Annual Report 2024

European Commission and WindEurope

Photo: *Horns Rev 2, Denmark. (Photo credit: Bel Air Aviation Denmark)*

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The European Union added 13 GW of new wind energy capacity in 2024, representing a decrease from the 16.1 GW installed in 2023. Of the 2024 installations, 1.5 GW comprised offshore wind projects, notably including a 25 MW floating pilot project deployed off the French Mediterranean coast.

Looking ahead, the EU expects to install 17 GW of new capacity in 2025, with continued growth anticipated in subsequent years. Over the 2025-2030 period, installations are forecast to average 23 GW annually [1].

Following several challenging years for Europe's wind industry, conditions are showing marked improvement. Permitting volumes have increased, auction volumes are expanding, investment levels have risen, and build-out projections have become more optimistic.

However, a significant new challenge has emerged: without immediate intervention, grid infrastructure threatens to become a critical bottleneck and may already constitute one in numerous Member States. Governments must urgently accelerate grid expansion through anticipatory investments, optimize utilization of existing grid capacity, and implement proactive management of grid connection queues.

Total (net) installed wind power capacity	241.7 GW
Total offshore capacity	20.7 GW
- of which floating	0.05 GW
New wind power capacity installed	13 GW
Decommissioned capacity (in 2024)	1.3 GW
Total electrical energy output from wind	475 TWh
Wind-generated electricity as a percentage of electricity demand	19 %
Average capacity factor	23% onshore 35% offshore
Target	At least 42.5% RES in final energy

Table 1. *Key Statistics 2024: EC & WE*

Highlights

- Installations totalled 13 GW in the EU in 2024, 3.1 GW less than the previous year.

- EU Installed wind power capacity is now 241.7 GW. 221 GW are onshore, and 20.7 GW are offshore.

- There are more than 100,000 turbines installed in the EU, of which 3,700 offshore.

- 89% of new installations were onshore. Germany connected 4 GW, the most in the EU.

Market Development

Targets and Policy

The EU remains highly competitive in wind power technology. However, EU players are under increasing pressure, notably as Chinese companies offer increasingly competitive products at lower prices. In 2024, the EU accounted for close to 13% of global manufacturing capacity in blades and nacelle assembly and about 22% of tower manufacturing. EU companies had a market share of close to 90% of the European market and 23% of the global market in 2023, marking a decline by around 7% in the global market compared to 2022. In the European market, EU companies continue to dominate with a market share of 89% in 2023 [2].

The EU has established a comprehensive framework of policy and legislative measures to guide the transition toward a sustainable, affordable, and competitive energy system with substantial wind energy integration.

The revised **Renewable Energy Directive**, entering into force in November 2023, has enshrined in EU law a 2030 renewable energy target of at least 42.5%.

In 2024, the European Commission published several recommendations and guidance to support the implementation of the Directive, for instance on *speeding-up permitting granting procedures*, on *designing renewables acceleration areas* and *on auctions design for renewable energies.*

The **Net-Zero Industry Act (NZIA)** entered into force in June 2024. Through the NZIA, the EU aims to strengthen domestic manufacturing capacity for key clean technologies and enhance the competitiveness and resilience of its industrial base. The objective is to reduce dependence on external suppliers, thereby increasing energy security and ensuring adequate supply chains to meet the EU's 2030 climate and energy targets. For wind energy, the combination of the EU's 2030 renewable energy goals and NZIA provisions establishes an indicative target of 36 GW annual wind turbine production capacity within the EU by 2030.

The European Commission is, together with the Member States, currently working on the implementation of NZIA. *Secondary legislation stemming from the NZIA regulation* includes legislation *on non-price criteria in renewable energy auctions* and on *main specific components under NZIA*.

The **Strategic Energy Technology (SET) Plan** is the established framework to ensure cooperation and alignment among the different research and innovation actors (public authorities, industry, academia, etc.).

Finally, **the Competitiveness compass**, adopted by the EC in January 2025, announced a set of initiatives to regain the EU competitiveness and secure its prosperity. Among these initiatives, **the Clean Industrial Deal,** adopted in February 2025, establishes a joint roadmap for competitiveness and

decarbonization while announcing that the upcoming **Horizon Europe work programme 2026-2027** will include a flagship initiative of approximately EUR 600 million to support the decarbonization and competitiveness of European industry. The wind energy sector is naturally positioned to benefit from this funding framework.

The Competitiveness Compass also announces an **Electrification Action Plan** and a **European Grids Package**, both of relevance to the wind energy sector.

Progress and Operational Details

In 2024, the EU installed 13 GW (11.5 GW onshore and 1.5 GW offshore) of new wind capacity. It now has 241.7 GW of cumulative installed wind capacity (221 GW onshore and 20.7 GW offshore). 1.3 GW of wind capacity were decommissioned in the EU, exclusively onshore.

Wind energy generated 475 TWh in 2024, 9 TWh more than in 2023. For the second year running, wind met a record 19% of demand across the EU, with electricity demand slightly up in 2024 compared to the previous year.

Capacity factors for the entire wind fleet in the EU were 24% on average. Capacity factors for onshore were 23% (down from 24% in 2023), while for offshore they were 35% (up from 34% in 2023). The capacity factors of new installations are significantly higher than the fleet-wide ones that include very old installations.

The average power rating of onshore turbines installed in 2024 was 4.6 MW, up from 4.5 MW in 2023. The average rated capacity of offshore turbines was 10.1 MW, up from 9.7 MW in 2023. The average power rating of turbines ordered in 2024 was 5.7 MW for onshore and 14.8 MW for offshore.

Final Investment Decisions in the EU totaled EUR 26.9 billion, financing 15.7 GW of new projects. Onshore investments totaled approximately EUR 19 billion, financing 13.1 GW of new projects.

Germany and Spain alone invested almost half of this amount. Offshore wind investments in the EU totaled EUR 7.9 billion, financing approximately 2.6 GW of new offshore wind capacity.

Three out of the four wind farms financed are in Germany (Nordsee-cluster A&B and Windanker), with the remaining one, Oranjewind, in the Netherlands.

Matters Affecting Growth and Work to Remove Barriers

Over the 2024-2030 period, the rate of build-out of wind energy is expected to increase. Wind energy installations could average up to 23 GW a year.

While permitting bottlenecks begin to ease (Germany and Spain each permitted 70% more onshore wind than in the previous year) [3], grid bottlenecks are emerging as a new key barrier. Member States struggle to build out the grid needed to integrate new wind capacity and to filter out speculative grid connection requests.

Some countries have increased wind energy auction bid ceilings and indexed strike prices to inflation to counter rising project costs.

RD&D Activities

In 2024 the European wind industry invested almost EUR 1.4 billion in R&D equal to 4.10% of the industry's direct contribution to the EU GDP [4]. The European wind industry through the European Technology and Innovation Platform on wind (ETIPWind) presented a new report '*from innovation to industrial competitiveness*' with the blueprint of a common European strategy to enhance policies and funding for wind energy Research & Innovation.

The report presents the consolidated views of the SET Plan community on wind energy. This community includes the European Technology & Innovation Platform on wind energy, ETIPWind, that gathers industry and research experts, the EERA Joint Programme on wind energy, EERA JP Wind, that gathers research experts, and the SET Plan implementation working group on wind energy. The report outlines the key actions to turn Europe's excellence into industrial competitiveness by 2050 at the latest.

After 2023, 2024 was the second-best year since 2014 for funding of EU wind research through the framework programmes (H2020, Horizon Europe) (Table 2). The number of new wind energy research projects remained stable, with 34 projects funded, and R&I investment decreased (EUR 93.8 million) compared to 2023 (EUR 169.1 million).

Horizon Europe funded projects	EU contribution Million EUR (Million USD)	Number of projects
Wind-specific projects	81 (84)	23
Non-wind specific projects	13 (13)	11
Total funding for wind energy	94 (97)	34

Table 2. *Wind energy specific funding under Horizon Europe granted to projects starting in 2023.* *(Source: JRC based in CORDIS, 2024)*

Figure 1 shows the development of wind R&I funding in the period 2014 – 2024 under the EU framework programmes Horizon 2020 and Horizon Europe. Wind energy projects starting in 2024 focused on new materials & components, which represented 21% of EC funding (EUR 19.5 million), followed by floating offshore research (19%, EUR 17.7 million), and grid integration (16%, EUR 15.3 million).

Since 2014, EU framework programmes have allocated substantial funding across all wind research R&I priorities. Projects on floating offshore wind (EUR 163 million), offshore wind technology (EUR 145 million) and new materials & components (EUR 93 million) concentrate most of the funds (Figure 2). Specifically, projects related to offshore technology include e.g. modelling studies of the offshore turbines and their environmental conditions, new rotor designs with larger capacities, performance optimization of vessels for operations and maintenance, as well as methods to realise cost energy reductions

Research Initiatives & Results

13 wind research projects, worth EUR 67 million in EU Funding, ended in 2024 (Figure 3). 47% of the funding addressed floating offshore wind (EUR 31.4 million), followed by new turbine materials & components (20%, EUR 13.2 million) and offshore technology (18%, EUR 12.1 million).

The following selected project exemplifies the research progress made:

The **FLOAWER** project (EU support: EUR 3.5 million) has made significant progress in advancing the design and development of floating wind turbines. Over the course of the project, four key scientific challenges were addressed, including wind resource assessment, advanced floater analysis, dynamics of wind turbines, and system design to reduce Levelised Cost of Energy (LCOE).

Key achievements include the development of novel methods for wind resource assessment, improved optimisation frameworks for FOWT mooring systems, and innovative approaches to reducing LCOE through integrated design and techno-economic analysis.

The project's multidisciplinary approach yielded valuable insights and tools, paving the way for the development of more efficient and economically viable floating wind turbines, and contributing to the growth of the offshore wind energy industry in Europe [5].

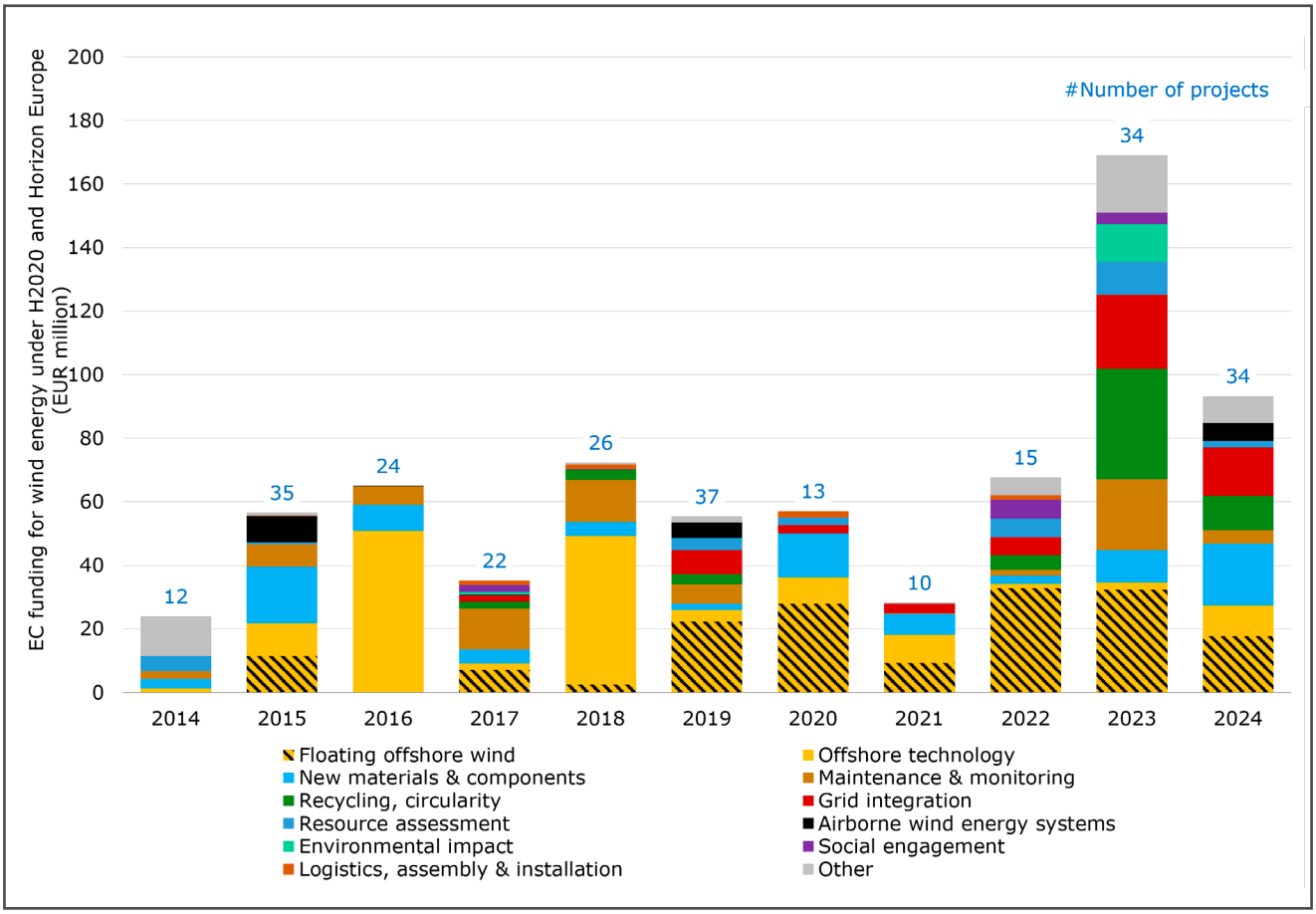

Figure 1: *Evolution of EU R&I funding categorised by R&I priorities for wind energy under H2020 (2014-2020) and Horizon Europe (2021-2024) programmes and the number of projects funded in the period 2014-2024. Project specifically on wind energy and those with a significant wind energy component are accounted for (see Table 2). Note: Funds granted refer to the start year of the project.* (Source: JRC based in CORDIS, 2025)

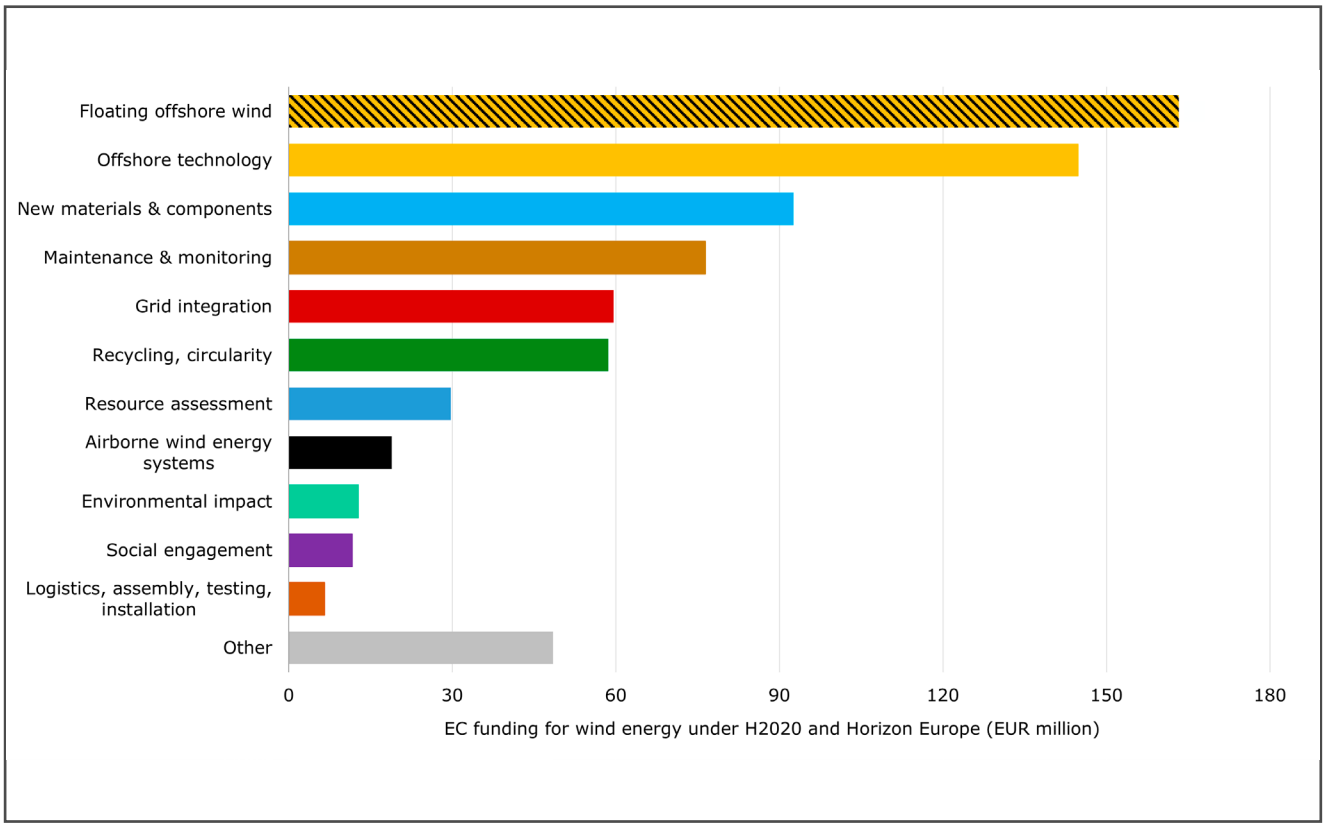

Figure 2: *EC funding on wind energy R&I priorities in the period 2014 -2024 under H2020 and Horizon Europe.* *(Source: JRC based in CORDIS, 2025)*

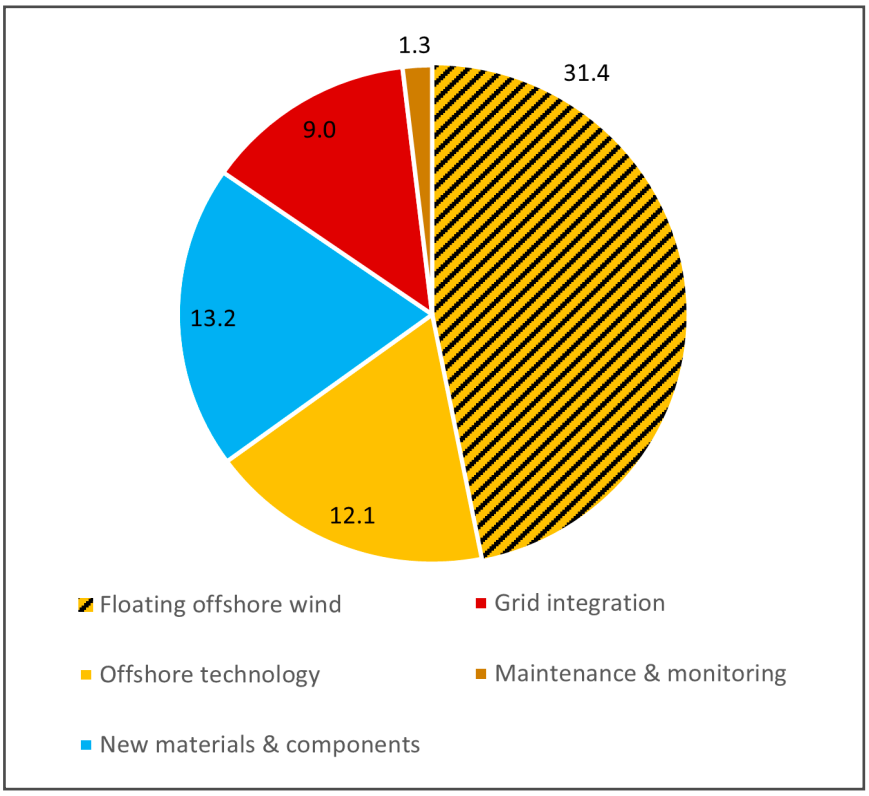

Figure 3: *Share of wind energy funding under H2020 and Horizon Europe granted to projects completed in 2024, categorised by research area for wind energy.* *(Source: JRC based in CORDIS, 2025)*

The aggressive marine environment poses a significant challenge to the maintenance costs of offshore installations, with corrosion accounting for approximately 60% of these costs. The **FIBREGY project** (EU support: EUR 6.5 million) aimed to address this issue by enabling the extensive use of Fibre Reinforced Polymers (FRP) materials in the structure of next-generation large Renewable Energy Offshore Platforms (REOPs).

Despite their convenient immunity to corrosion, FRP materials are currently limited to secondary components in marine structures. The project developed innovative FRP materials, design procedures, and production methodologies, to overcome the challenges associated with using FRP in large marine structures.

The project's outcomes are demonstrated through the re-engineering of two existing REOPs concepts in FRP, advanced simulation techniques, and the construction of a real-scale

prototype, ultimately reducing maintenance costs and increasing the competitiveness of offshore renewable energy generation [6].

Selected examples of new R&I projects

The **FLOATFARM project** (EU support: EUR 6.0 million) intends to advance the maturity and competitiveness of floating offshore wind (FOW) technology [7]. The project aims to increase energy production, reduce the cost of energy, and improve the offshore wind value chain, while also minimising negative environmental impacts on marine life. To achieve this, FLOATFARM will explore new rotor designs for better energy capture using an innovative co-design approach, as well as improved floaters, new generator concepts, turbine aerodynamic interaction, shared mooring and anchoring, and innovative dynamic cabling.

The **BLADE2CIRC project** (EU support: EUR 4.0 million) aims to enhance the sustainability of the wind energy sector by researching bio-based materials to develop innovative composites [8]. These composites will integrate high-strength bio-based carbon fibers and structural resins with dynamic performance characteristics, with the goal of improving the lifetime, decommissioning, and circularity of wind energy systems.The project will also focus on advancing technologies such as coatings with self-healing properties, non-permanent adhesives for recycling, and green solvents for fiber recovery, ultimately enhancing the overall sustainability of the wind energy sector.

Impact of Wind Energy

Environmental Impact

In 2024 wind energy helped to avoid 142 million tons of CO2 emissions in the EU with an estimated value of EUR 13.5 billion based on the average yearly price of the EU emissions allowances. Wind energy also helped avoid 668 tons of NOx and 3.9 tons of SO2 emissions [4].

Economic Benefits and Industry Development

In 2024 the European wind energy industry contributed EUR 46.2 billion to the Gross Domestic Product of the EU. EUR 28.6 billion was a direct contribution and EUR 17.6 billion was an indirect contribution [4]. For every EUR 10,000 revenue generated by wind activities, an additional EUR 2,372 was generated in other sectors [4].

The wind industry provides direct employment for almost 180,000 people in the EU. Indirect employment in the EU linked to wind energy activity was almost 160,000 [4].

The EU wind industry contributed EUR 9.8 billion in taxes. Corporate taxes amounted to EUR 3.9 billion, income taxes to EUR 3.5 billion and all other taxes, including community taxes, amounted to EUR 2.3 billion [4].

Next Term

In 2025 new installations in the EU are expected to total 17 GW, 4 GW more than in 2024. Both onshore and offshore wind installations are expected to increase [1].

We expect the EU to install 140 GW of new wind power capacity between 2025 and 2030. This would be on average just over 23 GW a year. 113 GW will be onshore [1].

We presume that at least 65% (74 GW) of the onshore capacity expected to be added by 2030 will come from wind farms awarded in auctions. Virtually all the offshore capacity (27 GW) expected to be added by 2030 will be awarded in auctions [1].

References

[1] *WindEurope (2025) Wind energy in Europe: 2024 Statistics and the outlook for 2025-2030*

[2] European Commission (2025), Progress on competitiveness of clean energy technologies; *EUR-Lex - 52025DC0074 - EN - EUR-Lex*

[3] Bundesministerium für Wirtschaft und Energie (2024), Energiewinde direkt, Record of onshore wind approvals; *bmwk-energiewende.de/EWD/Redaktion/EN/Newsletter/2024/10/Meldung/direkt-finds.html*

[4] ETIPWind (2025) European Wind Energy Competitiveness Report 2024

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