity mix in Denmark (55%), Ireland (34%), Germany (26%), Portugal (26%), Spain and Sweden (both 25%).

Figure 1 – Onshore wind energy production in the EU, 2022



Source: EPRS, based on Wind Europe [report](#), 2023.

According to the European Commission, the increased EU target of at least 42.5% renewable energy by 2030 would require the installed capacity to grow from 204 GW in 2022 to more than [500 GW](#) in 2030. A 2023 Wind Europe [report](#) estimates that in order to reach the REPowerEU goals, the new wind energy installations need to average 31 GW per year between 2023 and 2030 (taking into account the higher efficiency of new wind turbines). However, according to projections in that same report, the EU is expected to install 98 GW over the years 2023 to 2027 (i.e. 20 GW per year on average), which falls short of meeting the 2030 targets. The Commission estimates that the [pace](#) needs to be 37 GW per year to achieve the forecasted contribution of wind power to the EU's 2030 renewable energy target of 42.5 %.

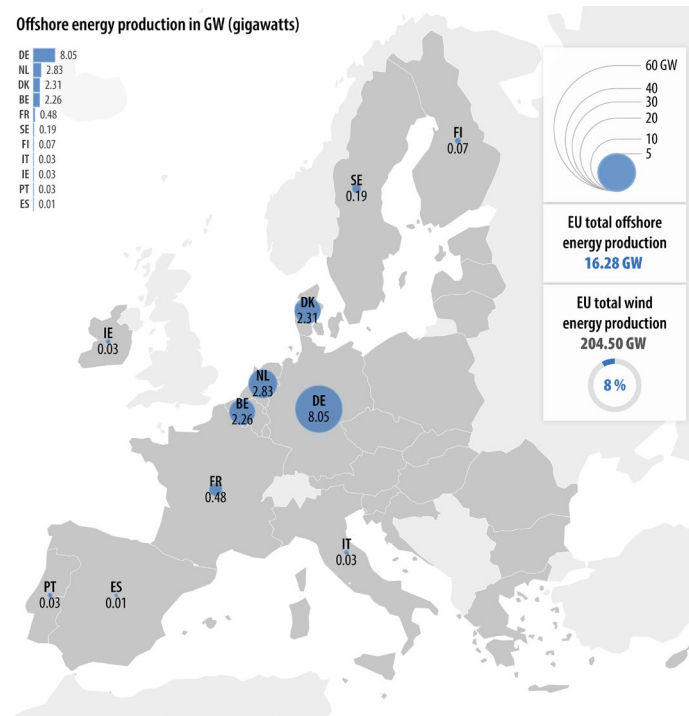
In terms of offshore wind, in its 2020 offshore renewable energy [strategy](#), the EU set a non-binding target of installed capacity of at least 60 GW of offshore wind by 2030 and 300 GW by 2050. In January 2023, Member States [agreed](#) on non-binding goals for offshore renewable energy across all EU sea basins of 111 GW by 2030 and 317 GW by 2050 (this includes ocean energy in addition to wind). According to the European Commission, to bridge the gap between the 111 GW committed by Member States and the installations in 2022, almost 12 GW/year on average must be installed, which is 10 times more than the 1.2 GW installed in 2022.

The majority of wind installations deployed in the EU are provided by the domestic wind manufacturing sector, with the main European manufacturers accounting for [85%](#) of the EU wind energy market (94% in the offshore sector). The wind manufacturing sector is also an important job provider, with the whole wind sector offering between 240 000 and 300 000 direct and indirect [jobs](#) in the EU, out of which 45 000 are located at turbine and component manufacturers, and 77 000 relate to offshore wind. The offshore sector is [expected](#) to generate between 20 000 and 54 000 new jobs in the next five years across Europe, while the Commission estimates that [68 000](#) new jobs in the wind sector will be needed by 2030 (including construction, services and transport).

EU legislation

While the EU does not have legislation dedicated exclusively to wind, it has adopted a non-legislative strategy on offshore renewable energy and a wind power package (see sections below). The main pieces of broader EU legislation with an impact on the wind sector include the TEN-E Regulation and the Renewable Energy Directive. Moreover, the recent [electricity market reform](#) aims to create a more flexible power system to accelerate the integration of renewable energy sources. Two ongoing industry-related files are also relevant to the wind sector. The [net-zero industry act](#) aims to support the manufacturing sector of net-zero technologies – including wind – through actions to streamline administrative processes, facilitate access to finance and boost skills. The

Figure 2 – Offshore wind energy production in the EU, 2022



Source: EPRS, based on Wind Europe [report](#), 2023.

[critical raw materials act](#) seeks to foster innovation and strengthen the value chain of critical raw materials, many of which are used by the wind industry.

TEN-E Regulation

The [TEN-E Regulation](#), revised in 2022, sets out the EU regulatory framework for cross-border energy infrastructure projects. It sets the rules for projects of common interest (PCIs), which are selected every two years (the latest [list](#) was published in November 2023). As the selection criteria regarding sustainability are becoming stricter with a view to supporting decarbonisation, renewable energy projects (including wind) are appearing more frequently. The revised TEN-E Regulation also provides regional cooperation structures that can support the creation of integrated and efficient offshore and onshore grids, including hybrid projects

interconnecting Member States and offshore wind projects. The most recent TEN-E revision of 2022 included setting up a framework for long-term offshore grid planning by transmission system operators (TSOs), involving regulators and the Member States in each sea basin, including for hybrid projects. Moreover, the TEN-E Regulation requires Member States to conclude a non-binding agreement to cooperate on goals for offshore renewables generation, to be deployed within each sea basin by 2050, with intermediate steps in 2030 and 2040. To facilitate the permit-granting process, the TEN-E Regulation also requires the establishment of a unique point of contact for cross-border offshore projects of common interest. Moreover, the regional cooperation framework under the TEN-E Regulation, aimed at identifying projects of common interest, also enables greater coordination among Member States in the same sea basin on planning the grid infrastructure and deploying offshore wind projects.

Renewable Energy Directive

The [Renewable Energy Directive](#) revised in 2023 sets a target of 42.5 % renewables share in EU energy consumption, which will translate into boosting renewable energy projects. The directive also includes specific provisions to support the deployment of such projects. Member States are required to establish a framework for cooperation on joint projects to produce renewable energy including wind. They must also publish information on the offshore volumes they plan to achieve through tenders, based on indicative goals for offshore renewable energy generation to be deployed within each sea basin identified in accordance with the TEN-E Regulation. Moreover, Member States are encouraged to allocate space for offshore renewable energy projects in their maritime spatial plans, taking into account the activities already taking place in the affected areas.

Furthermore, the directive includes provisions on facilitating permit granting for renewable energy projects. It establishes 'renewables acceleration areas', i.e. areas designated as particularly suitable for the installation of renewable energy plants. In these areas, the permit-granting procedure is limited to 12 months for offshore wind energy projects. Moreover, wind projects can be exempt from environmental assessments in justified circumstances, for instance to achieve climate and renewable energy targets, on the condition of adopting mitigation or compensatory measures.

North Seas Energy Cooperation

The North Seas Energy Cooperation (NSEC) initiative, established in 2016, brings together nine European countries (Belgium, Denmark, France, Germany, Ireland, Luxembourg, Netherlands, Norway and Sweden) with the aim of boosting the development of offshore wind in the North Sea. In 2022, a memorandum of understanding was signed between NSEC and the United Kingdom. The NSEC areas of work include: hybrid and joint projects, maritime spatial planning, support framework and finance, and delivering 2050.

Source: [European Commission](#).

Regulation on accelerating the deployment of renewable energy

In 2022, as one of the measures to address the energy crisis, the EU adopted an emergency [regulation](#) laying down a framework to accelerate the deployment of renewable energy. It introduces the provision that the planning, construction and operation of plants and installations for the production of renewable energy is presumed to be in overriding public interest. It also allows such projects to undergo simplified environmental assessments. In terms of wind energy, the provisions on repowering (i.e. modernising existing installations), where a maximum deadline of six months is set, are particularly important.

As the transposition period of the revised 2023 Renewable Energy Directive is 18 months, this emergency regulation provides a temporary regulatory framework to accelerate the permitting procedures for renewable energy projects until then. In December 2023, the emergency regulation's application period was [prolonged](#) until June 2025.

Offshore renewable energy strategy

The [EU strategy on offshore renewable energy](#) was adopted in November 2020, in the context of new EU energy and climate goals set out in the European Green Deal. The strategy proposed targets for an installed capacity of at least 60 GW of offshore wind by 2030 and 300 GW by 2050. In addition, it set targets for ocean energy of at least 1 GW by 2030 and 40 GW by 2050. The strategy also proposed specific actions and milestones to support the offshore energy sector's long-term sustainable development. It addressed issues such as access to sea-space and maritime spatial planning, regional and international cooperation, industrial and employment dimensions, environmental protection, and also the development of technologies such as floating wind, which is not yet a commercially viable technology compared with offshore wind on fixed foundations.

The Commission also committed to help mobilise funding for offshore renewables and to provide a supportive regulatory framework through a revision of the TEN-E Regulation, the Renewable Energy Directive and State aid guidelines on energy and environmental protection. The strategy was accompanied by a [staff working document](#) intended to provide regulatory guidance on electricity market arrangements for offshore renewable hybrid projects combining generation and interconnection.

According to the Commission, significant [progress](#) has been made and the actions proposed in the strategy have largely been implemented or are well under way. Once the electricity market [reform](#) is finalised, all actions set out in the strategy in terms of the regulatory framework will be completed.

Wind power package

The European [wind power package](#) was adopted on 24 October 2023 with the aim of strengthening the EU wind industry. The package consists of two elements: an action plan and a communication. The action plan proposes measures to help maintain a competitive supply chain for wind energy, with a clear and secure pipeline of projects, able to attract funding and compete on a level playing field globally. The communication, 'Delivering on the EU offshore renewable energy ambition', proposes a new vision, following up on the EU offshore renewable energy strategy. Overall, the package aims to ensure that the EU clean energy transition goes hand in hand with industrial competitiveness.

Action plan

The [action plan](#) is based on six pillars and includes actions to be undertaken by the European Commission, Member States and the industry:

- Acceleration of deployment (through better predictability and faster permitting)
- Improved auction design
- Access to finance
- Fair and competitive international environment
- Skills
- Industry engagement and Member State commitments.

As regards the acceleration of wind energy deployment, the Commission proposed the 'Accele-RES' initiative in order to frontload the revised RED's transposition and implementation. The aim is to accelerate permitting, improve the digitalisation of the permitting process and provide technical assistance. Moreover, Member States are encouraged to increase the visibility of the project pipeline through wind pledges, publication of mid-term auction schedules and national long-term plans. The Commission also supports the roll-out of electricity grids with a [grids action plan](#) (announced in November 2023).

When it comes to improved auction design, the Commission will support Member States to integrate objective and non-discriminatory criteria that reward higher value-added equipment, and measures to maximise the project execution rate. Commission guidelines on this are expected in March 2024. Strategic procurement standards will also be used in the context of the [Global Gateway](#) (an EU strategy for investment in third countries). Furthermore, a cybersecurity risk assessment as regards wind turbines and the related infrastructure will be conducted.

The Commission also plans to facilitate access to finance, mainly through the [Innovation Fund](#) and European Investment Bank (EIB) de-risking guarantees. Member States are encouraged to make full use of the flexibility provided by the amended [State aid rules](#) to support wind manufacturing in the EU.

To create a fair and competitive international environment, the Commission wants to ensure that the wind sector can operate on a level playing field and the internal market is protected against trade distortions and threats to security and public order. It therefore monitors possible unfair trade practices that benefit foreign wind manufacturers. It also aims to engage with investors in order to identify and address obstacles to investment, and use trade agreements to facilitate EU manufacturers' access to foreign markets, while promoting the adoption of EU and international standards for the wind sector (e.g. through the establishment of a [high-level forum on European standardisation](#)).

Regarding skills, large-scale [skills partnerships](#) for renewable energy under the [pact for skills](#) will be encouraged to design skills development projects. In the context of the [net-zero industry act](#), European net-zero industry skills academies will be launched, including an academy dedicated to the wind sector.

Lastly, the Commission will support industry engagement and Member States commitments to improve the enabling conditions for the European wind industry to remain competitive. To this aim, a European [Wind Charter](#) was signed on 19 December 2023.

Offshore communication

Alongside the action plan, the Commission adopted a [communication](#), 'Delivering on the EU offshore renewable energy ambitions'. It takes stock of the progress achieved so far and addresses the main challenges ahead. It notes that the targets for EU offshore renewables have almost doubled since the adoption of the offshore strategy and that the installation rate will thus have to increase significantly.

The communication proposes six areas of action to speed up the roll-out of offshore capacity:

- Strengthening grid infrastructure and regional cooperation
- Accelerating permitting
- Ensuring integrated maritime spatial planning
- Strengthening the resilience of infrastructure
- Sustaining research and innovation to support offshore renewable energy
- Developing supply chains and skills.

In terms of specific actions, the Commission aims to publish guidance for a specific cost-benefit analysis and cost-sharing, both at the level of offshore network development plans per sea basin and at project level. It will also seek to increase the attractiveness of offshore hybrid and joint projects, and facilitate the establishment of offshore bidding zones.

To accelerate permitting, it aims to boost support for national authorities through the CA RES (Concerted action on the Renewable Energy Directive) initiative, provide assistance in implementing permitting rules under the TEN-E Regulation and mobilise the Single Market Enforcement Task Force (SMET) to help accelerate permitting for all grids necessary to integrate renewable energy.

The Commission will also support cross-border consultations in the context of maritime spatial planning in order to help align them with the strengthened targets for offshore renewable energy and ensure compatibility with other marine economic activities and environmental objectives. It will also help estimate and address the effects that offshore renewable energy installations have on ecosystems and biodiversity. Moreover, it will support Member States in establishing links between developing offshore energy, maritime spatial planning and marine strategies developed under the Marine Strategy Framework Directive (MSFD).

As regards strengthening infrastructure resilience, the Commission will set up cooperation between Member States to develop regional surveillance plans for offshore infrastructure and develop cooperation on cybersecurity in the offshore domain with like-minded non-EU countries at bilateral and multilateral level.

Proposed measures in the area of research and innovation include: more action on wind under the strategic energy technology (SET) plan; projects on permanent magnets for wind turbines and floating wind; measures to reduce the environmental impact and optimise the socio-economic impacts of offshore wind farms; and efforts to improve industrial productivity and efficiency across the offshore wind energy value chain.

The Commission also aims to address the role of ports in the supply chain and their challenges relating to both their own environmental footprint and their ability to help decarbonise industrial activities and maritime transport. To increase the EU's strategic autonomy, reduce over-dependencies and strengthen supply chains, additional actions are explored in the context of the net-zero industry act and critical raw materials act. These include boosting the extraction of rare earth elements (REE) in Europe, increasing component manufacturing capacity, enhancing recycling of permanent magnets, substituting REE with innovative materials, and promoting partnerships with reliable partner countries. In terms of boosting skills in the offshore renewable energy sector, the measures propose supporting the development of new skills especially in digitalisation, ICT, robotics, health and safety. They also aim to improve diversity and inclusiveness of the sector.

EU funding for wind energy

- Recovery and Resilience Facility
- Innovation Fund
- Modernisation Fund
- European Investment Bank
- InvestEU
- Just Transition Fund
- Connecting Europe Facility
- Life Clean Energy Transition programme
- EU regional funds (cohesion policy)
- EU renewable energy financing mechanism
- Horizon Europe

Source: [European Commission](#).

Outlook

According to the Wind Europe outlook [scenario](#) for the coming years, the projected annual installation rate of 19.6 GW will be insufficient to meet the 2030 energy and climate targets, which require a rate of 31 GW per year. Wind Europe therefore recommends that the EU intensify its efforts to address permitting, supply chain bottlenecks, market design and investment signals, financial support and electricity grid expansion. For many of these issues, EU legislation is already in place and needs to be implemented swiftly.

While high electricity prices temporarily improved the economic prospects of older wind farms, which were repowered and saw their lifetime extended, accelerated deployment of new wind farms is also key to achieving EU goals. Speeding up the commercialisation of floating wind installations and hybrid projects (e.g. hybrid solar and wind installations, as well as projects linking offshore wind to hydrogen production or battery storage) may also prove helpful in this process.

Several other issues also have to be considered when boosting wind energy in the EU. Despite relatively high public [support](#) for renewable energy in general, local acceptance for wind installations is less pronounced (the 'not in my backyard' or 'nimbyism' phenomenon), albeit higher for offshore wind. Moreover, the [impact](#) of more wind installations on ecosystems and biodiversity (e.g. migratory birds, bats, marine mammals, and their habitats) requires proper mitigation. Co-existence with other economic sectors, such as fisheries and tourism, must also be addressed. According to a 2023 European Court of Auditors' [report](#), the successful development of wind energy will have to take into account environmental and social sustainability, and involve dialogue with various stakeholders, including local communities and industry representatives.

MAIN REFERENCES

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eprs@ep.europa.eu (contact)

www.eprs.ep.parl.union.eu (intranet)

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