

Status of Onshore Wind Energy Development in Germany

Year 2025



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Notes

The analysis within the scope of the Status of Onshore Wind Energy Development is based on the data of the core energy market data register (German: Marktstammdatenregister or MaStR) of the Federal Network Agency (German: Bundesnetzagentur or BNetzA) as well as on the announcements of the BNetzA regarding the tenders for onshore wind energy. The data was partially validated and corrected with regard to various details and supplemented with unrecorded dismantling and repowering properties of projects. Only wind turbines with an installed capacity of over 100 kW are included in the analysis.

The publication of the Status of Onshore Wind Energy Development takes place before the reporting deadline for commissioning in the year 2025. Further reports increasing the quantity added and decommissioned as well as permits are possible. Furthermore, changes or subsequent reporting of existing turbines to the MaStR may result in deviations from the cumulative portfolio shown.

Some of the figures in the text and illustrations are rounded values. Their addition may therefore result in slight deviations from the total values.

Photo on Title Page

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Publication Date

January 28, 2026

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Wind Energy Development and Status

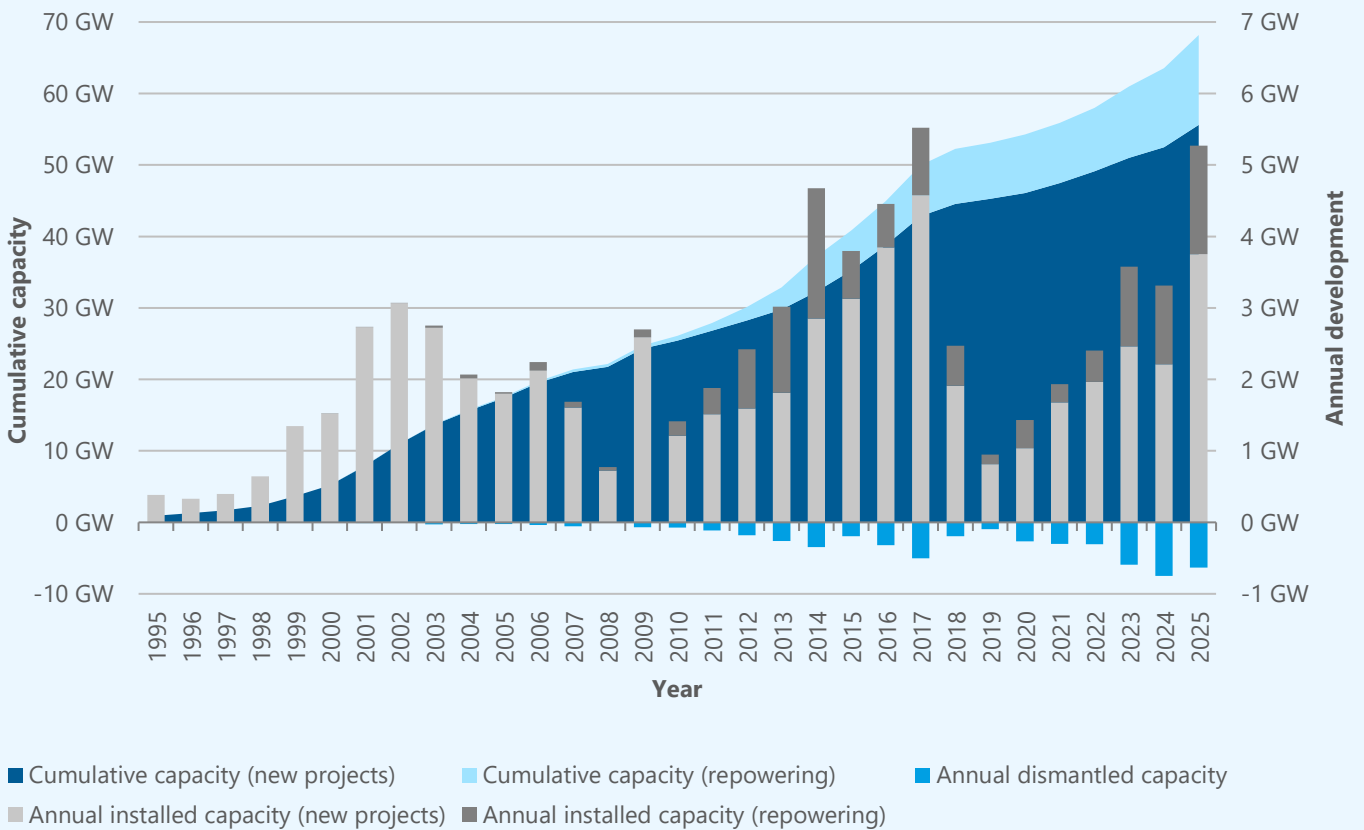
In 2025, a total of 965 new onshore wind turbines (WT) were commissioned in Germany, with a combined installed capacity of 5,269 MW. Compared with the previous year, this represents an increase in additions of 59%. As a result, 2025 ranks as the second-strongest year for onshore wind expansion in Germany, surpassed only by the record year 2017.

During the same period, 452 WT with a total capacity of 633 MW were decommissioned. Overall, this results in a net addition of 513 turbines and 4,636 MW in 2025.

Due to the strong expansion in 2025, the cumulative total portfolio at year-end amounts to 29,190 WT with a total installed capacity of 68.2 GW. Compared with 2024, cumulative capacity thus increased by around 7%, while the total number of installed turbines rose by 2%.

Status of onshore wind energy development

		Capacity	Turbines
Cumulative 2024-12-31	Cumulative 2024	63,541 MW	28,677 WT
	Development Year 2025		
Development Year 2025	Gross installations	5,269 MW	965 WT
	Repowering share	1,515 MW	274 WT
	Decommissioning	633 MW	452 WT
	Net installations	4,636 MW	513 WT
Cumulative 2025-12-31	Cumulative Year 2025	68,177 MW	29,190 WT



Annual development onshore wind energy capacity in Germany

Decommissioning, Continued Operation and Repowering

Over the course of 2025, 452 WT with a total capacity of 633 MW were decommissioned in Germany. The average operating lifetime of the decommissioned turbines was 23 years. A substantial share of these decommissions is associated with the replacement of older turbines by modern, higher-capacity wind turbines – so called repowering.

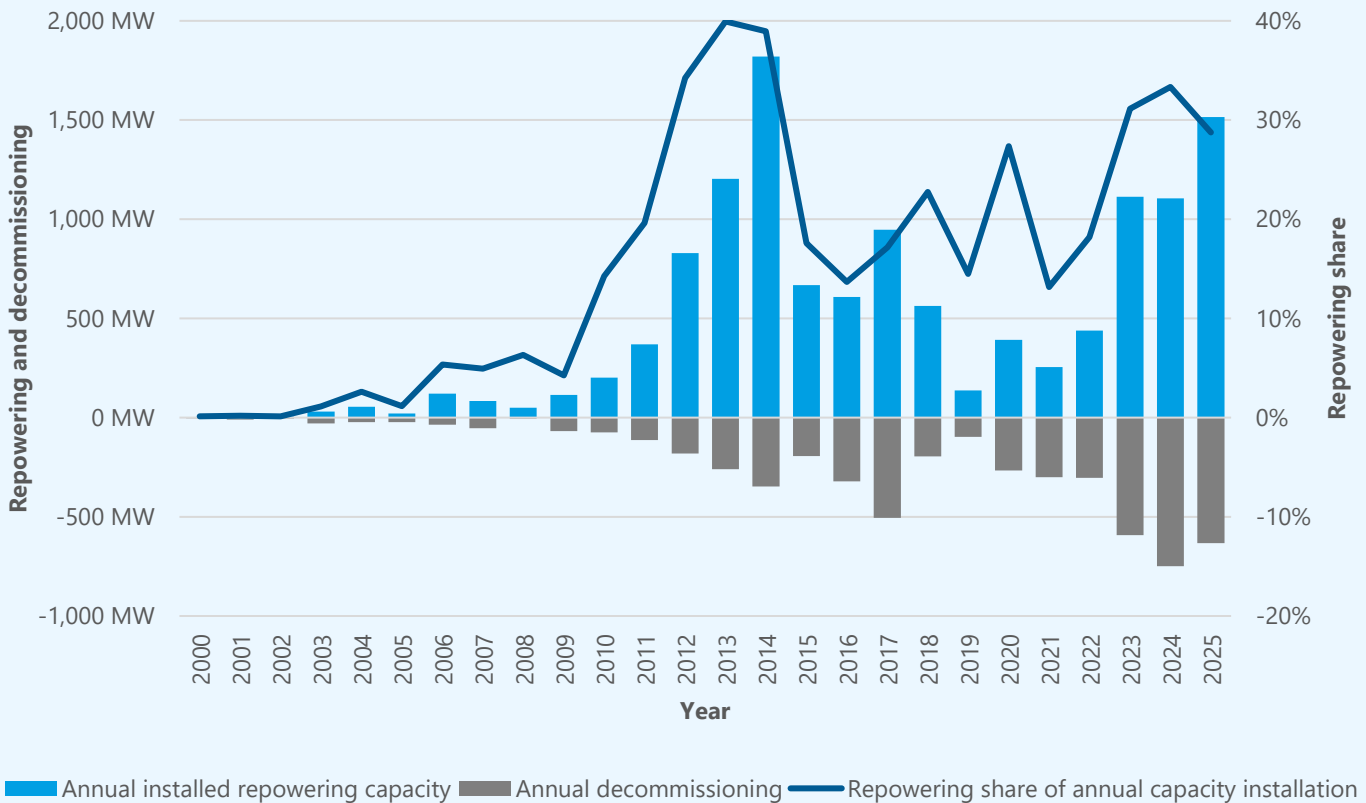
In total, around 1.5 GW of new capacity was installed as part of repowering projects, corresponding to approximately 29% of the capacity added in 2025. Compared with the previous year, repowering capacity increased by around 37% in 2025, although its share of total additions declined.

After an operating period of 20 years, existing turbines lose their entitlement to EEG support. In 2025, 9,411 WT with a total capacity of around 11.1 GW continued operation without subsidies. By 2030, a further 8.7 GW will gradually lose the

claim for a market premium, unless decommissioning takes place beforehand.

Age of dismantled and operating wind turbines

Age	Decommissioning Year 2025		Cumulative 2025-12-31	
	Capacity	Turbines	Capacity	Turbines
>20 Years, no funding claim (COD ≤ 2004)	461 MW	376 WT	11,088 MW	9,411 WT
15 - 20 Years (COD 2005 - 2009)	135 MW	62 WT	8,714 MW	4,684 WT
10 - 15 Years (COD 2010 - 2014)	32 MW	12 WT	13,277 MW	5,426 WT
5 - 10 Years (COD 2015 - 2019)	6 MW	2 WT	17,178 MW	5,852 WT
0 - 5 Years (COD 2020 - 2025)	0 MW	0 WT	17,921 MW	3,817 WT
Total	633 MW	452 WT	68,177 MW	29,190 WT



Development of annual decommissioning, annual installed repowering capacity and repowering share

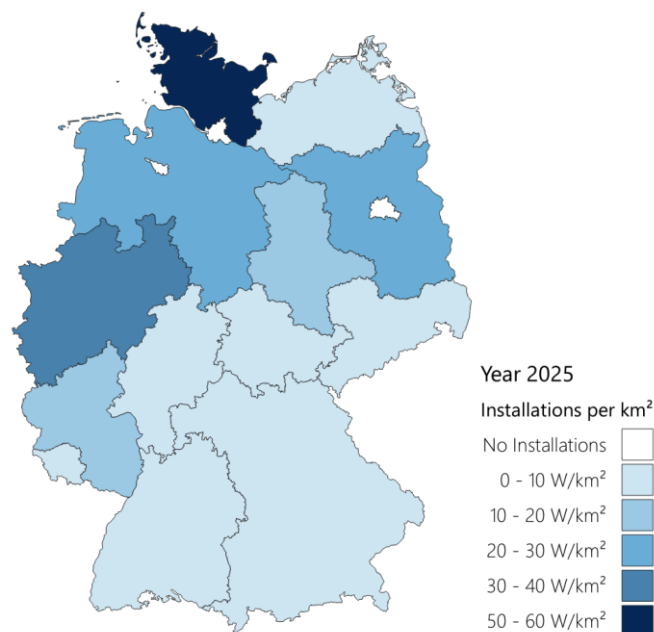
Regional Distribution of Wind Energy Installation

In a comparison across federal states, North Rhine-Westphalia once again ranked first in 2025 in terms of gross additions, with 1,358 MW, maintaining its leading position from the previous year. Lower Saxony followed in second place with 1,156 MW. Together, the two federal states account for just under half of total gross additions in 2025.

With a clear gap to the two leading federal states, Schleswig-Holstein and Brandenburg ranked third and fourth, adding 802 MW and 636 MW, respectively. Together, they contributed around a further quarter of gross additions in 2025. In terms of additions per km² of state area, however, Schleswig-Holstein even outperformed the two leading federal states.

The remaining federal states together accounted for the final quarter and thus made only a comparatively smaller contribution to gross additions. By the end of 2025, only the three city states remained without new installations. Due to

some decommissionings, Hamburg and Bremen even show a negative net installation.



Base map: © GeoBasis-DE / BKG 2022 | Database: MaStR with own modifications
Source: Deutsche WindGuard

Regional distribution of gross capacity installation

Gross installation, dismantling, net installation and repowering in German federal states

Year 2025		Gross installations			Dismantling and net installation			Repowering		
Position	Federal state	Capacity Instal- lation	Number of new turbines	Share*	Capacity Dis- mantling	Number of dismantled turbines	Net Instal- lation	Capacity Repo- wering	Number of repo- wering turbines	Repo- wering- share**
1	North Rhine-Westphalia	1,358 MW	262 WT	26%	60 MW	50 WT	1,298 MW	285 MW	55 WT	21%
2	Lower Saxony	1,156 MW	209 WT	22%	144 MW	91 WT	1,012 MW	450 MW	80 WT	39%
3	Schleswig-Holstein	802 MW	146 WT	15%	122 MW	77 WT	680 MW	205 MW	37 WT	26%
4	Brandenburg	636 MW	110 WT	12%	79 MW	50 WT	557 MW	112 MW	20 WT	18%
5	Saxony-Anhalt	331 MW	56 WT	6%	62 MW	42 WT	269 MW	270 MW	46 WT	82%
6	Rhineland-Palatinate	226 MW	41 WT	4%	60 MW	36 WT	166 MW	105 MW	19 WT	46%
7	Baden-Württemberg	188 MW	36 WT	4%	16 MW	12 WT	172 MW	4 MW	1 WT	2%
8	Mecklenburg-Western Pomerania	167 MW	29 WT	3%	36 MW	45 WT	131 MW	0 MW	0 WT	0%
9	Hesse	160 MW	28 WT	3%	7 MW	11 WT	153 MW	28 MW	5 WT	17%
10	Bavaria	82 MW	17 WT	2%	0 MW	0 WT	82 MW	6 MW	1 WT	7%
11	Thuringia	76 MW	14 WT	1%	29 MW	20 WT	47 MW	12 MW	2 WT	16%
12	Saxony	70 MW	14 WT	1%	8 MW	7 WT	63 MW	38 MW	8 WT	54%
13	Saarland	17 MW	3 WT	0%	5 MW	3 WT	12 MW	0 MW	0 WT	0%
14	Berlin	0 MW	0 WT	0%	0 MW	0 WT	0 MW	0 MW	0 WT	-
15	Hamburg	0 MW	0 WT	0%	3 MW	6 WT	-3 MW	0 MW	0 WT	-
16	Bremen	0 MW	0 WT	0%	4 MW	2 WT	-4 MW	0 MW	0 WT	-
	Germany	5,269 MW	965 WT		633 MW	452 WT	4,636 MW	1,515 MW	274 WT	29%

* Share of gross capacity Installations per federal state in total gross capacity installation

** Share of repowering capacity per federal state in gross capacity installation per federal state

Average Turbine Configuration and Regional Differences

The wind turbines installed in 2025 had an average rated capacity of 5,460 kW and an average total height of 222 m. Compared with the average turbine configuration in 2024, rated capacity increased by 7%, while total height rose by 3%. This means that the trend towards more powerful and at the same time larger wind turbines continues.

On average, rotor diameter amounts to 151 m, while average hub height is 146 m. The average specific power is 305 W/m².

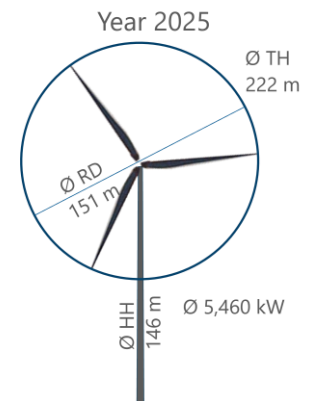
The average turbine capacity varies between federal states within a range of 4.9 to 5.9 MW. The lowest average capacities in 2025 were installed in Bavaria, while the most powerful new turbines on average were built in Saxony-Anhalt.

Regional differences are also evident in total height: In Schleswig-Holstein, newly installed

turbines, at an average of 183 m, continue to be significantly shorter than the federal average. The tallest turbines were realized in Saarland, with an average total height of 247 m.

Average wind turbine configuration

Installations Year 2025	Change compared to prior year
Rated power	+7%
Rotor Diameter	+4%
Hub Height	+2%
Tip Height	+3%
Specific Power	+1%



Average turbine configuration of newly installed wind turbines in German federal states

Installations 2025	State	Number of turbines	Average configuration of newly installed turbines				Specific Power
			Rated power	Rotor diameter	Hub height	Tip height	
	North Rhine-Westphalia	262 WT	5,184 kW	148 m	145 m	219 m	303 W/m ²
	Lower Saxony	209 WT	5,531 kW	153 m	146 m	223 m	303 W/m ²
	Schleswig-Holstein	146 WT	5,496 kW	146 m	110 m	183 m	327 W/m ²
	Brandenburg	110 WT	5,780 kW	155 m	158 m	236 m	307 W/m ²
	Saxony-Anhalt	56 WT	5,908 kW	155 m	165 m	242 m	311 W/m ²
	Rhineland-Palatinate	41 WT	5,500 kW	157 m	162 m	240 m	282 W/m ²
	Baden-Württemberg	36 WT	5,208 kW	155 m	161 m	238 m	275 W/m ²
	Mecklenburg-Western Pomerania	29 WT	5,763 kW	156 m	163 m	241 m	304 W/m ²
	Hesse	28 WT	5,718 kW	156 m	166 m	244 m	301 W/m ²
	Bavaria	17 WT	4,852 kW	147 m	163 m	236 m	283 W/m ²
	Thuringia	14 WT	5,414 kW	154 m	167 m	244 m	290 W/m ²
	Saxony	14 WT	5,026 kW	149 m	165 m	240 m	286 W/m ²
	Saarland	3 WT	5,600 kW	162 m	166 m	247 m	272 W/m ²
	Bremen	0 WT	-	-	-	-	-
	Hamburg	0 WT	-	-	-	-	-
	Berlin	0 WT	-	-	-	-	-
Germany		965 WT	5,460 kW	151 m	146 m	222 m	305 W/m²

Turbine Manufacturers and Types

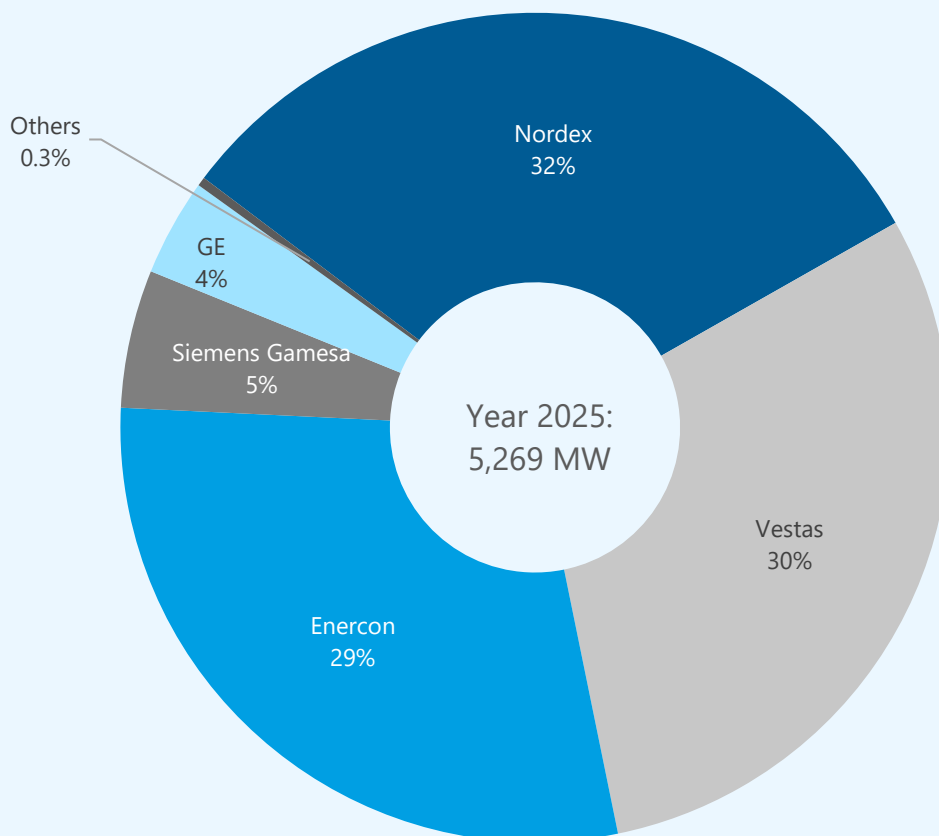
In 2025, capacity additions for onshore wind turbines in Germany were once again largely shaped by the three manufacturers Nordex, Vestas and Enercon, as in previous years. Together, they accounted for around 90% of total market additions. Nordex held the leading position with a share of 32%, closely followed by Vestas with 30% and Enercon with 29%. Siemens Gamesa followed at a considerable distance with a market share of 5%, and GE with 4%. Other manufacturers contributed less than one percent to total market volume.

Regarding the most frequently installed turbine types, only Nordex, Enercon and Vestas appear in the top ten. The most frequently installed turbine type in Germany in 2025 was the E-160 EP5 E3 by Enercon with a rated capacity of 5.56 MW, with a total of 127 units installed. Nordex N149/5.X

ranked second with 107 commissioned turbines. Nordex also took third place with the N163/6.X – 6.8 MW. Vestas V162-6.2 MW ranked fourth.

Most popular turbine types

Rank	Manufacturer	Type
1	Enercon	E-160 EP5 E3
2	Nordex	N149/5.X
3	Nordex	N163/6.X - 6,8 MW
4	Vestas	V162-6.2 MW
5	Enercon	E-138 EP3 E2 4,2 MW
6	Vestas	V162-6.0 MW
7	Enercon	E-138 EP3 E3 4,26 MW
8	Vestas	V150-6.0 MW
9	Vestas	V162-5.6 MW
10	Nordex	N163/5.X



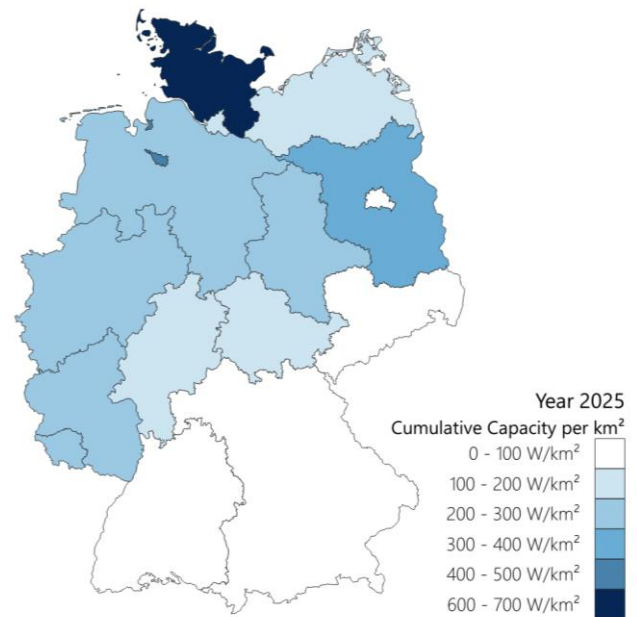
Manufacturers' market share of onshore capacity development in Germany

Regional Distribution of the Cumulative Portfolio

As of 31 December 2025, the cumulative total portfolio in Germany amounted to 29,190 WT with a total installed capacity of 68.2 GW. Almost half of total installed capacity is attributable to the three federal states of Lower Saxony with 21%, and Schleswig-Holstein and Brandenburg with 14% each.

The highest capacity density was achieved in Schleswig-Holstein at 610 kW/km², which is significantly above the level of the other federal states. Bremen also made a comparatively high contribution despite its small area, with a capacity density of 475 kW/km². Brandenburg followed with 322 kW/km².

The north-south disparity in the distribution of onshore wind capacity becomes clearly visible by the cumulative capacity per km² of state area. In Saxony, Baden-Württemberg, Bavaria and Berlin, capacity per km² was at a significantly lower level of less than 100 kW/km².



Base map: © GeoBasis-DE / BKG 2022 | Database: MaStR with own modifications
Source: Deutsche WindGuard

Regional distribution of cumulative capacity

Cumulative capacity and number of wind turbines in the German federal states

Cumulative portfolio* (2025-12-31)				
Federal state	Cumulative capacity	Cumulative number	Share	Capacity per area
Lower Saxony	13,977 MW	6,239 WT	21%	293 kW/km ²
Schleswig-Holstein	9,644 MW	3,313 WT	14%	610 kW/km ²
Brandenburg	9,555 MW	4,135 WT	14%	322 kW/km ²
North Rhine-Westphalia	9,095 MW	3,853 WT	13%	267 kW/km ²
Saxony-Anhalt	5,790 MW	2,747 WT	8%	283 kW/km ²
Rhineland-Palatinate	4,328 MW	1,790 WT	6%	218 kW/km ²
Mecklenburg-Western Pomerania	3,925 MW	1,826 WT	6%	168 kW/km ²
Hesse	2,799 MW	1,201 WT	4%	133 kW/km ²
Bavaria	2,759 MW	1,169 WT	4%	39 kW/km ²
Baden-Württemberg	2,071 MW	823 WT	3%	58 kW/km ²
Thuringia	1,902 MW	861 WT	3%	117 kW/km ²
Saxony	1,431 MW	863 WT	2%	78 kW/km ²
Saarland	565 MW	218 WT	1%	220 kW/km ²
Bremen	199 MW	85 WT	0%	475 kW/km ²
Hamburg	122 MW	61 WT	0%	161 kW/km ²
Berlin	17 MW	6 WT	0%	19 kW/km ²
Germany	68,177 MW	29,190 WT	100%	191 kW/km²

* with a minimum turbine capacity of > 100 kW

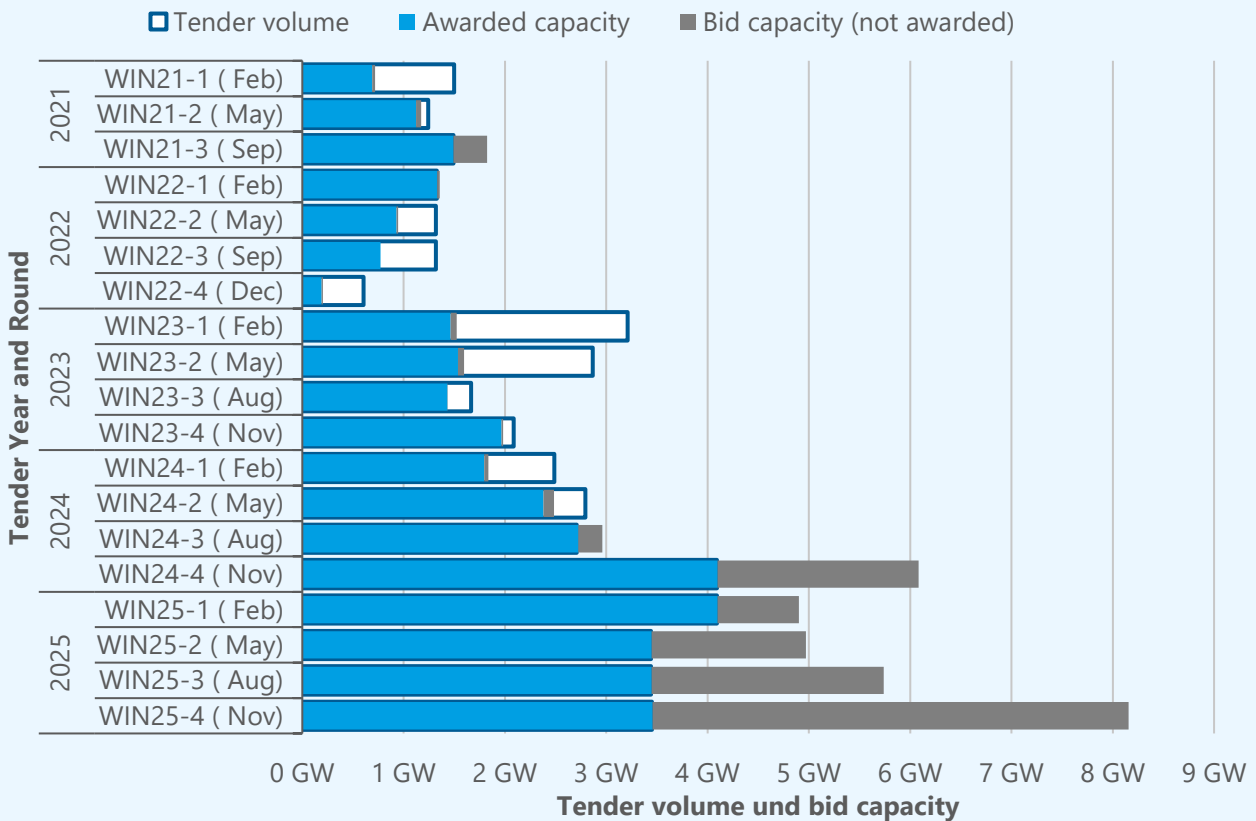
Results of Tender Rounds

In 2025, the Federal Network Agency (Bundesnetzagentur) conducted a total of four auction rounds for onshore wind energy to receive EEG support. The first auction round in February 2025, with an auction volume of around 4.1 GW, was larger than the subsequent rounds due to higher catch-up volumes from 2023. Overall, the capacity awarded across all four auction rounds in 2025 amounted to 14.5 GW. Although the largest volumes since the introduction of auctions were tendered in 2025, all rounds were oversubscribed for the first time since 2017. In February 2025, the bid surplus amounted to around 0.8 GW; in the May round it was around 1.5 GW, in August around 2.3 GW, and in November around 4.7 GW could not be awarded. The significantly increased interest in auctions for onshore wind turbines was also reflected in the award values. The average award value of the

auction rounds in 2025 amounted to 6.63 ct/kWh and was thus well below the level of the average award values of previous years, which had been strongly oriented towards the permissible maximum value.

Development of awarded bids of tender rounds for onshore wind energy in Germany (Database: BNetzA)

Year of tender	Permissible maximum value	Average capacity-weighted award value
2021	6.00 ct/kWh	5.88 ct/kWh
2022	5.88 ct/kWh	5.81 ct/kWh
2023	7.35 ct/kWh	7.33 ct/kWh
2024	7.35 ct/kWh	7.26 ct/kWh
2025	7.35 ct/kWh	6.63 ct/kWh



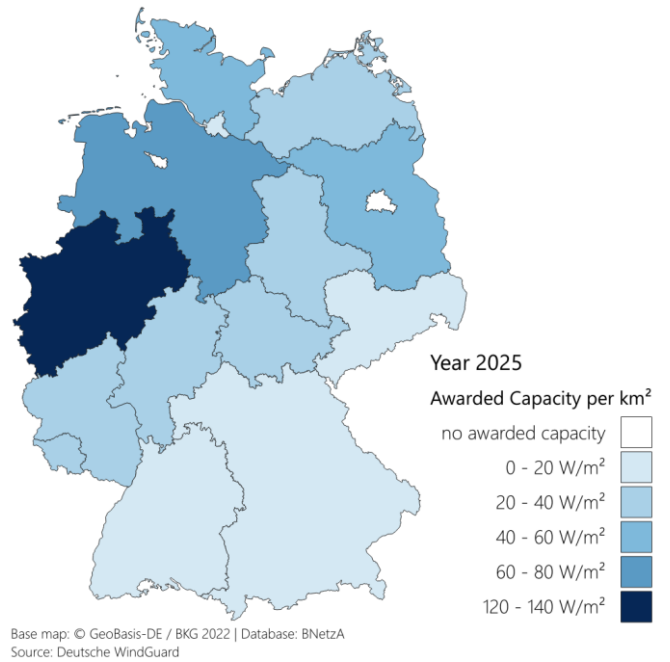
Competitive situation in tender system for onshore wind energy (Database: BNetzA)

Regional Distribution of Awarded Bids

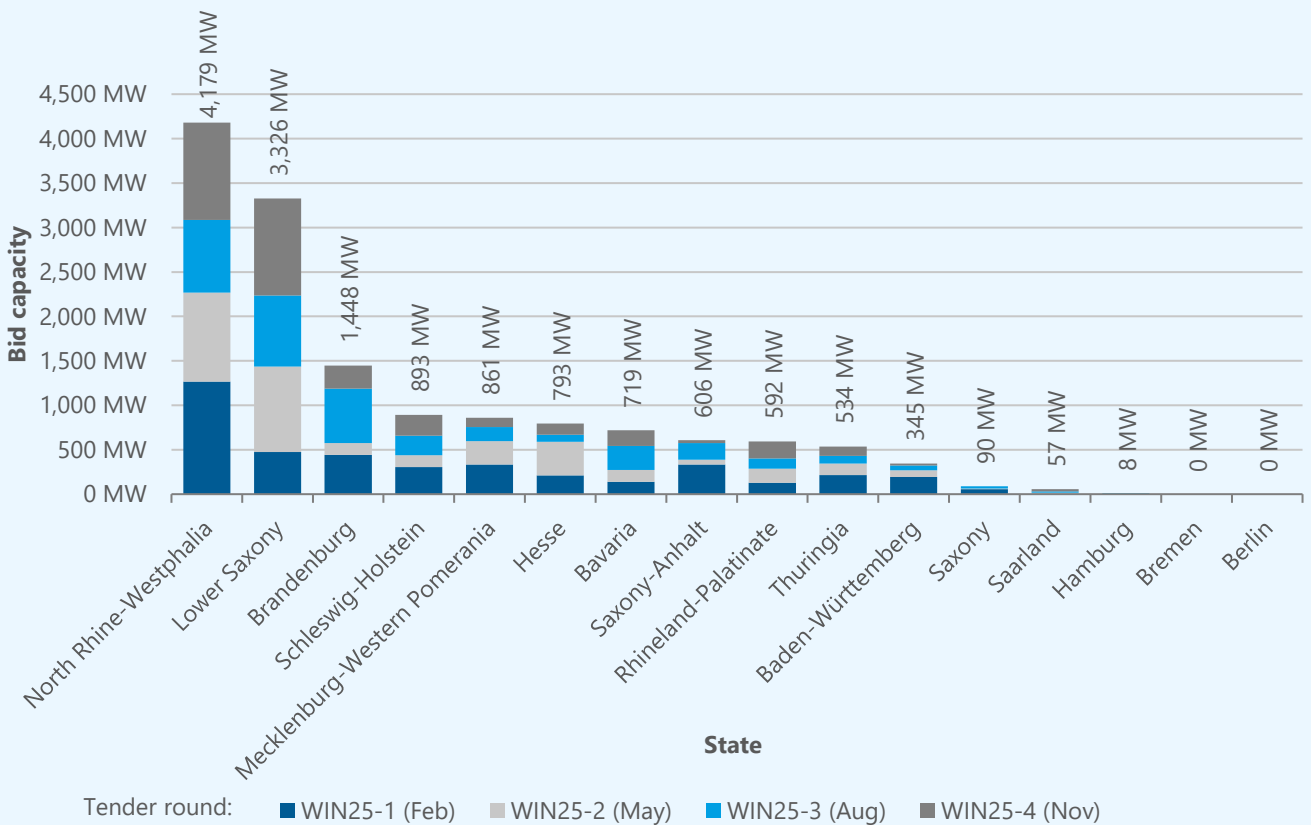
In 2025, wind turbines from almost all federal states received awards in at least one of the four auction rounds. Only Bremen and Berlin submitted no bids, and accordingly no awards were granted in these federal states.

North Rhine-Westphalia recorded the largest awarded volume at 4.2 GW, corresponding to around 29% of total awarded capacity for the year. In terms of awarded capacity per unit of state area, North Rhine-Westphalia also clearly leads compared with the other federal states.

Lower Saxony accounts for around 23% of awarded capacity, while Brandenburg, as the third strongest federal state, reaches a share of around 10%. In the remaining federal states, shares for 2025 are below 10%. Only small volumes of total awarded capacity were allocated to the southern federal states, meaning that the existing north-south disparity continues to persist.



Regional distribution of awarded capacity across the federal states (Database: BNetzA)



Regional distribution of awarded capacity across the German federal states (Database: BNetzA)

Development Status of Awarded Turbines

Since 2021, a total of 38.4 GW of onshore wind capacity has been awarded, of which around 12.4 GW has so far been commissioned. The deadline for the realization of the unused awards amounting to around 0.9 GW has already passed. Unless an extension has been granted, these awards expire and the respective projects may participate in the auctions again or have already secured a new award.

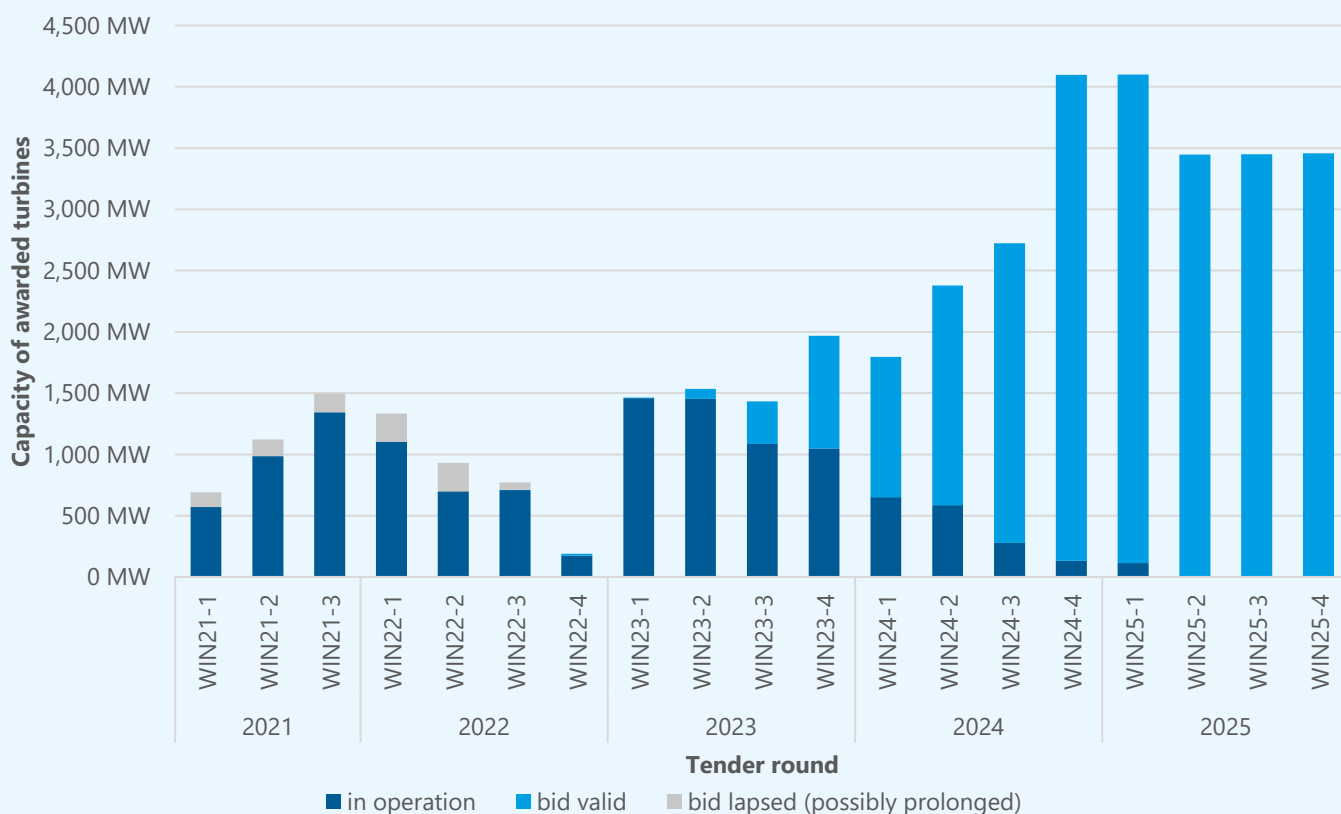
The regular realization period for the awards from 2021 and 2022 has expired. In 2021, 88% of the awarded capacity was realized. The realization rate for awards from 2022, at 83%, remains below the level of the previous year. Turbines awarded in 2023 must be implemented gradually by the end of 2026; so far, 79% of their capacity has been commissioned. Awards granted in 2024 have already been realized to 15%. Awards from 2025

are still at an early stage of implementation; accordingly, only a small share of these turbines has so far been commissioned. On average, the period between award and commissioning for turbines commissioned in 2025 was 21 months.

Realized capacity* of tenders for onshore wind energy in Germany

Year of tender	Realized capacity*	Realization rate
2021	2,899 MW	88%
2022	2,684 MW	83%
2023	5,046 MW	79%
2024	1,647 MW	15%
2025	114 MW	1%

* The evaluations represent an assessment of the development status based on an analysis of the MaStR and the awards issued by BNetzA. Deviations from actually allocated awards are possible. It was assumed that the award volume corresponds to the permitted/installed capacity.



Development status* of awarded capacity (Database: BNetzA, MaStR, own research and assumptions)

Permitted Capacity and Development Status

In 2025, a total of 3,265 WT with a combined capacity of around 20,5 GW were permitted. This marks a new record level, after the previous year (2024) had already significantly exceeded the previous highest approval volume from 2016 with 14,1 GW. Compared with 2024, approved capacity in 2025 increased by 45%.

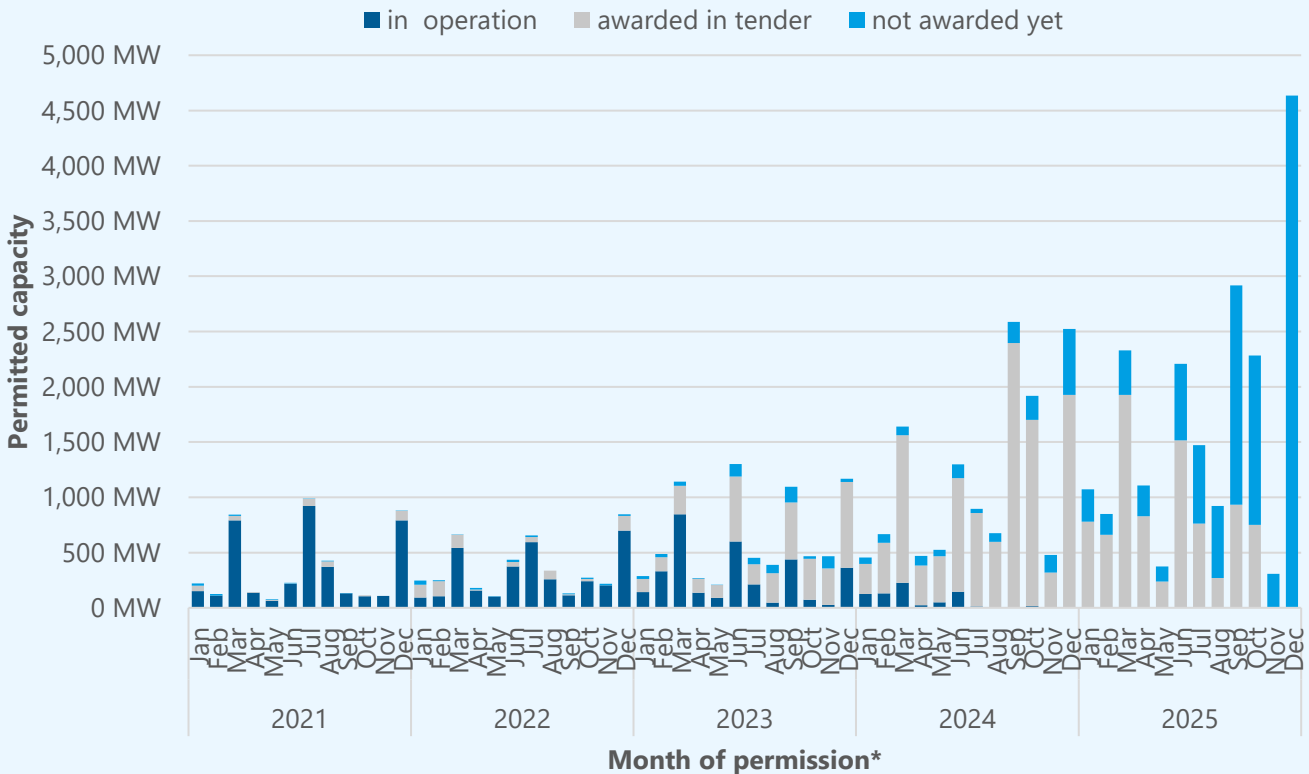
Wind turbines for which approvals were granted in 2021 and 2022 were in operation at year-end 2025 at rates of 91% and 80%, respectively. Of the capacity approved in 2023, 43% is already in operation. Only 5% of the capacity approved in 2024 is already feeding in, while only a few megawatts of the capacity approved in 2025 are already connected to the grid. The average period between approval and commissioning for turbines commissioned in 2025 was 29 months.

In total, 42% of the newly approved WT in 2025 have already received an award for EEG support.

Accordingly, 11,8 GW, including the 4,6 GW of capacity approved in December 2025, have not yet been awarded. In addition, further turbines with approvals from 2024 and earlier years are still without an award. For the auctions in 2026, a sufficient volume of approved capacity is already available, amounting to a total of 14,5 GW.

Annual permitted capacity

Year of permission	Permitted capacity	Permitted wind turbines
2021	4,291 MW	877 WT
2022	4,338 MW	831 WT
2023	7,735 MW	1,385 WT
2024	14,136 MW	2,383 WT
2025	20,480 MW	3,265 WT



* Permits with an updated permit date have been dated back to the date of the first registration in MaStR.

Monthly permitted capacity including status

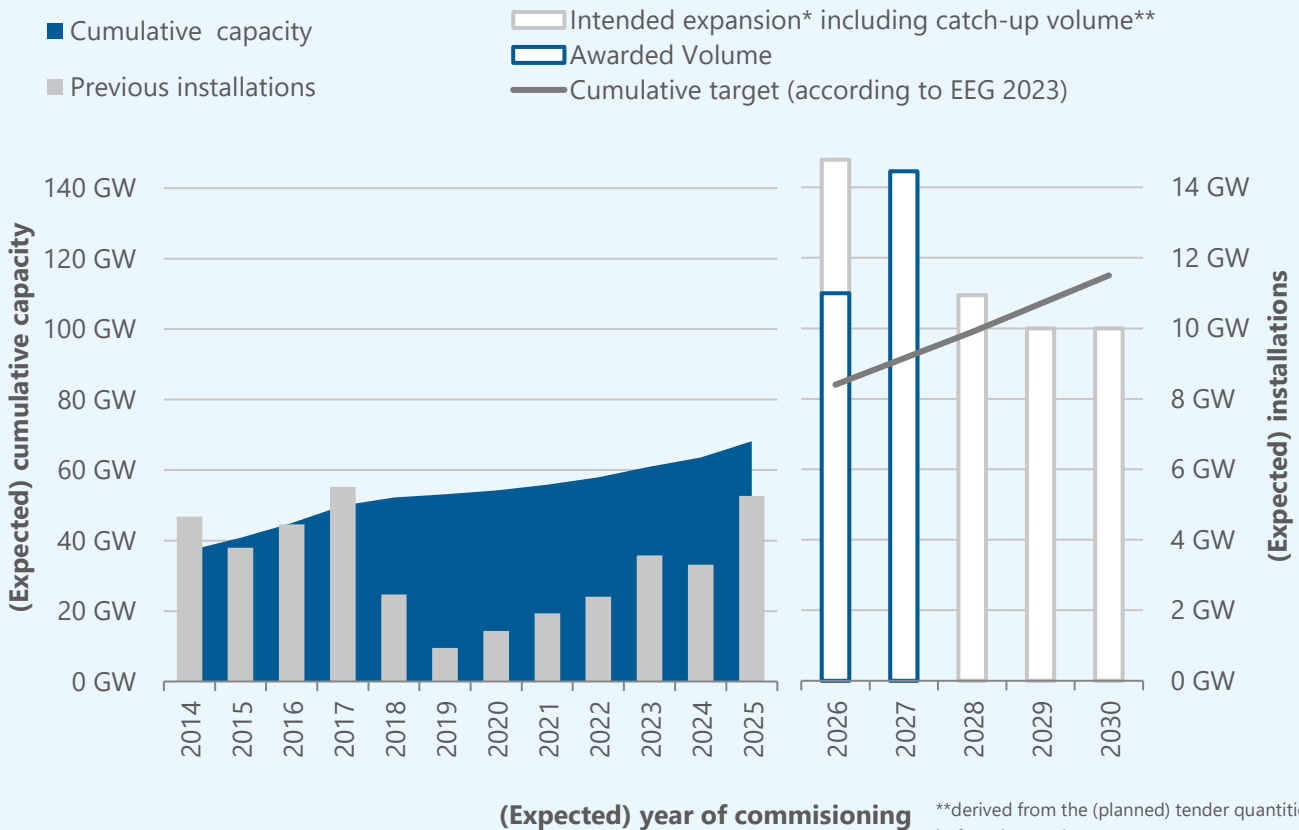
Political Target and Future Tender Rounds

The Renewable Energy Sources Act (EEG) defines the expansion targets for onshore wind energy in Germany. For the year 2024, achieving a cumulative installed capacity of 69 GW was envisaged. Due to significant undersubscription of auctions in previous years, only a cumulative total capacity of 68,2 GW was reached by the end of 2025. The next legally defined milestone provides for a total installed capacity of 84 GW in 2026. This results in a required net addition of around 15,8 GW by the end of 2026, which is unlikely to be achieved due to further undersubscription in 2024.

In the 2025 auction year, and thus for capacity additions scheduled for 2027, all planned volumes,

including catch-up volumes from previous years, were once again fully awarded for the first time. Sufficient approvals are also already available for the auctions in 2026. The planned auction volume of 10 GW has already been increased by almost 1 GW due to remaining catch-up volumes from 2024. Further adjustments may follow.

In the long term, the EEG 2023 provides for continuous expansion of onshore wind energy nationwide to 115 GW by 2030. By 2040, installed capacity is to increase further to 160 GW and be maintained at that level thereafter.



Expected installations in 2025 and political targets according to EEG 2021/23

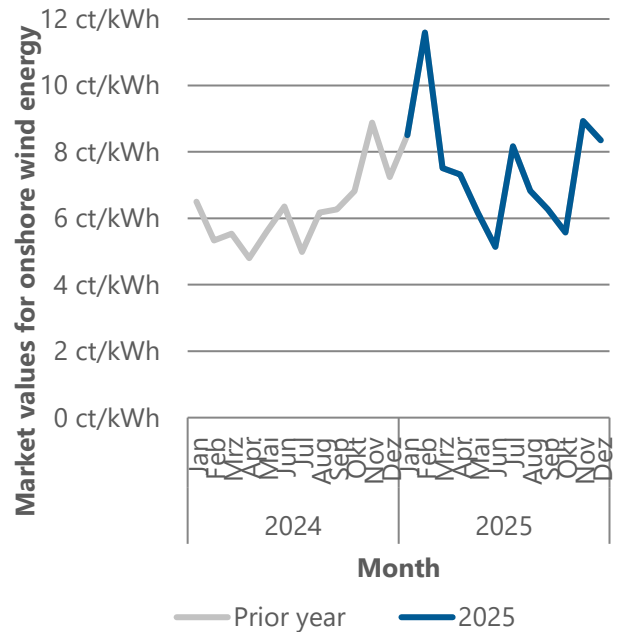
**derived from the (planned) tender quantities in the year before the previous year

**Tender volume corrected in accordance with § 28 EEG

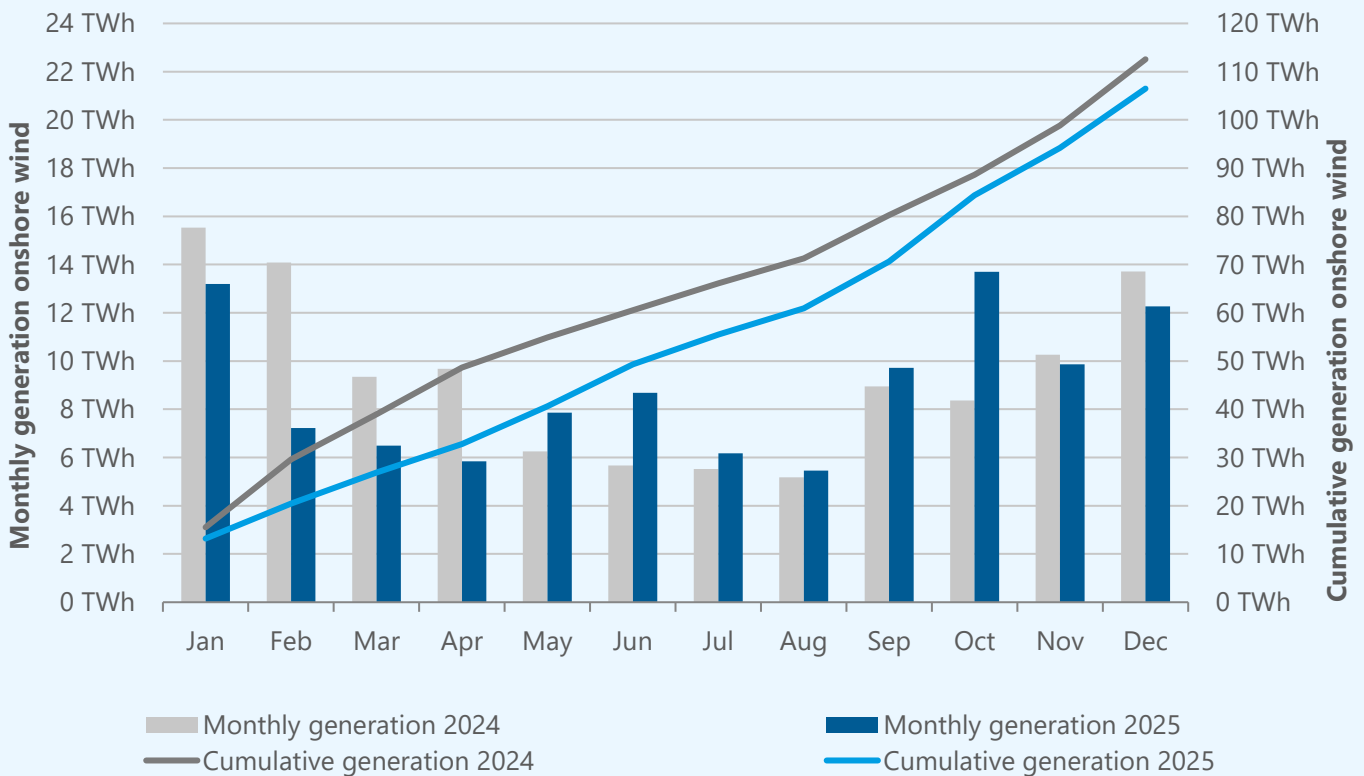
Power Generation and Market Values

In 2025, onshore wind turbines installed in Germany generated 106 TWh of electricity. Compared with the previous year, electricity generation was thus around 5% lower. This was due to a below-average windy spring; in particular, less electricity was generated in February, March and April than in the previous year. Nevertheless, onshore wind energy remained the most important energy source in electricity generation in Germany, accounting for 24%.

Over the course of 2025, average market values for onshore wind energy temporarily increased to 11,6 ct/kWh in February. Over the remainder of the year, monthly market values ranged between 5,1 ct/kWh (in June) and 8,9 ct/kWh (in November). The average annual market value for onshore wind in 2025 amounted to 7,44 ct/kWh and thus increased by 18% compared with the previous year.



Monthly market values for onshore wind energy (Database: Netztransparenz)



Power generation onshore wind (Database: Bundesnetzagentur | SMARD.de)

Deutsche WindGuard – The Wind Professionals

Deutsche WindGuard is one of the leading independent service providers in the wind energy industry worldwide. It offers comprehensive services and consulting along the entire value chain of a wind energy project. One key area of activity is advising federal and state governments on issues relating to onshore and offshore wind energy as well as preparing market, cost and value creation analyses for various associations and other stakeholders in the wind energy sector and politics. Further business activities include technical inspections and management, site assessment, measurements on wind turbines, wind tunnel measurements, offshore consulting and training as well as certification.

In the complex energy market, Deutsche WindGuard is committed to providing unbiased, manufacturer-independent consulting and comprehensive scientific, technical, and operational services.

Deutsche WindGuard was founded in 2000. With the headquarters in Varel and subsidiaries in Germany, the United States, China and India, it employs more than 220 experienced experts.