More!

by Ewa Kochańska

The report *Wind Energy in Europe: 2024 Statistics and the Outlook for 2025-2030*, published in February this year by WindEurope, provides a comprehensive analysis of the wind energy sector's performance in 2024 and projections for the upcoming years. Europe added 16.4 gigawatts of wind energy capacity last year, with the EU accounting for 12.9GW. By the end of 2024, Europe's total wind power capacity reached 285GW, comprising 248GW on- and 37GW offshore. The report emphasises the need for accelerated wind farm deployment and supportive government policies to ensure that wind energy can assist Europe in its transition to a sustainable future.

In 2024, wind power supplied 19% of the EU's electricity. Looking ahead, the report forecasts the addition of 187GW of new wind power capacity in Europe between 2025 and 2030, averaging over 31GW annually. The EU-27 is expected to contribute 140GW to this growth, aiming for a total installed capacity of 351GW by 2030.

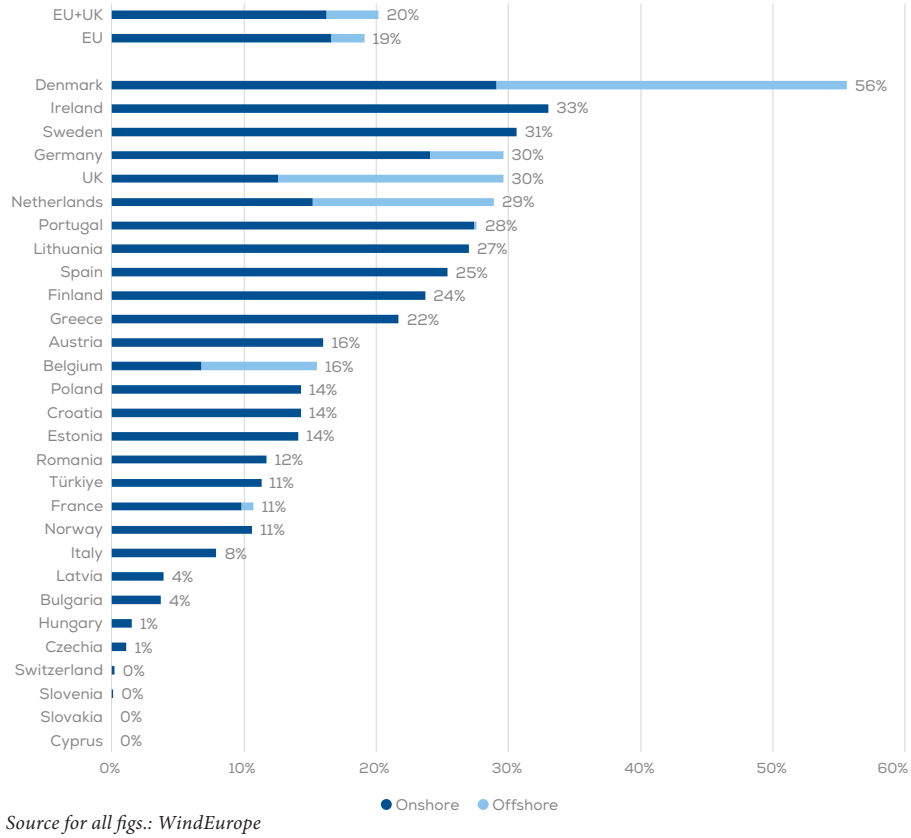
However, to meet the EU's renewable energy target of 42.5% by 2030, installations would need to reach 425GW. Recognising the great potential of wind energy, particularly in decarbonisation and climate goals, as well as economic and energy security, scaling up the development of new wind farms is critical.

Onshore installations take the cake

At this point, land installations are more common than offshore due to much lower construction and maintenance costs; onshore wind farms accounted for 84% of the total new wind capacity added in Europe in 2024.

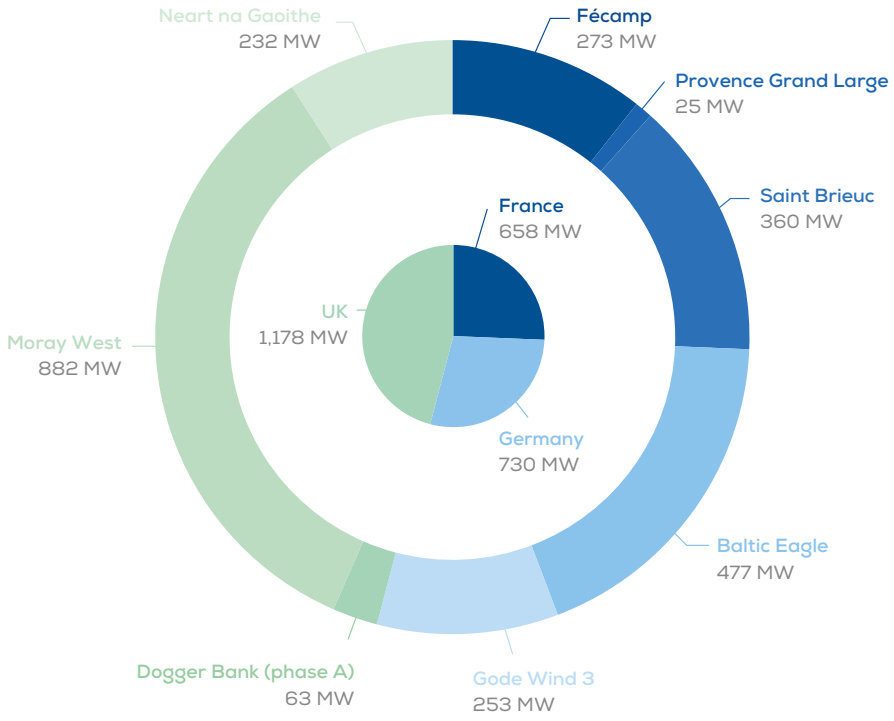
Germany was the leader in onshore wind development, adding 3.3GW from 644 turbines with an average power rating of 5.1 megawatts. Net additions amounted to 2.6GW after 712MW of decommissioned

Fig. 1. Percentage of electricity demand covered by wind in 2024



Source for all figs.: WindEurope

Fig. 2. New offshore wind capacity connected in Europe in 2024



capacity. Finland ranked second with 1.4GW from 235 turbines, maintaining an average rating of 6.0MW. Türkiye doubled its previous year's capacity with 1.3GW (average power rating 4.8MW), driven by ongoing capacity extensions and the 1,000MW YEKA-2 projects. Spain also nearly doubled its volume from 2023 by adding added 1.2GW (power rating of 5.2MW), while France's 1.1GW addition marked a decrease from 2023 (average power rating 2.8MW – one of the lowest in Europe in 2024). Sweden, with 1,015MW from 165 turbines, had an average power rating of 6.2MW.

Poland, the UK, Italy, and Lithuania completed the Top 10 for new onshore wind capacity in 2024. Poland's 805MW was hindered by height restrictions from the 10H rule (requiring that new installations must be located at least the distance of 10 times the turbine's height – including the blade in its upper-most position – from the nearest buildings), resulting in a lower average power rating of 3.3MW. Italy added 685MW with a 4.1MW average power, while the UK installed 739MW at a 3.7MW average power rating. Lithuania saw a record 522MW of new capacity, achieving Europe's highest average power rating (alongside Romania) at 6.3MW. Overall, the European onshore wind sector faced regulatory and supply chain challenges yet saw significant contributions from multiple nations.

Onshore wind energy is projected to dominate Europe's renewable installations, with 140GW of new capacity expected between 2025 and 2030, accounting for three-quarters of the continent's 187GW total. After accounting for decommissioning, the total onshore capacity in Europe is estimated to reach 366GW by 2030, with the EU contributing 113GW of the new capacity. The capacity labelled in the report as 'already awarded in auctions' is expected to add around 26GW by 2027 for the whole continent. Meanwhile, the capacity of 'scheduled to be auctioned' and 'expected to be auctioned' could contribute an extra 35GW and 13GW, respectively, by 2030.

There are also 'non-auction projects' that concern wind power capacity completed without central auctioning systems on power purchase agreements or exclusively on a merchant basis. This last category is prevalent in countries with no government support, such as Sweden and Finland, and the capacity from such systems is expected to amount to 39GW in 2025-30.

Overall, the onshore wind sector in Europe is poised for significant growth, but much of the capacity depends on successful auctions and the effective implementation of non-auction projects.

Offshore – sailing against the wind

Installations out there in the sea lag behind those ashore, posing significant cost, construction, infrastructure, maintenance, and environmental challenges. However, it is important to note that they also offer benefits that surpass those of onshore wind farms, such as greater wind energy efficiency because of higher wind speeds and consistency.

In its calculations, WindEurope only reports new offshore energy capacity that's actually grid-connected and generating energy. Since offshore wind farms are much bigger than onshore, they take much longer to build and connect to the grid. Therefore, some turbines might have already been built but are not counted in this report because they are not yet operational.

All that considered, last year, Europe added 2.6GW of offshore wind power across eight wind farms in three countries. The UK led with 1,178MW from three sites, including the full connection of 60 turbines at Moray West (882MW) and contributions from Neart na Gaoithe (296MW) and Dogger Bank Phase A (1.2GW), averaging a power rating of 12.7MW per turbine (so over three times stronger than the country's land ones). Germany connected 730MW from Baltic Eagle (477MW) and Gode Wind 3 (253MW) with 73 turbines and a power rating of 10MW. In France, 658MW was added from Saint Brieuc (496MW), Fécamp (497MW), and the pilot Provence Grand Large floating project (25MW), with 87 turbines averaging a power rating of 7.6MW. Additional construction took place at six wind farms in the UK, France, and Germany, but their turbines have not yet been connected to the grid.

Europe has set far-reaching goals for its offshore wind sector, recognising its potential for enhancing the continent's energy security, helping to achieve climate goals, lowering noise pollution and visual impact, and creating job opportunities with stable prospects. The initial target set for Europe was 114GW of offshore wind power by 2030, later raised to 158GW. That said, many countries have scaled back these goals due to challenges in setting regulatory frameworks, upgrading grids, and developing supply chains. Despite slower-than-expected progress, new offshore wind projects are expected to come online shortly after 2030; nevertheless, the report states that achieving the original goals on time now seems unlikely.

A significant obstacle to offshore wind expansion in Europe is the slow implementation of offshore auctions (often due to rule drafting or the absence of related regulations). This leads to uncertainty in project timelines and complicates supply chain development. Although parts of the supply chain are expanding along with the projects, certain elements require longer planning.

Fig. 3. Distribution of new wind installations by country in 2015-24

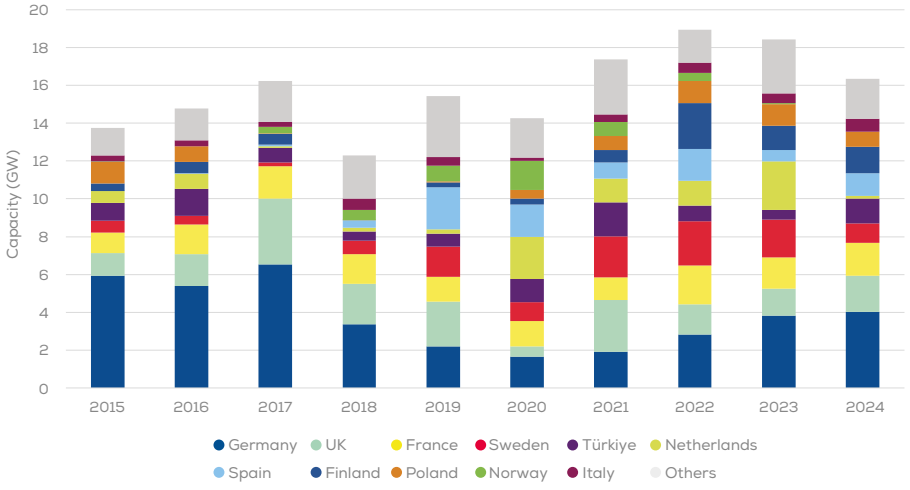
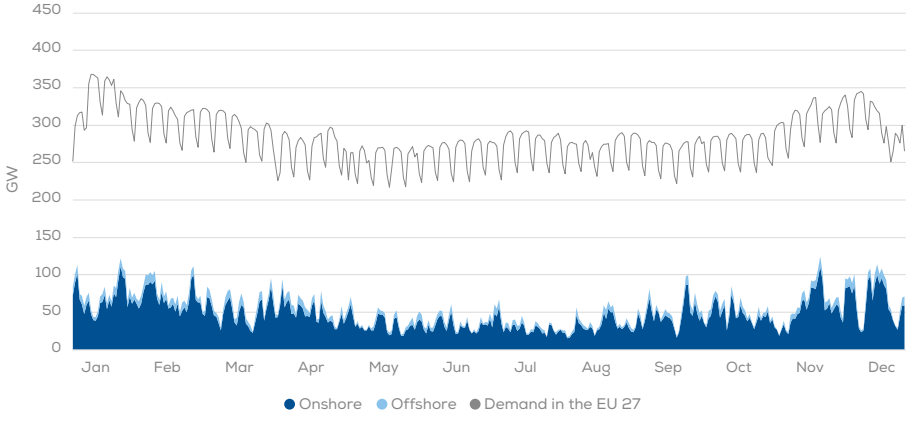


Fig. 4. Power demand and wind energy generation in the EU-27 in 2024 (GW)



Yet, the most critical constraint for offshore development is port capacity. While current seaport facilities can support offshore wind projects until 2028, planned installations are expected to exceed capacity the following year, even when accounting for expansions. "We, therefore, expect offshore project delays to become a major bottleneck across Europe from 2029," says WindEurope in its latest summary. With port development taking 6-10 years, urgent expansion investments are needed to prevent offshore project delays. Additional problems are posed by lagging electrical grid development, inadequate management of connection requests, and outdated grid permitting methods, which hinder project prioritisation.

Vessel availability also creates a conflict. Of around 80 ships supporting offshore wind construction in Europe, only five can handle the largest 14-15MW turbines, which will be the norm by 2030. Demand from global markets and seasonal deployment of ships in the Southern Hemisphere further strain availability. Building new vessels takes 2-3 years, underscoring the importance of timely investments.

Although challenges have delayed offshore wind ambitions in Europe, the sector's outlook remains positive, according to WindEurope. Governments are still committed, and while installations may lag by 1-2 years, a decline in deployment is not anticipated. The EU is projected to reach 48GW of offshore wind capacity by 2030, with 29GW of new installations planned between 2025 and 2030. The majority of this capacity, 24GW, comes from projects already awarded in auctions and considered reliable. An additional 3.0GW is expected from projects scheduled for future auctions, though their timelines remain uncertain until rights are secured. A smaller portion, around 1.0GW, consists of non-auction projects, primarily in Sweden and Finland, which face greater uncertainty regarding their development schedules (especially in the former, whose military is, for this or another reason, against offshore wind energy, a stance sharply contrasting their EU-Baltic counterparts' approach).

By 2030, Europe's total offshore wind capacity is anticipated to reach 84GW, with 39GW from awarded auctions, 8.0GW from upcoming auctions, and less than 1.0GW from non-auction projects. Despite some uncertainties, the outlook for offshore wind expansion remains strong, supported by a mix of auction-backed projects and open development systems.

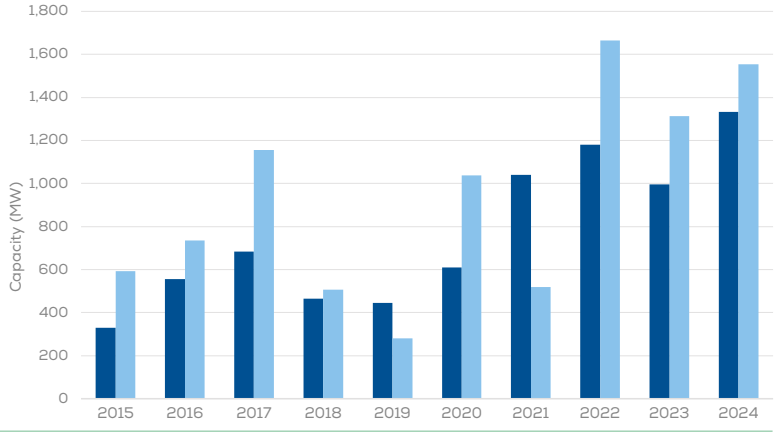
Let there be light (but first, wait to be connected)

Electrification is a key strategy for enhancing resilience and decarbonising Europe, as the European Commission's (COM) ***Competitiveness compass*** from January 2025 underscored. The EU report highlights Europe's heavy dependence on imported fossil fuels, a vulnerability particularly exposed by Russia's use of energy as a geopolitical (power)tool. The WindEurope report warns that to reduce this reliance, the EU must rapidly expand clean energy and promote electrification.

The COM's Clean Industrial Deal aims to drive electrification by supporting operating and capital expenditures for renewables-based processes. According to the COM's impact assessment, electricity's share of final energy consumption is set to double to 50% by 2040, with generation increasing from 3,360TWh in 2030 to 4,560TWh in 2040. Wind energy will be critical in meeting this demand, potentially quadrupling output by providing 1,830TWh if annual deployment reaches 30GW throughout the 2030s. Streamlined permitting (e.g., Germany increased permitting sevenfold over the last four years), digitalisation, and binding EU permitting rules are essential for accelerating wind deployment.

However, Europe's electricity grid remains a significant bottleneck, hindering renewable energy deployment and competitiveness. Continual underinvestment has resulted in lengthy grid connection queues, curtailment issues, and weakened investment incentives. Over 500GW of wind capacity across multiple European countries awaits grid connection assessments. To address this challenge, the report calls for national authorities, TSOs, and DSOs to adopt dynamic and strategic management of grid connections, moving away from the 'first come, first served' model and implementing prioritisation and filtering criteria. The EU's Action Plan for Grids calls for more than €584 billion in investments this decade,

Fig. 5. Decommissioned and repowered capacity in Europe in 2015-24



	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Decommissioned capacity	329	555	684	466	444	610	1,041	1,180	997	1.332
Repowered capacity	593	735	1,155	508	281	1,037	519	1,666	1,314	1,555

primarily for national grid expansion. This requires long-term planning from system operators, risk mitigation tools for investment recovery, and enabling private investment while adhering to unbundling regulations. Strengthening Europe's electricity grids is essential to unlocking renewable energy potential, phasing out fossil fuels, and creating a sustainable investment environment for clean energy.

With great power comes the need for repowering

In 2024, wind energy provided 19% of the EU's electricity demand – the same as in 2023, despite increased output, as electricity consumption rose 1.4%; onshore installations generated 16.6% and offshore 2.5%.

Denmark led Europe, with wind covering 56% of its demand, while Ireland came in second at 33%. Sweden's share grew significantly from 26% in 2023 to 31% in 2024, following a 6.0% increase in installed capacity and improved fleet efficiency, surpassing Spain, the Netherlands, the UK, and Germany. Estonia, Finland, and Lithuania also saw significant gains, with Lithuania's share rising from 21% to 27%, Finland's from 18% to 24%, and Estonia's from 10% to 14%. The UK ranked fifth in Europe with wind energy meeting 30% of its needs, while the Netherlands used wind energy for 29% and Portugal for 28% of their energy demand. Combined, the EU and UK produced 557TWh of wind power, meeting 20% of their joint electricity demand. The UK's offshore capacity alone generated 47TWh (which would cover Hungary's entire demand of 43TWh).

The power capacity of wind turbines has seen a significant rise over the past decade. Onshore turbines installed in 2024 had an average power rating of 4.6MW, a slight increase from 4.5MW in 2023 but an impressive 84% growth from 2.5MW in 2015. Recent innovations include turbines with larger rotor diameters and lower power ratings, designed for low-wind sites, expanding viable project locations. Orders placed in 2024 averaged a record 5.7MW, suggesting continued growth in onshore turbine capacity. Offshore turbines in Europe also experienced notable advancements, with average power ratings increasing 2.4 times over the last decade and more than 25% since 2022. Offshore orders in 2024 averaged 14.8MW, slightly above 14.7MW in 2023, and introducing even more powerful turbines promises further capacity growth in the coming years.

Despite these positive trends in turbine technologies, fluctuations in hard-to-control circumstances, such as changing demand and weather conditions, have impacted generation last year. Inconsistency is a natural aspect of wind power; winter months see greater fluctuations, while summer's stable, high-pressure systems reduce output and variability. Poor wind conditions in 2024 reduced output in Ireland and the UK; on the flip side, favourable weather boosted production in Sweden, Norway, Finland, and the three Baltic States. Estonia and Finland saw a 39% increase in generation, while Lithuania's output surged by 37% compared to 2023. The EU-wide capacity factor averaged 24%, with onshore wind at 23% and offshore at 35%. Here, the age of the installations also plays a role; new wind farms boast higher generation capacity than older ones, with onshore capacity from 30-35% and offshore from 42-55%.

Wind farms do have a finite lifespan, typically ranging from 15 to 25 years for older installations (modern turbines are designed for longer use). When a wind farm reaches the end of its operational life, decommissioning involves dismantling and removing turbines unless their life is extended through upgrades. Repowering can still be a better option, replacing outdated components with advanced technology to enhance efficiency and output.

In 2024, 1.3GW of wind capacity was decommissioned across eight European countries. Repowering contributed 1.6GW out of 16.4GW of new wind installations in Europe (mainly from Germany). Repowered projects are strategic as they leverage existing infrastructure and permits, making them less challenging than new developments. The decision to repower wind farms is influenced by electricity prices, incentives, and environmental regulations, varying by region and project age. Repowering is more common with younger wind farms due to clear economic benefits, while older ones are often maintained until decommissioned. The EU supports repowering by mandating shorter permitting timelines under the 2023 Renewable Energy Directive. However, national challenges persist, such as Italy's auction rules that require discounted bids in repowering, which do not account for decommissioning costs.

By 2030, annual installations from repowering are expected to increase from 1.4GW to over 5.0GW, totalling 21GW, while around 22GW of older wind farms will be decommissioned. Despite this growth, repowered wind farms will only represent 8.0% of Europe's installed capacity by 2030. Though repowering is essential to Europe's energy and climate strategy, persistent challenges like regulatory obstacles and policy discrepancies must be addressed to fully capitalise on repowering potential and strengthen Europe's renewable energy framework.

To speed up wind energy deployment in Europe, cabinets (central and local alike) must modernise and expand electricity grids, enhance port infrastructure, and fully implement the EU's new permitting rules. Streamlining approvals should be a governmental priority across the continent. Additionally, increased investments in grid capacity, ports, and vessels are needed to support offshore wind growth.

Consistently deploying onshore and offshore wind farms at scale is essential to meet the EU's 2030 target of 425GW and drive economic resilience while reducing reliance on fossil fuels. □