The Arcadis Ost 1 Wind Farm, declared at 257.2 MW was inaugurated on 5 December 2023 and is located in the Baltic Sea northwest of Rügen Island (Germany). It has twenty-seven Vestas V174/9.5 MW turbines (174 metres in diameter and 9.5 MW of capacity).

GE RENEWABLE ENERGY

476.6 TWh

The estimated electricity production from wind power in the EU of 27 in 2023

WIND ENERGY BAROMETER 2024

A study carried out by EurObserv'ER.

The European Union wind energy industry has put a spate of alerts and uncertainties behind it as the market bullishly eyes renewed growth prospects. The connection figures for 2023, mark a year of transition commensurate with the final investment decisions of previous years. EurObserv'ER's figure for newly installed capacity installation in 2023 is at least 15.6 GW, which once decommissioned capacity for the year is subtracted, takes European Union capacity in service to 218.5 GW.
Leaving Europe aside, China's annual installation figure more than doubled that of 2022, approaching a stunning 76 GW, and took its total capacity in service by the end of 2023 to 441.3 GW. This exceptional growth enabled wind energy to push its 12-month worldwide installation figure past the 100-GW mark for the first time, and with it thrust the total global wind energy capacity installation figure to over one terawatt.

218.5 GW
Wind power capacity installed in the European Union at the end of 2023

18.4 GW
Wind offshore capacity installed in the EU of 27 at the end of 2023

The SIF group, based in the port of Rotterdam, is currently constructing a foundation manufacturing plant for offshore wind turbines.

This barometer came too early for the release of the final global wind energy market figures for 2023. Yet, provisional data for the five main markets (China, the EU, USA, Brazil and India) were published early in March 2024 and will probably be consolidated upwards. They already hint at an installation level of over 105 GW. The GWEC (Global Wind Energy Council) put total global wind capacity in service in 2022 at 906.2 GW (841.9 GW onshore and 64.3 GW offshore) while Irena's estimate was 898.8 GW (835.6 GW onshore and 63.2 GW offshore). They both indicate that in 2023 worldwide capacity in service was well past the 1-TW threshold.

CHINESE WIND ENERGY FLEXES ITS MUSCLES

At the end of January 2024, the National Energy Administration (NEA) published the national statistics of China's power industry for 2023. These quantified installed wind energy capacity to date at 441.34 GW on 31 December 2023 – a 20.7% YoY (year-on-year) increase. About 75.7 GW of additional wind energy capacity was installed in 2023, setting a new installation record that eclipsed its 2020 record of 72.2 GW. While no breakdown was given between the onshore and offshore wind energy figures, the WFO (World Forum Offshore Wind) data for the first half of 2023 notes that at least eight offshore wind farms with combined capacity of 2.5 GW were connected off China's coasts.

What is particularly astonishing about this growth is that most of this new capacity was installed without subsidies or Feed-in Tariff but applied the "grid parity" mechanism. China's new wind and solar power projects are either grid parity projects (which benefit from a provincial regulation equating to the prices paid to coal producers), or are projects based on the negotiated market. The 2020 installation record was driven by the announced end to the guaranteed Feed-in Tariff for onshore wind energy and the gradual introduction of this "grid parity" system. The FiT system for offshore wind energy ended a year later in 2021 (accompanied by an installation rush) and was replaced by the grid parity mechanism from 2022 onwards. Thus, China installed more than double the amount of wind energy capacity, i.e., an additional 36.8 GW in 2023 than in the previous year, which was when the NEA put the country's accumulated installed wind energy capacity at 365.44 GW. China's wind turbine manufacturing capacity, which primarily relies on Chinese components, has thus become colossal, much to the consternation of its European and American challengers on the global market, especially as China's 2024 wind energy market shows no signs of slowing down. According to the China Electricity Council, 530 GW of wind energy capacity is expected for the end of 2024, while solar power capacity is forecast at 780 GW. Together, installed wind and solar power capacity will outstrip that of coal and constitute 40% of the country's total installed capacity. Furthermore, the official 1200-GW target for wind and solar power by 2030, restated in 2022 when the 14th Five-Year Plan (FYP) for renewable energies was published is already pointless, because it should be achieved six years ahead of schedule. Coincidentally, this plan set a renewable electricity output target of 33% by 2025 and the target for non-hydropower renewable energies of 18%, compared to the total 28.8% renewable share in 2020 (11.4% non-hydropower renewable energies). Yet for all this, China's renewable energies industrial complex is scaled not only to satisfy its decarbonation needs but to achieve its CO_2 emissions peak in 2030 and carbon neutrality in 2060. Pan Huimin, Deputy Director General of the Department of International Affairs, National Energy Administration (NEA), declared at a press conference in January 2024, that in 2023 China had contributed to over half the renewable energy capacity installed in the world (editor's note: this is a gross understatement) and that the country was a crucial force for stimulating clean energy development across the world. She also confirmed that Chinese companies' investments in clean energies abroad had penetrated the main countries and regions, covering wind energy, photovoltaic power and hydropower, which, on the basis of mutual benefit and win-win results, had assisted local populations in their low-carbon emission growth. She further emphasised the fact that Chinese wind and photovoltaic power products had been exported to over 200 countries and regions and had played a part in dramatically reducing electricity production costs over the past decade.

Table No. 1

Wind power capacity installed* in the European Union at the end of 2023** (MW)

	2022	Of which Offshore	2023	Of which Offshore	Installed in 2023	Of which Offshore	Decommissioned 2023***
Germany	66 188.0	8 200.0	69 474.0	8 458.0	3 837.0	258.0	551.0
Spain	30 113.8	5.0	30 774.8	5.0	661.1	0.0	0.0
France	20 810.6	500.8	22 389.6	842.0	1 672.0	341.2	93.0
Sweden	14 278.0	193.0	16 134.0	193.0	1 858.0	0.0	2.0
Italy	11 850.5	30.0	12 335.8	30.0	522.3	0.0	37.0
Netherlands	8 754.8	2 569.5	10 749.0	3 978.0	1 994.2	1 408.5	0.0
Poland	8 150.2	0.0	9 428.3	0.0	1 278.1	0.0	0.0
Denmark	7 104.0	2 301.0	7 281.0	2 469.0	203.0	168.0	26.0
Finland	5 677.0	73.0	6 946.0	73.0	1 280.0	0.0	11.0
Portugal	5 538.1	25.0	5 809.0	25.0	270.9	0.0	0.0
Belgium	5 303.4	2 261.8	5 501.8	2 261.8	308.4	0.0	110.0
Greece	4 702.3	0.0	5 231.7	0.0	529.4	0.0	0.0
Ireland	4 536.1	25.0	4 730.4	25.0	194.3	0.0	0.0
Austria	3 633.0	0.0	3 945.0	0.0	331.0	0.0	19.0
Romania	3 015.2	0.0	3 100.0	0.0	84.8	0.0	0.0
Lithuania	946.0	0.0	1 288.0	0.0	342.0	0.0	0.0
Croatia	986.9	0.0	1 156.9	0.0	170.0	0.0	0.0
Bulgaria	702.1	0.0	702.1	0.0	0.0	0.0	0.0
Estonia	316.0	0.0	376.0	0.0	60.0	0.0	0.0
Czechia	339.4	0.0	343.7	0.0	5.3	0.0	1.0
Hungary	324.5	0.0	324.6	0.0	0.1	0.0	0.0
Luxembourg	165.9	0.0	207.9	0.0	42.0	0.0	0.0
Cyprus	157.5	0.0	157.5	0.0	0.0	0.0	0.0
Latvia	129.9	0.0	137.0	0.0	7.1	0.0	0.0
Slovakia	4.0	0.0	4.0	0.0	0.0	0.0	0.0
Slovenia	3.3	0.0	3.3	0.0	0.0	0.0	0.0
Malta	0.1	0.0	0.1	0.0	0.0	0.0	0.0
Total EU-27	203 730.8	16 184.1	218 531.5	18 359.8	15 650.7	2 175.7	850.0

** Net maximum electrical capacity. ** Estimation. *** Decommissioning data of the year 2023 concerns only onshore wind power.* ***Sources: EurObserv'ER 2024.***

WIND ENERGY BAROMETER – **EUROBSERV'ER** – MARCH 2024

The Vesterhav Nord Wind Farm (176 MW) off the west coast of Jutland, Denmark, started up at the beginning of 2024. It is equipped with 21 Siemens Gamesa 8.0-167 DD wind turbines

Table No. 2

Gross electricity production from wind power in the European Union in 2022 and 2023* (TWh)

	2022	Of which Offshore	2023	Of which Offshore
Germany	124.816	25.124	142.103	23.884
Spain	62.784	0.004	64.153	0.006
France	38.650	0.652	50.600	1.900
Sweden	33.087	0.550	34.333	0.550
Netherlands	21.401	8.015	28.885	11.452
Italy	20.494	0.000	23.400	0.056
Poland	19.780	0.000	22.120	0.000
Denmark	19.108	8.743	19.540	8.573
Belgium	12.353	6.652	15.625	8.040
Finland	12.022	0.272	15.049	0.243
Portugal	13.244	0.078	13.156	0.079
Ireland**	11.208	0.000	11.398	0.000
Greece	10.883	0.000	11.022	0.000
Austria	7.245	0.000	8.036	0.000
Romania	6.997	0.000	7.625	0.000
Croatia	2.138	0.000	2.533	0.000
Lithuania	1.512	0.000	2.524	0.000
Bulgaria	1.499	0.000	1.550	0.000
Czechia	0.641	0.000	0.701	0.000
Estonia	0.668	0.000	0.684	0.000
Hungary	0.610	0.000	0.620	0.000
Luxembourg	0.312	0.000	0.451	0.000
Latvia	0.190	0.000	0.268	0.000
Cyprus	0.224	0.000	0.250	0.000
Slovenia	0.006	0.000	0.006	0.000
Slovakia	0.004	0.000	0.005	0.000
Malta	0.000	0.000	0.000	0.000
Total EU-27	421.877	50.089	476.636	54.782

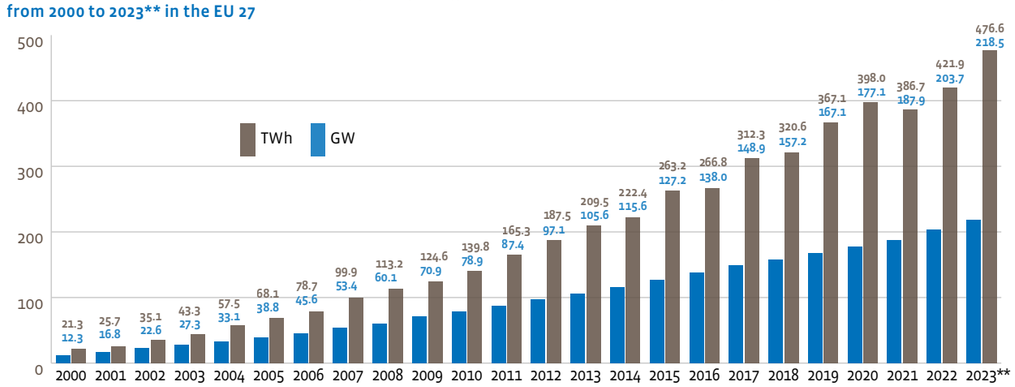
** Estimation. ** Ireland wind offshore electricity production not available.* ***Source : EurObserv'ER 2024.***

WIND ENERGY HAS A TOUGH TIME IN THE USA. YET IS THRIVING IN BRAZIL

The American Clean Power (ACP) annual report confirms that in 2023, United States wind energy capacity installations fell to their lowest level since 2014. Some 1 910 wind turbines totalling 6 402 MW of capacity were installed, compared to 8 876 MW in 2022 and 13 667 MW in 2021. At the end of 2023, the USA had 150.5 GW of wind energy capacity in service. The ACP suggests that the elements behind this slowdown are that some regions have saturated their capacity, others are lagging behind in development, while other extenuating factors are changes to incentive schemes, fluctuating costs and building permit delays. The offshore wind energy sector has been particularly hard hit. Several major projects have been abandoned because of inflation or have had their final investment decisions postponed while they seek to renegotiate their PPA contracts that have become unprofitable.
Much more positive trends prevail in India and Brazil, which are turning out to be major wind energy nations. In Brazil, ANEEL (the National Electric Energy Agency), put the country's newly connected wind energy capacity at 4.92 GW during 2023 compared to 2.9 GW in 2022, raising its capacity to date to 29.5 GW.

Graph No. 1

Evolution of wind power capacity installed* (in GW) and gross wind electricity production (in TWh) from 2000 to 2023** in the EU 27



** Net maximum electrical capacity. ** Estimation.* ***Sources : Years 2000-2021 (Eurostat). Year 2022 and 2023 (EurObserv'ER).***

According to India's Central Electricity Authority (CEA) data, total accumulated installed capacity stood at about 44.7 GW at the end of 2023, while total installed wind energy capacity reached 44.96 GW at the end of January 2024, with 233 MW added in the month of January 2024 alone. In its annual report, IRENA (the International Renewable Energy Agency) put total accumulated capacity at the end of 2022 at 41 930 MW (official data), which equates to an annual installation volume of at least 2.8 GW in 2023 (1 847 MW in 2022).

THE EUROPEAN UNION IS BULLISH

The new European Union RED III renewable energy directive targets announced in October 2023 are likely to give wind energy ambitions a shot in the arm, in both the onshore and offshore segments. However, the annual capacity installation figures of the EU are unlikely to increase significantly before 2025. EurObserv'ER reckons that net installed wind energy capacity in the EU, defined as the net maximum capacity in service that can be injected into the grid, reached at least 218.5 GW at the end of 2023 (including 18.4 GW of offshore wind capacity), namely, 14.8 GW of additional net capacity compared to 2022 (including 2.2 GW of offshore wind capacity (Table 1 and Graph 1)). This is a little less than the additional net capacity (15.8 GW) measured between 2022 and 2021. EurObserv'ER quantifies the additional net capacity in service at just under 15.7 GW, the remaining 850 MW or so having been decommissioned in 2023 across the European Union (of which 551 MW by Germany, 110 MW by Belgium and 93 MW by France).
EurObserv'ER cautions that the final count is not set in stone, as this estimate is primarily based on questionnaires filled in by the ministries and statistical bodies tasked with monitoring renewable energy capacities (sources listed on the last page of this barometer). Some data has been qualified as provisional and may yet be consolidated.
It should be borne in mind that the annual capacity decommissioning figures are steadily increasing and that the decommissioning pace is set to rise sharply over the next few years. This is just as well because some wind farms will benefit from repowering operations. WindEurope, which represents Europe's wind energy industry, surmises in its annual statistics report "**Wind Energy in Europe, 2023 Statistics and the outlook for 2024-2030**", that from 2024 to 2030 accumulated decommissioned capacity could rise to 27 GW in Europe. Part of this capacity (16 GW) will be replaced by new, more powerful wind turbines (potentially 28 GW of capacity), while 11 GW will be simply dismantled and withdrawn from the electricity generating system. The prime interest of repowering is to increase a site's electricity output and reduce its operating costs. According to WindEurope, repowering trebles wind farm output on average while cutting the number of turbines by 25%. Another trend signalled in this report is the continuous ramp-up in the average wind turbine unit capacity installed in Europe, which in 2023 was 4.5 MW for onshore wind turbines and 9.2 MW for offshore wind turbines, compared to just 3.5 MW for onshore and 8.2 MW for offshore wind turbines in 2020 and only 2.5 MW for onshore and 4.2 MW for offshore wind turbines in 2015.
The WindEurope association often publishes its own indicators out of step with the official statistics bodies' data. EurObserv'ER believes that this disparity can be explained by the fact that turbines installed at the end of the year, while not officially commissioned, are included in the count. This is glaringly obvious for offshore capacity. WindEurope thus puts the European Union's installed wind energy capacity in 2023 at 16.2 GW (including 2.9 GW offshore), which is slightly more than in 2022 (16.1 GW, including 1.2 GW offshore), and the European Union-wide base at 220.3 GW (including 19.4 GW offshore). WindEurope argues that 2023 was a much busier year for wind energy tenders and auctions, as 27.3 GW of capacity

Gravity base foundations of the future Fécamp Wind Farm (Normandy).

JACQUES BASILE

was awarded in 13 European countries (including the UK) – much more than the 16.9 GW allocated in 2022. WindEurope reckons that if the EU is to meet its 42.5% renewable energy target by 2030, average annual installed capacity must rise to 33 GW between 2024 and 2030, based on an installed wind energy capacity target of 425 GW at the end of 2030.

The former 440 GW target equated to a 45% RES share. The WindEurope 2024-2030 outlook examines a likely wind turbine installation scenario, based on a 200 GW installation level between 2024 and 2030, equating to an average annual pace of 29 GW (thus, a little lower than what is needed to achieve the EU's climate targets), enough to reach 393 GW by the end of 2030. WindEurope feels that offshore wind energy will make the difference towards the end of the decade. The onshore wind energy installation level should stabilise at around 20–22 GW p.a. from 2027 to 2030, while that of offshore should rise from 3.8 GW in 2027 to 7.1 GW in 2028, 17.6 GW in 2029 and 25.2 GW in 2030.

EU OFFSHORE WIND ENERGY SURGES

Many European Union offshore projects were accomplished last year. EurObserv'ER recorded at least 2 176 MW of offshore wind energy capacity officially connected to the grid compared to just over 1 GW in 2022 (1 020 MW), which made 2023 the best ever year for new offshore wind energy installations and includes the commissioning of Hollande Kust Zuid.

Once again, the Netherlands was the most active country in 2023. It consolidated its rank as the No. 2 offshore wind energy power in the European Union, behind Germany and ahead of Denmark and Belgium. Statistics Netherlands reports that the country officially connected 1 408.5 MW of offshore capacity, pointing out that its statistics only included the capacity that injected electricity into the grid in 2023, which is installed in the Hollandse Kust Noord 5 Wind Farm (759 MW, comprising sixty-nine Siemens Gamesa SG 11.0-200 DD turbines each with unit capacity of 11 MW). The unsubsidised wind farm started up on 20 December 2023 and is expected to generate 3.3 TWh p.a. The capacity also covers the remaining turbines of the Hollandse Kust Zuid Wind Farm, which is currently the world's biggest offshore wind farm, namely, one hundred and thirty-nine Siemens Gamesa SG 11.0-200 DD turbines, for total capacity of 1 529 MW. This capacity is equally split between Hollandse Kust Zuid 1&2 and Hollandse Kust Zuid 3&4 wind farms. While the last wind turbine was installed in June 2023, the wind farm was originally designed to have 140 turbines, but in January 2022, a merchant vessel, the Julietta D, crashed into one of the wind turbine's foundations while under construction causing irreparable damage. The wind farm will become fully operational in 2024. Bids closed at the end of 2022 for the next stage – starting up Hollandse Kust West 1&2, scheduled for the end of 2026 (see below).

France followed on the Netherlands' heels for new offshore installations in 2023, with two wind farms currently being installed off the coasts of Fécamp (497 MW) and Saint-Brieuc (496 MW). Commissioning will be phased in and the facilities should be fully operational in 2024. According to the French grid operator, RTE, the capacities on-grid at the end of 2023 were 224 MW and 136 MW respectively, i.e., a total of 360 MW. The Fécamp Wind Farm will have seventy-one 7-MW Siemens Gamesa SG 7.0-154 wind turbines, while the Saint-Brieuc Wind Farm will have sixty-two 8-MW Siemens Gamesa SG 8.0-167 wind turbines, the last of which was installed on 17 December 2023.

According to the calculations of Germany's working group on renewable energy statistics, AGEE-Stat, the country installed 258 MW, tantamount to the capacity of the Arcadis Ost 1 Wind Farm. This wind farm, declared at 257.2 MW, was inaugurated on 5 December 2023 and is located in the Baltic Sea northeast of Rügen Island. It has twenty-seven Vestas V174/9.5 MW turbines (174 metres in diameter and 9.5 MW of capacity) with capacity-uprated turbines.

The Danish Energy Agency reports that Denmark set the ball rolling in 2023, when it connected the 168 MW of capacity of the Vesterhav Syd, which started delivering electricity in November 2023. It is equipped with twenty Siemens Gamesa 8.0-167 DD turbines (uprated to 8.4 MW). The Vesterhav Nord Wind Farm (176 MW), equipped with twenty-one of the same turbines, has also been installed and is expected to come on stream early in 2024. In August 2023, Spain started up the DemoSATH test platform 3 km off its Basque coast, which is equipped with a 2-MW floating wind turbine. The purpose of this two year-long operation is to gauge the interactions of this floating wind turbine technology with the environment ecosystem, such as birds, bats and also the shellfish, fish and cetacean community. The output from this floating turbine demonstrator will be excluded from the official Ministry for Ecological Transition and the Demographic Challenge accounts.

Further commissioning operations will follow. At the end of 2023, construction of three German wind farms was underway – Baltic Eagle (476.3 MW) and God Wind 3 (241.8 MW) due to start up in 2024 and Borkum Riffgrund 3 (900 MW) due to start up in 2025. The final investment decision was taken in July 2023 on the EnBW He Dreiht Wind Farm (900 MW) for construction in 2024 and commissioning in 2025. At the beginning of 2024, France should start up several pilot floating offshore wind farms: Gulf of Lion (30 MW), Provence Grand large (25.2 MW), then in the middle of the year Eolmed (30 MW). The Courseulles-sur-Mer Wind Farm (448 MW) will start up in

2025. The Netherlands will commission the Hollandse Kust (West) VI (756 MW) and Hollandse Kust (West) VII (760 MW) wind farms in 2026.

THE EUROPEAN UNION'S ELECTRICITY MIX GETS A PICK-ME-UP

EurObserv'ER, which draws on preliminary official estimates, reckons that combined onshore and offshore wind power output rose to 476.6 TWh in 2023 (Table 2), setting a new European Union production record with a YoY rise of 13.0% (54.8 TWh). The Ember think tank feels that in 2023, for the first time, wind power output overtook that of the EU's gas-fired power plants, which plummeted.

Offshore wind power output for 2023 is put at 54.8 TWh, amounting to 9.4% (4.7 TWh) growth, and thus delivered 11.5% of total wind power output. The European Union benefitted from much better wind conditions than in the previous two years. This improvement was felt across the board except for in Portugal whose output slipped (by 0.7% YoY). More than half of the EU's countries, including some of the major producer countries, enjoyed double-digit growth rates for wind power output. Cases in point are Germany (13.8%, a 17.3-TWh rise), France (30.9%, a 12-TWh rise), the Netherlands (35%, 7.5 TWh), Italy (14.2%, 2.9 TWh), Poland (11.8%, 2.3 TWh), Belgium (26.5%, 3.3 TWh) and Finland (25.2%, 3.0 TWh).

Denmark's electricity production coverage rate was the best thanks to wind power. According to the Danish Energy Agency, wind power provided 57.5% of the country's electricity output in 2023 (54.3% in 2022) and 53.8% of its electricity supply (53.6% in 2022) (allowing for transmission losses). According to Eirgrid data, wind power accounted for 35.2% of Ireland's electricity supply (33.2% in 2022), which is very close to its historic record of 2020 (36.3%), and this includes 9.9% of imports. According to AGEE-Stat estimates, wind power supplied at least 27.66% of Germany's electricity production 2023 (23.01% onshore and 4.65% offshore). In 2022, AGEB put this share at 21.6% in 2022 (17.3% onshore and 4.3% offshore).

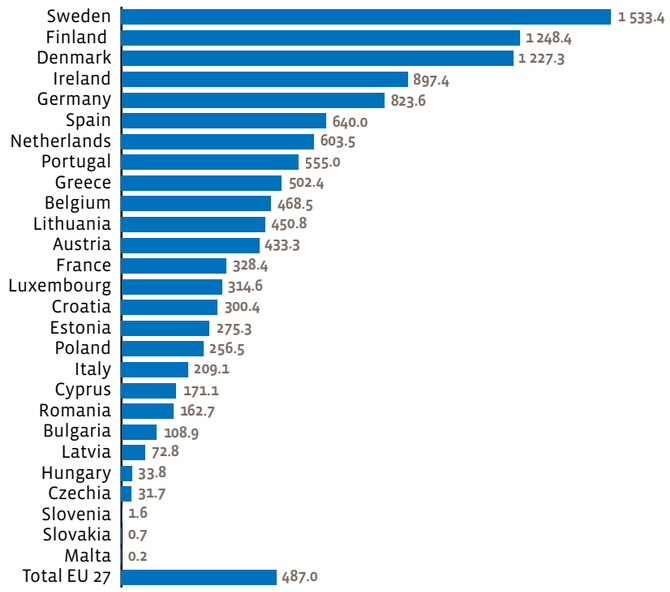
OFFSHORE TENDERS OFFERED HIGH RETURNS TO GERMANY'S GRID

Germany topped the European Union league for wind energy capacity installation again in 2023. According to AGEE-Stat, it connected as much as 3 837 MW over the year, split between 3 579 MW for onshore and 258 MW for offshore. Subtracting the capacity decommissioned over the 12-month period (i.e., 551 MW), results in a rise in total on-grid capacity to 69 474 MW by the end of 2023 (61 016 MW onshore and 8 458 MW offshore). Germany also allocated more capacity through tenders or auctions than any other country. Every year, the Federal network authority (Bundesnetzagentur) publishes the annual tender results. In 2023, four tenders for onshore wind energy were launched for an advertised amount of 9 829.4 MW (bidding deadlines: February, May, August and November respectively), through a floating feed-in-premium, yet all four were undersubscribed. Finally, 6 377 MW of capacity was allocated. The maximum permissible value for these tenders was set at 7.35 euro cents/kWh (compared to 5.88 euro cents/kWh in 2022) with the average value allocated for the first two of 7.34 euro cents/kWh and 7.32 euro cents/kWh and 7.31 euro cents/kWh for the third and fourth tenders. About 12 GW of onshore capacity will be offered in 2024. The first tender results for the year have already been published with 1 795 MW allocated for the 2 486 MW offered at an average price of 7.34 euro cents/kWh.

In 2023, 8.8 GW of offshore capacity was allocated (7 GW in June and 1.8 GW in August) for wind farms that will be installed in 2030. For the June 2023 tender, the bidders have competed on each site by submitting their demand for public aid per kilowatt-hour produced, the lowest demand should win the tender. However, it turns out that many bidders for the three North Sea sites and the Baltic Sea site have demanded zero-subsidy per

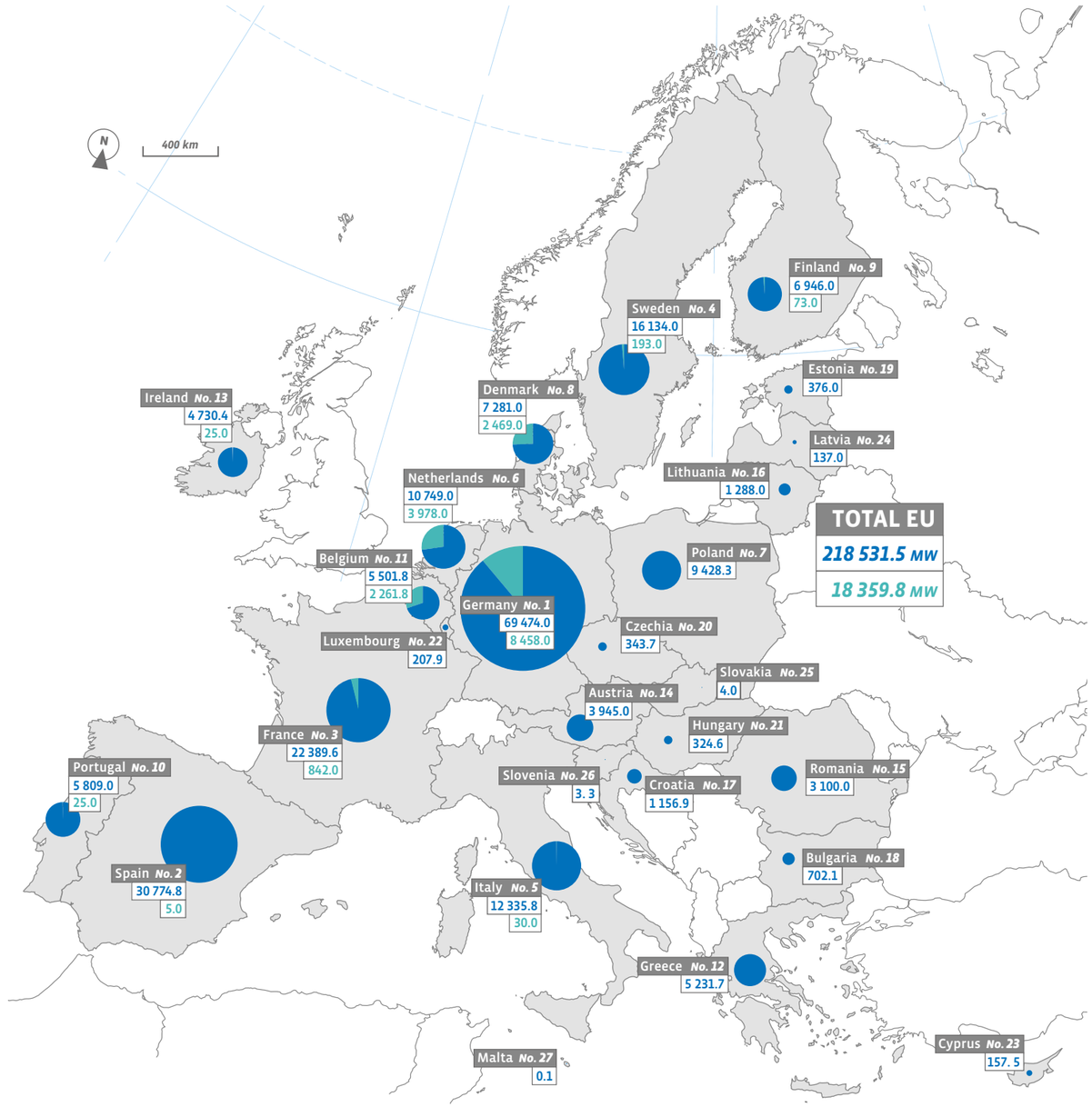
Graph No. 2

Wind power capacity per 1 000 inhabitants in the EU in 2023* (kW/1 000 inhab.)



*Estimation. **Source: EurObserv'ER 2024**

Wind power capacity installed* in the European Union at the end of 2023** (MW)



Key

218 531.5 Total wind power capacity* (onshore and offshore) at the end of 2023** (in MW)

18 359.8 of which offshore wind power capacity at the end of 2023 (in MW)

*Net maximum electrical capacity. **Estimate. **Source: EurObserv'ER 2024.**

kWh. To differentiate between them, Bundesnetzagentur has opened a procedure provided for by German law, which is a dynamic auction system, whereby the remaining bidders for each site must state how much they are prepared to pay per megawatt of capacity to be installed. Finally, BP was allocated two North Sea sites for 2 GW each, the first at a bid price of 1.83 million euros per MW (3.66 billion euros in all) (after 63 bidding rounds) and the second through a bid of 1.56 million euros per MW (3.12 billion euros in all) (after 55 bidding rounds). The other two were won by TotalEnergies, at 1.875 million euros per MW) for the third North Sea site for 2 GW (3.75 billion euros in all) after 65 bidding rounds and 2.07 million euros per MW for the Baltic Sea site for 1 GW (2.07 billion euros in all), after 72 bidding rounds. Bundesnetzagentur points out that 90% of the revenue will be used to reduce electricity costs, and five percent each will be allocated to marine conservation and promoting environmentally friendly fishing. The same offshore capacity of 8 GW will be allocated in 2024 (2.5 GW in June and 5.5 GW in August).

THE NORTH SEA, THE NETHERLANDS' GOLDEN GOOSE FOR OFFSHORE WIND ENERGY

Statistics Netherlands reports that the Netherlands connected 1 994.2 MW of wind energy capacity in 2023 including 1 408.5 MW offshore. The country is the sixth in the EU to pass the grid-connected capacity threshold of 10 GW (10 749 MW at the end of 2023, split between 6 771 MW onshore and 3 978 MW offshore). In 2023, wind energy covered a quarter of the country's gross electricity production (24.8%). Within the next three years, offshore wind energy will be the country's main growth vector as its offshore base should rise to about 6 200 MW at the end of 2026 compared to 7 000 MW of onshore capacity, according to the European Wind Power Action Plan's Wind Pledges (see below). Furthermore, according to Wind Pledges, the country will set itself a 21-GW target for offshore wind energy capacity by 2031, a figure which could rise to 50 GW in 2040 and even 70 GW in 2050. The Dutch authorities have set a tight framework for offshore development. The tenders for the Hollandse Kust West sites closed in 2022 and 1.4 GW worth of projects were allocated between Oranje Wind Power II, a subsidiary of RWE, and EcoWende (Shell and Eneco). These zero-subsidy wind farms should be up and running by the end of 2026. The next stage entails setting up an initial 4-GW tender for the IJmuiden Ver zone (Alpha and Beta sites each with 2 GW), sited 62 km off the Dutch coast, west of the Hollandse Kust Noord site which lies 18.5 km off the coast. A third site in the same zone (Gamma) will be covered by a tender for 2 GW by 2025. The wind farms planned for these sites should be completed in 2029 and 2030, making this 6-GW capacity zone Europe's biggest wind energy production area. While offshore wind energy will play the biggest role, the country is pursuing the development of onshore wind energy. In fact, the Netherlands allocated 387 MW of onshore wind energy capacity under the framework of its SDE++ scheme in 2023. Most of the projects were allocated at a strike price of about € 60/MWh, supported by a floating Feed-in-Premium allocated for a 15-year term.

SWEDEN PLUMPS FOR ONSHORE WIND ENERGY

According to Statistics Sweden, the country connected just under 2 GW (1 858 MW) of capacity to the grid in 2023, which is the third highest amount in the European Union. The country is in fact the leading country for wind power per capita in the European Union (1,533.4 kW/1,000 inhab.) ahead of Finland and Denmark (Graph 2). This on-grid capacity minus the decommissioned capacity (2 MW) takes the total capacity in service to 16 134 MW (including 193 MW of offshore capacity). Like the Netherlands, Sweden has sharply increased its installed wind energy capacity in the space of a few years but has focused its investments on onshore capacity. It has in fact connected as much as 6.2 GW in three years, at an annual installation pace of about 2 GW since 2021. Only Germany can claim to have outdone this in the same period, but the difference is that Sweden has a population of just over 10.5 million, whereas Germany's population was 84.7 million at the end of 2023. Sweden's installation pace is likely to slacken in the next few years. The Swedish Wind Energy Association (SWEA) states that on 1 January 2024, 2 769 MW of capacity was under construction for projects due to be commissioned in 2024, 2025 and 2026. SWEA also believes that as early as 2025, wind energy could become the country's second largest electricity generator, outstripping nuclear energy. Its output could reach 55 TWh as soon as 2026, covering 28% of its electricity production. The Swedish Energy Agency's accumulated installed capacity forecasts are for 23.5 GW at the end of 2030 and 40.2 GW at the end of 2050.

Table No. 3

Examples of European wind farm developpers and operators in 2023

	Country	Wind capacity operated in 2023*
Iberdrola	Spain	20 883 MW onshore 1 793 MW offshore
Enel	Italy	17 006 MW (3 776 MW in Europe)
EDP renewables	Portugal	12 985 MW onshore (5 070 MW in Europe) 322 MW offshore (322 MW in Europe)
ENGIE	France	Capacity installed: 14 347 MW onshore (6 845 MW in Europe) and 1 462 MW offshore (1 462 MW in Europe)
Orsted	Denmark	4 785 MW onshore (6 407 MW installed. decided and contracted) 8 872 MW offshore (19 221 MW installed. decided and awarded)
RWE	Germany	8 411 MW onshore 3 515 MW offshore
ACCIONA	Spain	9 387 MW (5 089 MW in Europe)
EDF renewables	France	8.4 GW**
Vattenfall	Sweden	1 968 MW onshore 3 387 MW offshore
TotalEnergies	France	5.5 GW onshore (1.7 GW in Europe) 1.4 GW offshore (1.1 GW in Europe)

** Worldwide activity. ** 12.8 GW net capacities capacities (wind offshore, wind onshore, solar and storage) in the world at the end of 2023, of which 66 % wind power.*
Source: EurObserv'ER 2024 based on diverse sources (2023 annual reports, corporate websites).


THIBAULT MAÎTREJEAN / KALLISTA ENERGY

In 2021, Kallista Energy repowered the Trébry Wind Farm, in the Côtes d'Armor, which has been operating since 2005.

RECOVERY UNDERWAY FOR EUROPE'S WIND TURBINE MAKERS

As the March 2024 Rystad Energy "Our Wind, Our Value" report produced in conjunction with WindEurope notes, Europe has one of the world's largest wind energy component manufacturing capacities. The continent has an interconnected supply chain, in that the European Union's free exchange agreement facilitates the circulation of goods across its Member States' borders. The most significant European countries in the wind energy supply chain are Germany, Spain and Denmark, which are all major players producing the main components: blades, nacelles and towers. France has become a key player in recent years, with new blade and nacelle factories. The main producers of offshore wind turbine foundations are the Netherlands, Germany and Denmark. This report has a map showing the locations of the production sites along the value chain.

Nonetheless until recently, the industrial situation was particularly tough on the turbine makers. For several years Europe's manufacturers were plagued with financial difficulties, because of empty order books and more to the point, low profit margins. Spiralling inflation arising from the hike in energy prices, raw materials prices and the war in Ukraine made 2022 a particularly difficult year. The situation was so worrying that warnings were given to Europe's policy makers and institutions to the effect that Europe's industry was no longer in a financial position to increase its production capacity to meet the EU decarbonation requirements and targets. An upshot of this situation was that turbine manufacturers resorted more heavily to outsourcing the manufacture of key turbine components to countries outside the European Union, even if that entailed reducing the activity of EU production facilities. According to the Rystad Energy report, turbine-related imports to the European Union increased sharply in recent years, rising to about 6.4 billion dollars in 2022 whereas they were below 2.5 billion dollars in 2018 and about 3.5 billion in 2020. The report points out that the main exporter towards the EU in commercial value terms was China, which contributed an average of over 50% of the value of imports between 2018 and 2022. India, Turkey and the USA are the other major turbine component exporters to the EU. There was a slight, 11% drop in the value of imports in 2023 through lower Chinese and Indian imports and an increase in imports from Turkey. It is this weakening of the European value chain in the face of the Chinese wind turbine industry's boom, bankrolled by the Chinese State, that prompted the European authorities to intervene to get the wind turbine industry back on track.
Having ridden out a difficult period, Europe's turbine makers seem to have turned the corner, as orders from Europe and across the world pick up and new investments are made in Europe's supply chain. The situation is much brighter for Vestas for example, which having made an eye-watering loss in 2022, returned to profitability in 2023. The 2023 Vestas annual report, shows that it posted a € 15.4 bn of sales in 2023, up from € 14.5 bn in 2022, and made a positive net profit of € 78 M, having made a 1 572 million euro loss in 2022. Vestas puts this recovery down to a sharp rise in firm orders, primarily from the United States onshore segment, and also from Europe, the Middle East, Africa and Brazil. Orders on hand rose to 21 GW for onshore with 15.3 GW placed in 2023 (10.5 GW in 2022) and 4.3 GW for offshore with 3.1 GW placed in offshore (0.6 GW in 2022). The Danish group's core business is the onshore segment with sales worth 10.7 billion euros compared to 1.1 billion for the offshore segment and 3.6 billion for its services and maintenance business. Vestas expects 2024 sales to be in the 16–18 billion euro bracket. One uplifting news item is that in 2023, the final investment decision was made on Poland's first commercial

offshore wind farm, the 1.2-GW Baltic Power project. This project will kick off Poland's offshore wind energy development plans through to 2040, when it expects to have 18 GW of capacity installed. The manufacturers are scrambling to set up facilities in Poland. Vestas announced its intention to construct a new blade manufacturing plant at Szczecin for its flagship V236-15.0 MW offshore wind turbine, in addition to its nacelle assembly site in Europe, which will create 1 700 direct jobs by 2026.

It will take Siemens-Gamesa, the wind turbine branch of Siemens Energy a little longer to return to profitability because of quality issues detected in some of the manufacturer's machine pools. To put this into context, Siemens Energy, which in 2022 fully bought out its subsidiary facing financial difficulty (to the tune of 4 billion euros) before delisting it, announced in June 2023 that it had identified major quality problems on the components (mainly rotor bearings and blades) of some of its onshore wind turbines on its 4X and 5X platforms, compounded by unspecified design concerns. Siemens Energy at the time stated that potentially 15–30% of its pool could be affected by these issues. These revelations cost the company about a third of its market value and cast doubt on Siemens Energy's wind turbine activities. In November 2023, Siemens Energy having triggered an annual 4.6 billion euro loss for the group on its non-calendar fiscal year 2022/2023, primarily attributable to its wind turbine subsidiary, secured a 12 billion euro credit line supported for up to 7.5 billion euros by the German government. This relieved the group's investors of their main concerns that it would lose business without these funds. At the time, Siemens Energy declared that it had drawn up a plan to ensure that its stricken wind turbine unit would break even by FY 2026 and then return to profitability. This should be made easier to achieve by the very sharp rise in the numbers of orders placed in the offshore segment, which is one of the German turbine maker's particular strengths. WindEurope considers that offshore wind energy investments in Europe (including the UK) have reached a new record. A total of 30 billion euros has been raised in eight wind farms, compared to 0.4 billion euros in 2022. The sum will cover the financing of 9 GW of new offshore capacities.

NEW GAME PLAN FOR THE EUROPEAN MARKET

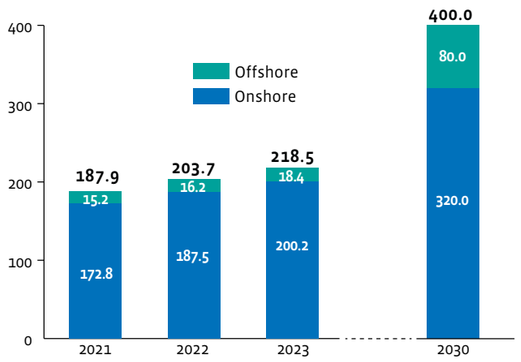
Europe's wind industry will at last have the wherewithal to face off the Chinese industrialists' designs on the European continent. The European Commission has taken this issue to heart following repeated warnings made by the wind industry. On 23 October 2023, it presented an EU Wind Action Plan to guarantee that the transition to clean energy would go hand-in-hand with the industrial competitivity of Europe's players. The purpose of this action plan is to maintain a healthy and competitive wind energy supply chain, with a clear and secure pipeline of projects attracting the necessary financing and competing on a level playing field globally. It defines 15 measures to be rolled out immediately, building on existing policies and legislation. They are structured into six key areas: (i) acceleration of deployment through increased predictability and faster permitting, (ii) improved auction design, (iii) access to finance, facilitated notably through the Innovation Fund, (iv) the creation of a fair and competitive international environment, (v) skills development primarily through the creation of European net-zero industry skills academies, including one dedicated to the wind sector, (vi) industry engagement and Member States commitments. The latter entails producing a European wind charter to improve the conditions for enabling the European wind industry to remain competitive. The European Wind Charter was signed in December 2023 by 26 Member States (Hungary was the only country to desist) and 300 wind energy companies. The European Wind Action Plan also called on Member States to pledge to specific, tangible (but not legally binding) commitments on wind energy deployment volumes covering at least 2024–2026, providing a clear and credible overview of this deployment over the next few years, to be formalised at the end of 2024. Following the Commission's call, 21 Member States pledged their commitment for a total of 55 GW of new wind energy capacity by the end of 2026.

This plan is supported by a Communication entitled "Delivering on the EU offshore renewable energy ambitions", which follows on from the Offshore Renewable Energy Strategy published three years ago and that aims to fast-track the development of offshore wind energy. The Communication's conclusion emphasises that since the Offshore Renewable Energy Strategy was adopted in November 2020, the war in Ukraine and the REPowerEU plan drawn up to deal with its consequences, have underlined the importance of accelerating the rollout of offshore renewable energies. The Communication signals that just over a year ago, in January 2023, the Member States agreed on new non-binding targets for offshore renewable energy production by 2050, with interim targets for 2030 and 2040 in five EU offshore basins, on the basis of the Offshore Renewable Energy Strategy and the TEN-E Regulation. The level of installed capacity ambition set by the new targets is higher than that envisaged by the strategy. As a result, the 2030 timeline targets are almost twice as high as the 61 GW set in the Offshore Renewable Energy Strategy (60 GW of offshore and 1 GW of marine energy). The new overall ambition is to install about 111 GW of offshore renewable energy production capacity by the end of 2030, 232 GW by the end of 2040 and to raise it to about 317 GW by the middle of the century. The Ostende North Sea summit in April 2023 increased the ambition level further, by raising the North Sea basin target up to at least 300 GW by 2050.

Early in February 2024, the European Parliament and Council came to an agreement over a compromise document on the Net-Zero Industry Act (NZIA), the new European legislation promoting clean technologies and green jobs, that naturally includes onshore and offshore wind energy with an ambitious annual wind turbine manufacturing target of 36 GW in Europe. This regulation is the European Union's response to unfair competition strategies adopted by other economic areas such as the USA's Inflation Reduction Act, but also and more to the point, China's extremely aggressive industrial policy regarding wind turbine components. We should point out that the European manufacturers that have production plants on American soil or that invest in the USA, take advantage of the American aid and protectionism in that market. Vestas has already invested over a billion dollars to set up several manufacturing facilities in Colorado to serve North America's onshore wind energy market. It has two manufacturing plants at Brighton and Windsor, Colorado, that specialise in blades and nacelles, with components primarily intended for the US market, but also the Mexican, Brazilian and Uruguayan markets. So, these players find developing the American market to be profitable. The Net-Zero Industry Act also changes the rules for tendering. Now, when a Member State proposes an auction for the rollout of renewable energy technologies, it can apply non price-only prequalification and award criteria, such as environmental sustainability, contribution to innovation, the integration of energy systems and cybersecurity. These criteria must be applied to at least 30% of each Member State's annual auction volume. The sector's experts feel that the criteria could be designed so that European rather than foreign manufacturers are at an advantage. In the past, European Union rules on national subsidies already enabled up to 30% non price-related criteria to be included in renewable energy auctions, as part of the European legislation on state aid, but this was optional. The NZIA also stipulates fast permit-granting procedures. The maximum time limit for issuing a permit for constructing or expanding large (>1 GW) net-zero technology manufacturing projects, and those not measured in gigawatts, will be 18 months. The deadline for issuing permits for small projects (<1 GW), will be 12 months. The conditions seem to be ripe for getting the European wind sector back on track and for giving Europe's players growth opportunities, at least until China's turbine and component manufacturers react. □

Graph No. 3

EurObserv'ER projection of the evolution of wind power net capacity in the EU 27 (in GW)



Note: Data is rounded to the nearest decimal. ***Source: EurObserv'ER 2024***

Sources: UBA and AGEE-Stat (Germany), Ministry for the Ecological Transition and the Demographic challenge (Spain), SDES (France), RTE (France), Terna (Italy), Statistics Netherland, ENS (Denmark), URE and PSE i ARE (Poland), DGEG (Portugal), SPF Economie (Belgium), CRES (Greece), EIRGRID (Ireland), Statistics Austria, Statistics Finland, Statistics Sweden, Hops (Croatia), Litgrid (Lithuania), Ministry of Industry and Trade (Czechia), MAVIR (Hungary), STATEC (Luxembourg), INSSEE (Romania), Elering (Estonia), ATS (Latvia), WindEurope.

The next barometer will cover photovoltaics.

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