DEUTSCHE WINDGUARD

Status of Onshore Wind Energy Development in Germany

First Half of 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 first half of 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

Publication Date

July 18, 2025

Contact

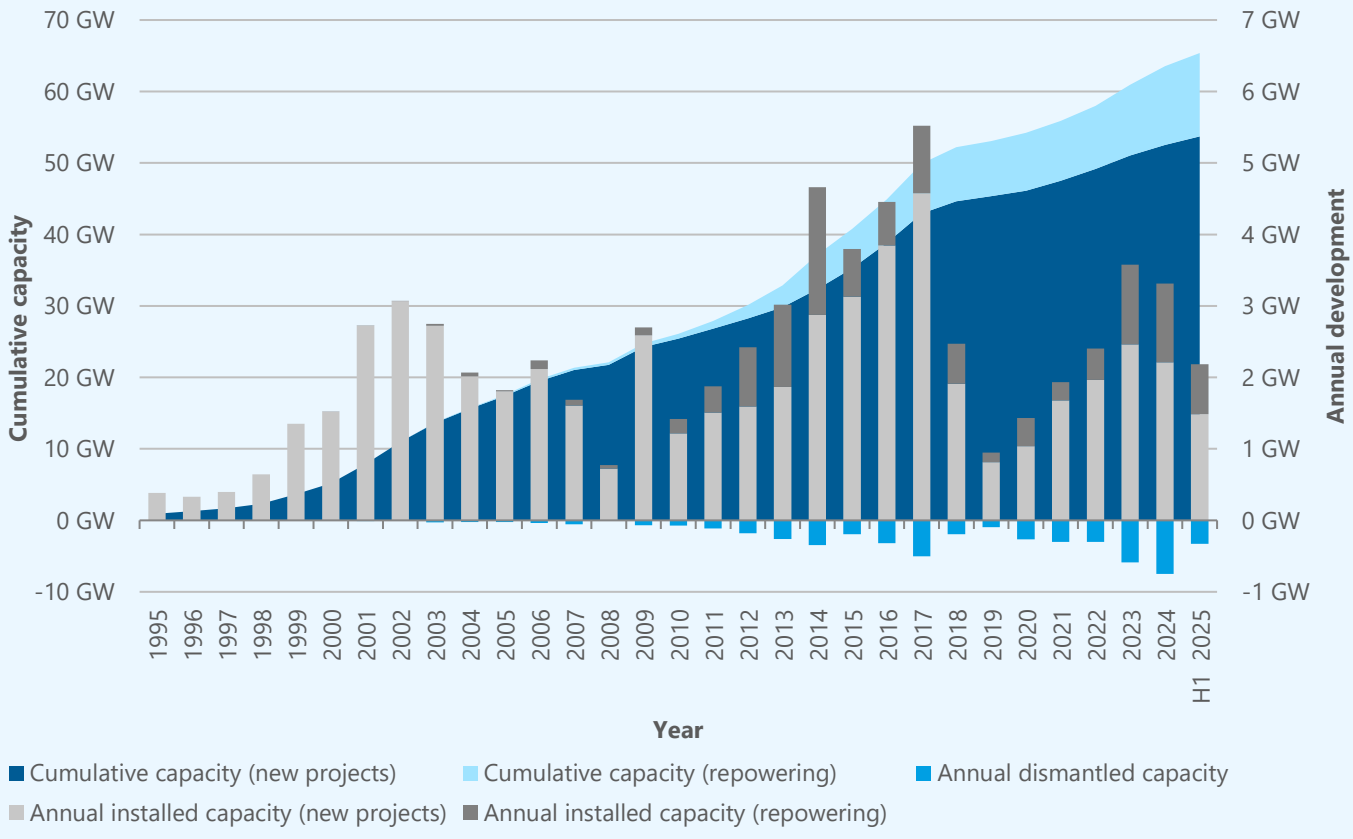
Deutsche WindGuard GmbH
Oldenburger Straße 65 A
26316 Varel, Germany
Phone +49 (4451) 9515-0
Fax +49 (4451) 9515-29
Email info@windguard.de
URL http://www.windguard.com/

Wind Energy Development and Status

In the first half of 2025, 406 new onshore wind turbines (WT) were commissioned in Germany. This corresponds to an increase in capacity of 2,186 MW. Compared to the first half of 2024, the gross installations have increased by around 66%. The new installations are offset by the dismantling of 210 wind turbines with a total capacity of 328 MW. This means that the number of decommissioned turbines in the first half of 2025 has fallen slightly compared to the first half of the previous year. The net increase in the first half of 2025 amounts to 196 wind turbines, or 1,859 MW. As of 30 June 2025, the cumulative total portfolio of wind turbines in Germany amounts to 28,879 wind turbines with a total capacity of 65,383 MW. Cumulative capacity has increased by around 2.9% so far this year. The total number of wind turbines installed has increased by 0.7%.

Status of onshore wind energy development

		Capacity	Turbines
Cumulative 2024-12-31	Cumulative 2024	63,525 MW	28,683 WT
Development H1 2025	Gross installations	2,186 MW	406 WT
	Repowering share	701 MW	125 WT
	Decommissioning	328 MW	210 WT
	Net installations	1,859 MW	196 WT
Cumulative 2025-06-30	Cumulative H1 2025	65,383 MW	28,879 WT



Annual development onshore wind energy capacity in Germany

Decommissioning, Continued Operation and Repowering

During the first half of 2025, 210 wind turbines with a total capacity of 328 MW were decommissioned in Germany. The average operating lifetime of the decommissioned wind turbines was 22 years.

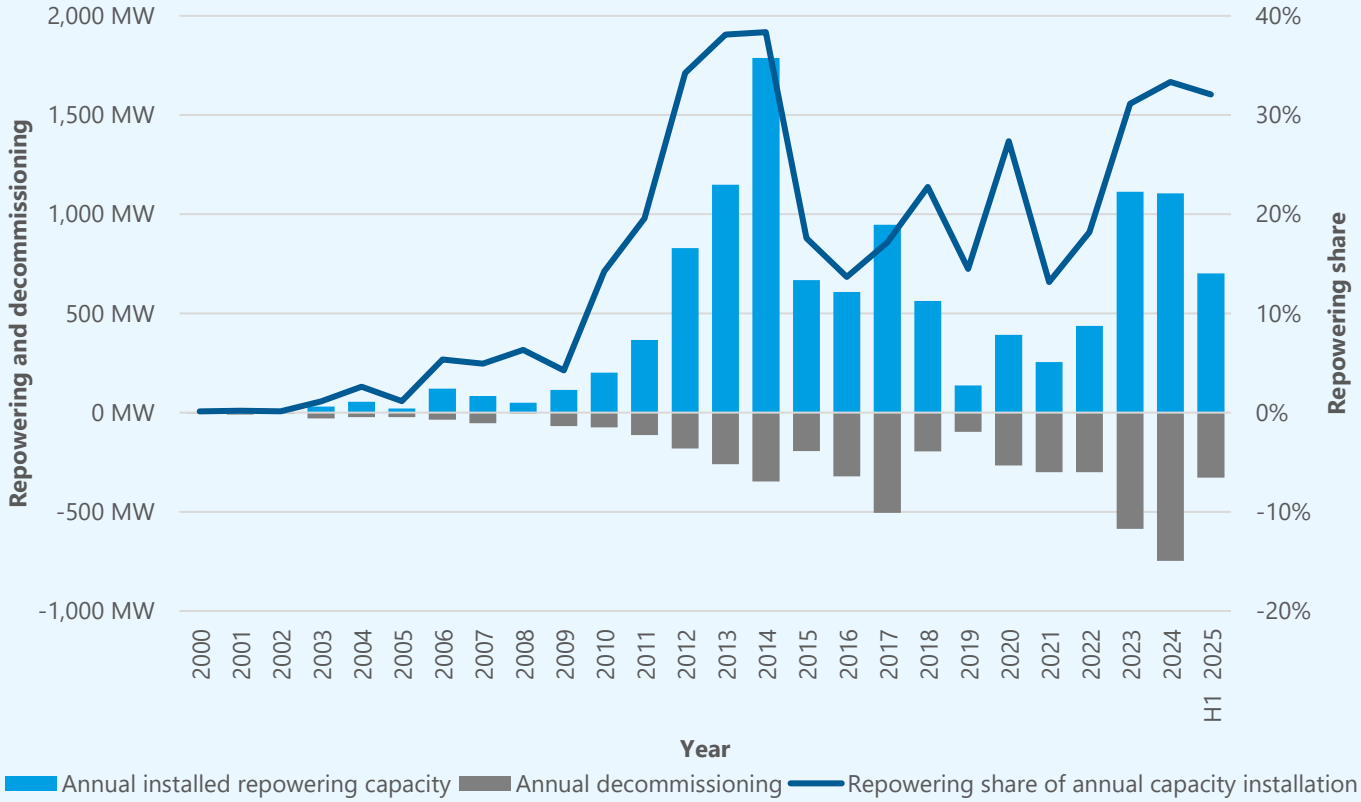
Many of the decommissioned turbines will be replaced by new turbines on the same site after dismantling. The repowering share of the turbines added in the first half of 2025 is 32%, which is roughly the same level as in 2023 and 2024.

After 20 years of operation, the EEG subsidy entitlement for existing turbines will end at the end of the next year in accordance with the EEG. Wind turbines that have neither been repowered nor decommissioned can continue to operate without financial support. In the first half of 2025, this will apply to 9,628 wind turbines with a capacity of around 11.3 GW.

For wind turbines that went into operation in 2005 or later, the subsidy entitlement will gradually be phased out. Over the next five years, this will affect 4,710 turbines with about 8.8 GW of installed capacity.

Age of dismantled and operating wind turbines

	Decommissioning H1 2025		Cumulative 2025-06-30	
Age	**Capacity**	**Turbines**	**Capacity**	**Turbines**
>20 Years, no funding claim (COD ≤ 2004)	223 MW	164 WT	11,324 MW	9,628 WT
15 - 20 Years (COD 2005 - 2009)	81 MW	37 WT	8,769 MW	4,710 WT
10 - 15 Years (COD 2010 - 2014)	22 MW	8 WT	13,273 MW	5,430 WT
5 - 10 Years (COD 2015 - 2019)	2 MW	1 WT	17,180 MW	5,853 WT
0 - 5 Years (COD 2020 - 2025)	0 MW	0 WT	14,838 MW	3,258 WT
Total	**328 MW**	**210 WT**	**65,383 MW**	**28,879 WT**

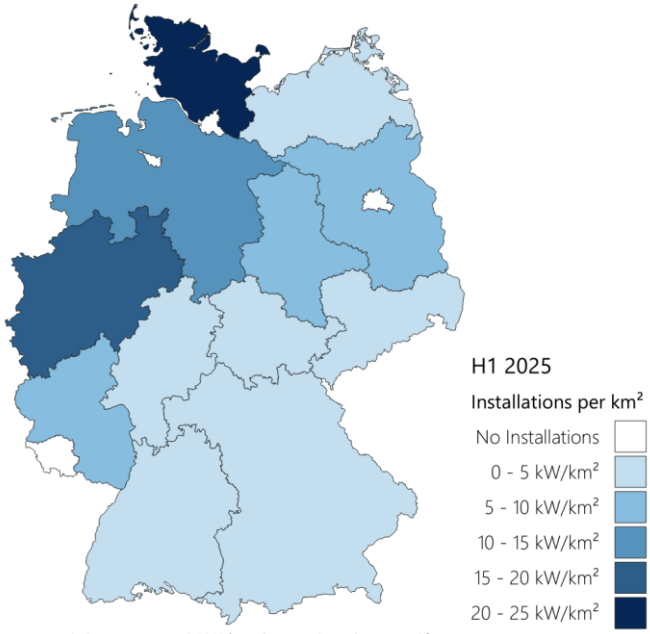


Development of annual decommissioning, annual installed repowering capacity and repowering share

DEUTSCHE WINDGUARD

Regional Distribution of Wind Energy Installation

In a comparison between the federal states, North Rhine-Westphalia is in the lead with an expansion of 598 MW in the first half of 2025. Lower Saxony is close behind in second place with an expansion of 502 MW. Together, North Rhine-Westphalia and Lower Saxony account for a good half of the expansion in the first half of the year. Schleswig-Holstein and Brandenburg are far behind the top two, with 329 MW and 239 MW of new capacity respectively, accounting for a further quarter of total gross new capacity in the first half of 2025. The federal states of Saxony-Anhalt, Rhineland-Palatinate, Mecklenburg-Western Pomerania, Baden-Württemberg, Hesse, Bavaria, Saxony and Thuringia contribute to a significantly lesser extent to gross expansion in the first half of 2025. The three city states (Berlin, Hamburg and Bremen) and Saarland remain completely without the expansion of new wind turbines by mid-2025.



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

H1 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	598 MW	117 WT	27%	48 MW	38 WT	551 MW	194 MW	37 WT	32%
2	Lower Saxony	502 MW	91 WT	23%	64 MW	40 WT	438 MW	148 MW	27 WT	29%
3	Schleswig-Holstein	329 MW	59 WT	15%	80 MW	44 WT	249 MW	62 MW	10 WT	19%
4	Brandenburg	239 MW	45 WT	11%	39 MW	24 WT	200 MW	63 MW	11 WT	26%
5	Saxony-Anhalt	146 MW	24 WT	7%	30 MW	18 WT	116 MW	141 MW	23 WT	96%
6	Rhineland-Palatinate	105 MW	18 WT	5%	41 MW	25 WT	65 MW	47 MW	8 WT	45%
7	Mecklenburg-Western Pomerania	57 MW	10 WT	3%	1 MW	2 WT	56 MW	0 MW	0 WT	0%
8	Baden-Württemberg	53 MW	13 WT	2%	9 MW	5 WT	44 MW	4 MW	1 WT	8%
9	Hesse	42 MW	8 WT	2%	2 MW	3 WT	40 MW	0 MW	0 WT	0%
10	Bavaria	42 MW	8 WT	2%	0 MW	0 WT	42 MW	6 MW	1 WT	13%
11	Saxony	37 MW	7 WT	2%	4 MW	4 WT	33 MW	31 MW	6 WT	85%
12	Thuringia	36 MW	6 WT	2%	7 MW	4 WT	29 MW	6 MW	1 WT	17%
	Saarland	0 MW	0 WT	0%	5 MW	3 WT	-5 MW	0 MW	0 WT	-
	Berlin	0 MW	0 WT	0%	0 MW	0 WT	0 MW	0 MW	0 WT	-
	Hamburg	0 MW	0 WT	0%	0 MW	0 WT	0 MW	0 MW	0 WT	-
	Bremen	0 MW	0 WT	0%	0 MW	0 WT	0 MW	0 MW	0 WT	-
	Germany	**2,186 MW**	**406 WT**		**328 MW**	**210 WT**	**1,859 MW**	**701 MW**	**125 WT**	**32%**

* 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

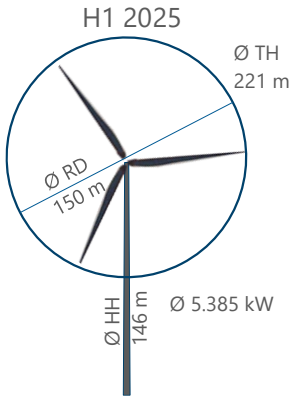
Average Turbine Configuration and Regional Differences

On average, the wind turbines installed in the first half of 2025 have a rated power of 5,385 kW and a total height of 221 m. The trend towards ever more powerful and larger wind turbines continues: Compared to the average turbine configuration in 2024, both the rated turbine power and the total height have increased by 6% and 3% respectively. The average rotor diameter is 150 m, and the hub height is 146 m. The specific power averages 306 W/m².

The average rated turbine power per federal state ranges between 4.1 and 6.1 MW. The turbines with the lowest average capacity were installed in Baden-Württemberg in the first half of 2025, while the new turbines with the highest average power are in Saxony-Anhalt. The total height of the new turbines in the first half of 2025 is also well below average in Schleswig-Holstein, with an average of 182 m. The tallest turbines on average were erected in Saxony-Anhalt (244 m) and Thuringia (244 m).

Average wind turbine configuration

Installations Year H1 2025	Change compared to prior year
Rated power	+6%
Rotor Diameter	+3%
Hub Height	+2%
Tip Height	+2%
Specific Power	+1



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

Installations H1 2025		Average configuration of newly installed turbines				
State	Number of turbines	Rated power	Rotor diameter	Hub height	Tip height	Specific Power
North Rhine-Westphalia	117 WT	5,114 kW	147 m	143 m	216 m	302 W/m²
Lower Saxony	91 WT	5,521 kW	151 m	150 m	225 m	307 W/m²
Schleswig-Holstein	59 WT	5,577 kW	146 m	110 m	182 m	335 W/m²
Brandenburg	45 WT	5,302 kW	149 m	159 m	233 m	306 W/m²
Saxony-Anhalt	24 WT	6,097 kW	157 m	166 m	244 m	317 W/m²
Rhineland-Palatinate	18 WT	5,848 kW	161 m	163 m	243 m	287 W/m²
Mecklenburg-Western Pomerania	10 WT	5,652 kW	161 m	158 m	238 m	276 W/m²
Baden-Württemberg	13 WT	4,105 kW	143 m	158 m	229 m	256 W/m²
Hesse	8 WT	5,288 kW	154 m	165 m	242 m	285 W/m²
Bavaria	8 WT	5,193 kW	152 m	164 m	242 m	283 W/m²
Saxony	7 WT	5,240 kW	153 m	165 m	241 m	285 W/m²
Thuringia	6 WT	5,967 kW	154 m	167 m	244 m	322 W/m²
Saarland	0 WT	-	-	-	-	-
Bremen	0 WT	-	-	-	-	-
Hamburg	0 WT	-	-	-	-	-
Berlin	0 WT	-	-	-	-	-
Germany	**406 WT**	**5,385 kW**	**150 m**	**146 m**	**221 m**	**306 W/m²**

Turbine Manufacturers and Types

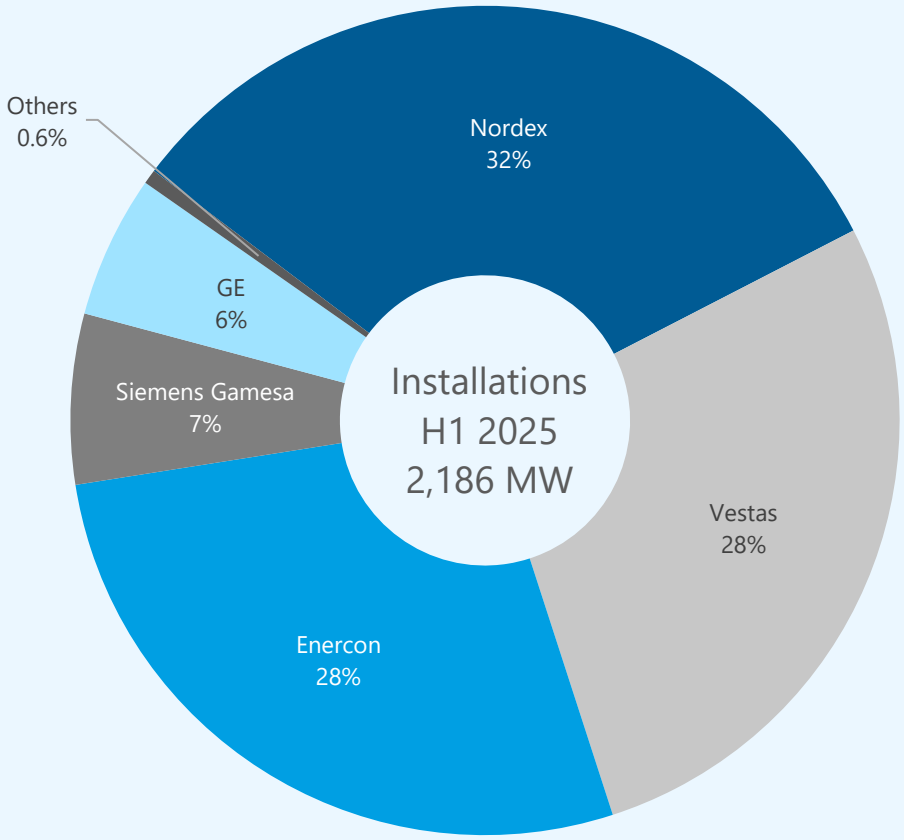
In the first half of 2025, wind turbine manufacturers Nordex, Vestas and Enercon accounted for a total of 87% of the market share for new capacity in Germany. Nordex achieved the largest share with 32%, closely followed by Vestas and Enercon with 28% each, meaning that all three manufacturers can claim similarly high market shares. Siemens Gamesa follows in fourth place with a market share of 7%, followed by GE with 6% and other turbine manufacturers with less than 1% of the market volume.

The list of the most popular turbine types is dominated by the market leaders. The most frequently installed turbine type in the first half of 2025 was the E-160 EP5 E3 from Enercon, with a capacity of 5.56 MW. A total of 47 turbines of this type were installed.

The top ten turbine types not produced by the three dominant turbine manufacturers are Siemens Gamesa with the SG 6.6-155 and GE with the GE 5.5 158 wind turbine in seventh and eighth place.

Most popular turbine types

Rank	Manufacturer	Type
1	Enercon	E-160 EP5 E3
2	Nordex	N163/6.X
3	Nordex	N149/5.X
4	Vestas	V162-6.0 MW
5	Enercon	E-138 EP3 E2 4,2 MW
6	Vestas	V162-6.2 MW
7	Siemens Gamesa	SG 6.6-155
8	GE	GE 5.5-158
9	Enercon	E-138 EP3 E3 4,26 MW
10	Nordex	N163/5.X

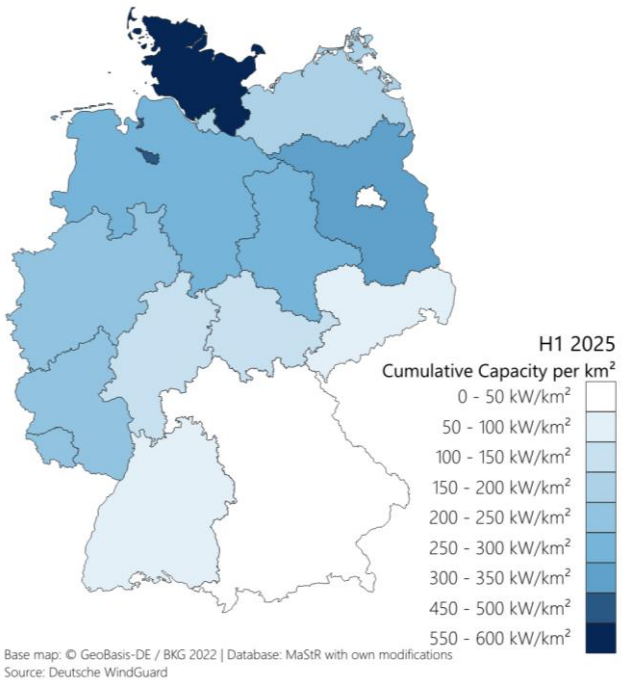


Manufacturers' market share of onshore capacity development in Germany

Regional Distribution of the Cumulative Portfolio

The cumulative total portfolio for the first half of 2025 amounts to 28,879 wind turbines with a total capacity of approximately 65.4 GW. Lower Saxony has the highest total installed capacity at around 13.4 GW, accounting for 20% of the total capacity in Germany, followed by the federal states of Schleswig-Holstein and Brandenburg with 14% each. North Rhine-Westphalia and Saxony-Anhalt follow in fourth and fifth place with a share of 13% and 9% of the total capacity respectively.

In terms of capacity per land area, Schleswig-Holstein is well ahead of the other federal states with 583 kW/km². Bremen also makes a comparatively large contribution of 483 kW/km² given its small size. Brandenburg follows at a considerable distance with 310 kW/km², as do Lower Saxony and Saxony-Anhalt, whose power densities range between 250 and 300 kW/km². In Baden-Württemberg and Saxony, the capacity per area is already at a significantly lower level, at less than 100 kW/km². Bavaria and Berlin have the lowest capacity per area, at less than 50 kW/km².



Regional distribution of cumulative capacity

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

Cumulative portfolio* (2025-06-30)				
Federal state	**Cumulative capacity**	**Cumulative number**	**Share**	**Capacity per area**
Lower Saxony	13,395 MW	6,169 WT	20%	281 kW/km²
Schleswig-Holstein	9,214 MW	3,259 WT	14%	583 kW/km²
Brandenburg	9,186 MW	4,095 WT	14%	310 kW/km²
North Rhine-Westphalia	8,348 MW	3,725 WT	13%	245 kW/km²
Saxony-Anhalt	5,638 MW	2,741 WT	9%	276 kW/km²
Rhineland-Palatinate	4,226 MW	1,777 WT	6%	213 kW/km²
Mecklenburg-Western Pomerania	3,850 MW	1,851 WT	6%	165 kW/km²
Bavaria	2,720 MW	1,160 WT	4%	39 kW/km²
Hesse	2,685 MW	1,189 WT	4%	127 kW/km²
Baden-Württemberg	1,941 MW	808 WT	3%	54 kW/km²
Thuringia	1,884 MW	869 WT	3%	116 kW/km²
Saxony	1,403 MW	861 WT	2%	76 kW/km²
Saarland	548 MW	215 WT	1%	213 kW/km²
Bremen	203 MW	87 WT	0%	483 kW/km²
Hamburg	125 MW	67 WT	0%	166 kW/km²
Berlin	17 MW	6 WT	0%	19 kW/km²
Germany	**65,383 MW**	**28,879 WT**		**183 kW/km²**

* with a minimum turbine capacity of > 100 kW

DEUTSCHE WINDGUARD

Results of Tender Rounds

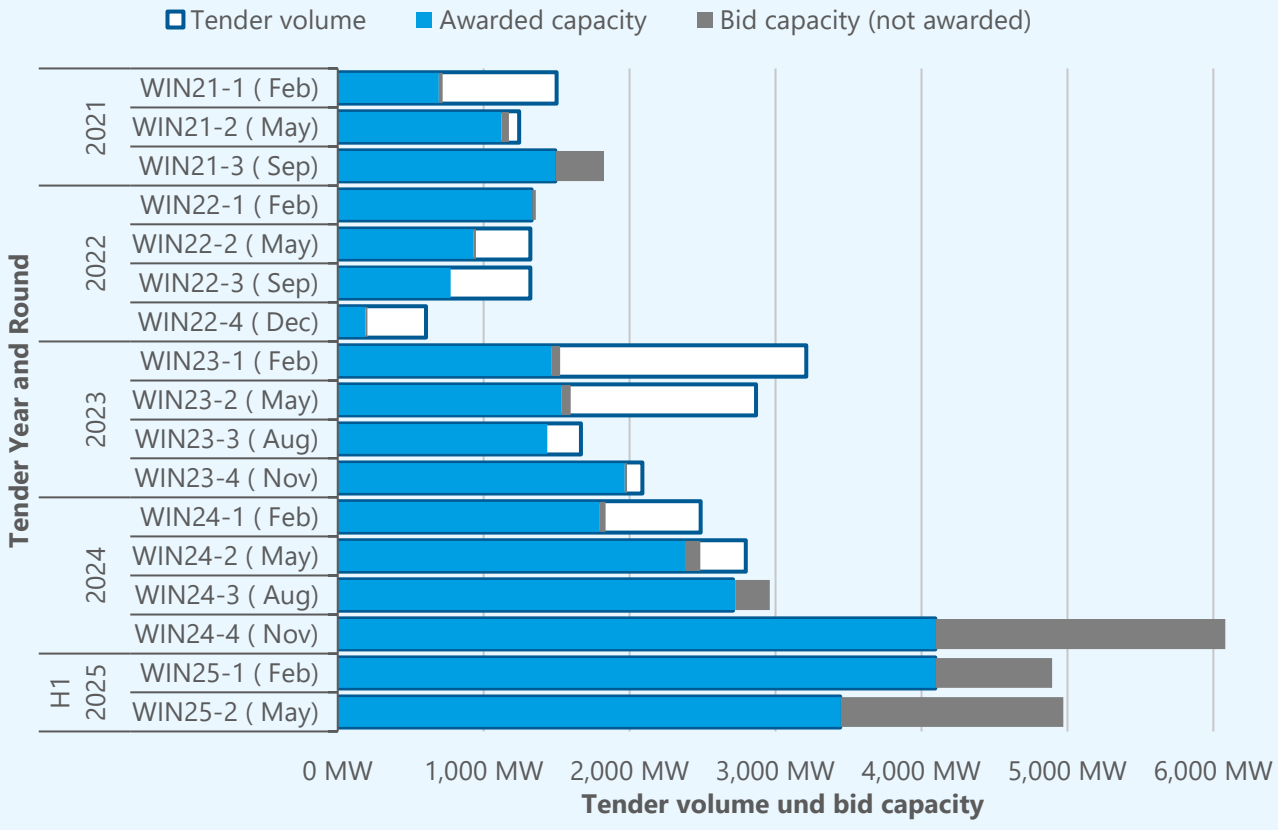
In the first half of 2025, the Federal Network Agency (German: Bundesnetzagentur or BNetzA) conducted two rounds of tenders for the promotion of onshore wind energy. The volume tendered was around 4.1 GW in the February round and 3.4 GW in May.

The bid volume was significantly higher than the tender volume in both rounds: the February round was oversubscribed by 64% and the May round by 38%. The actual volume awarded in the two tender rounds together amounted to 7.5 GW.

The increased interest in onshore wind tenders since mid-2024 is also having an impact on the award values. The average award value of the tender rounds in the first half of 2025 was 6.92 ct/kWh, which is significantly lower than the average award values for 2023 and 2024. Since 2023, the maximum permissible bid value in tenders for onshore wind energy has been 7.35 ct/kWh, and this value has also been set for the following tenders in 2025.

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

	Year	Maximum permissible value	Average capacity-weighted award value
Tender Year	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
	H1 2025	7,35 ct/kWh	6,92 ct/kWh

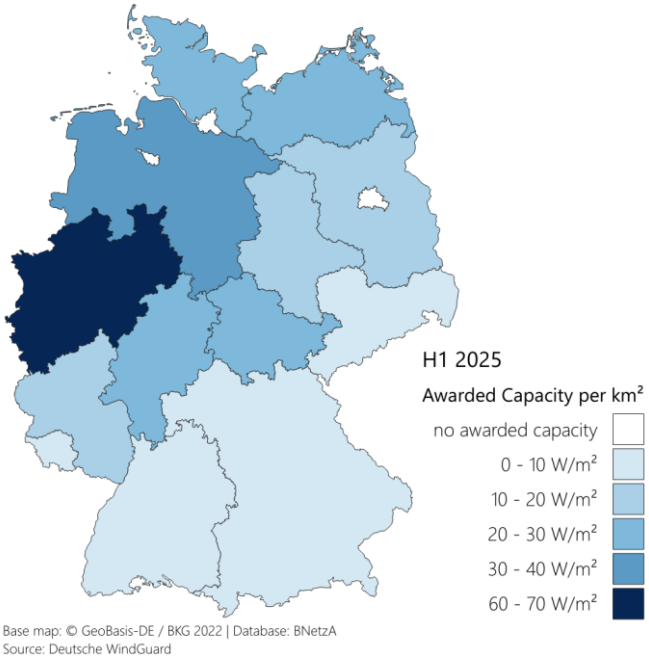


Competitive situation in tender system for onshore wind energy (Database: BNetzA)

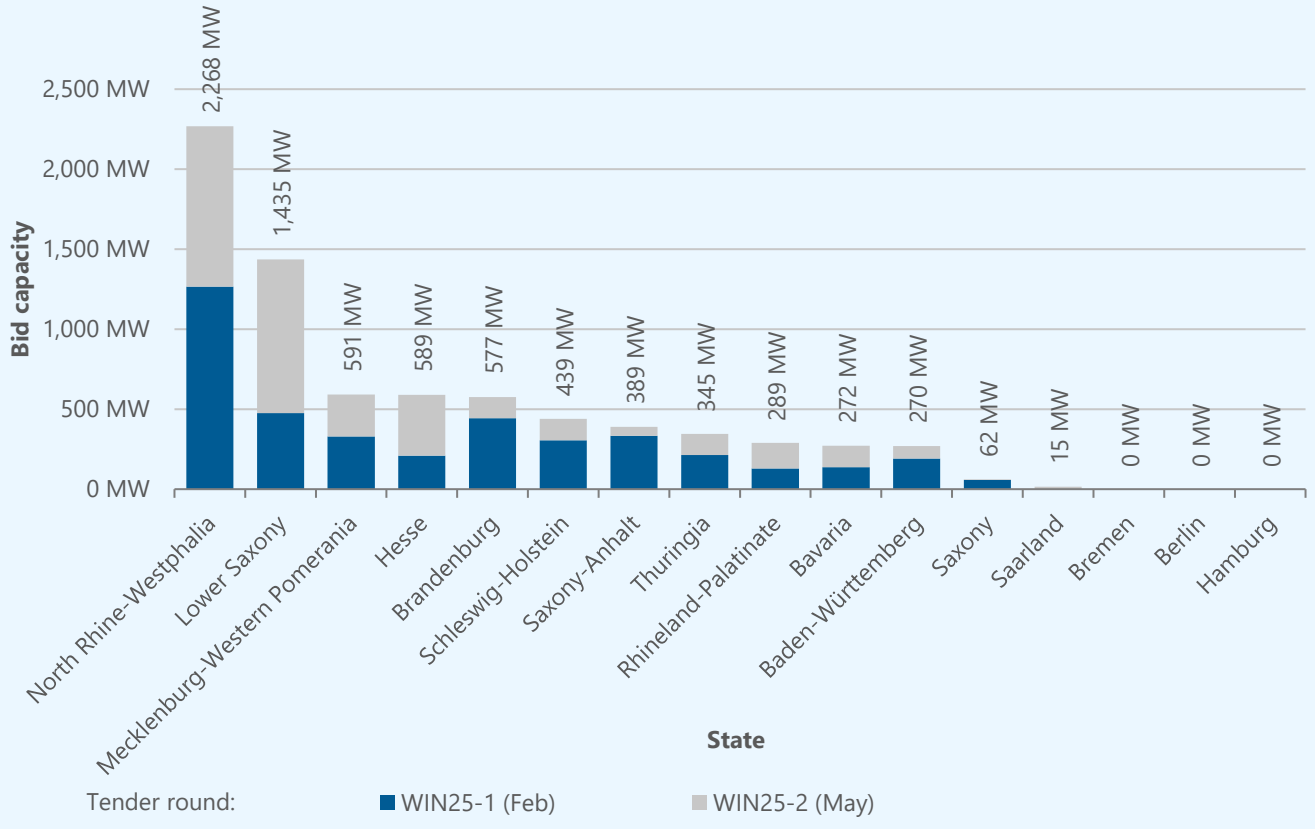
Regional Distribution of Awarded Bids

In the first half of 2025, wind turbines from almost all federal states were awarded in at least one of the two tender rounds. No bids were received from the three city states, so no wind turbines were awarded there.

North Rhine-Westphalia has the largest amount of capacity awarded, with 2.3 GW, which corresponds to a 30% share of the total awarded capacity in Germany. North Rhine-Westphalia is also well ahead of the other federal states in terms of the amount of capacity awarded per state area. Lower Saxony accounts for 19% of the awarded capacity; Mecklenburg-Western Pomerania, Hesse and Brandenburg each account for 8%, therefore the awarded capacity per federal state is over 500 MW. In the other federal states, the shares in the first half of 2025 amount to 6% or less. The southern federal states account for only small amounts of the total awarded capacity, thus continuing the existing north-south divide of onshore wind energy expansion in Germany.



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



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

DEUTSCHE WINDGUARD

Development Status of Awarded Turbines

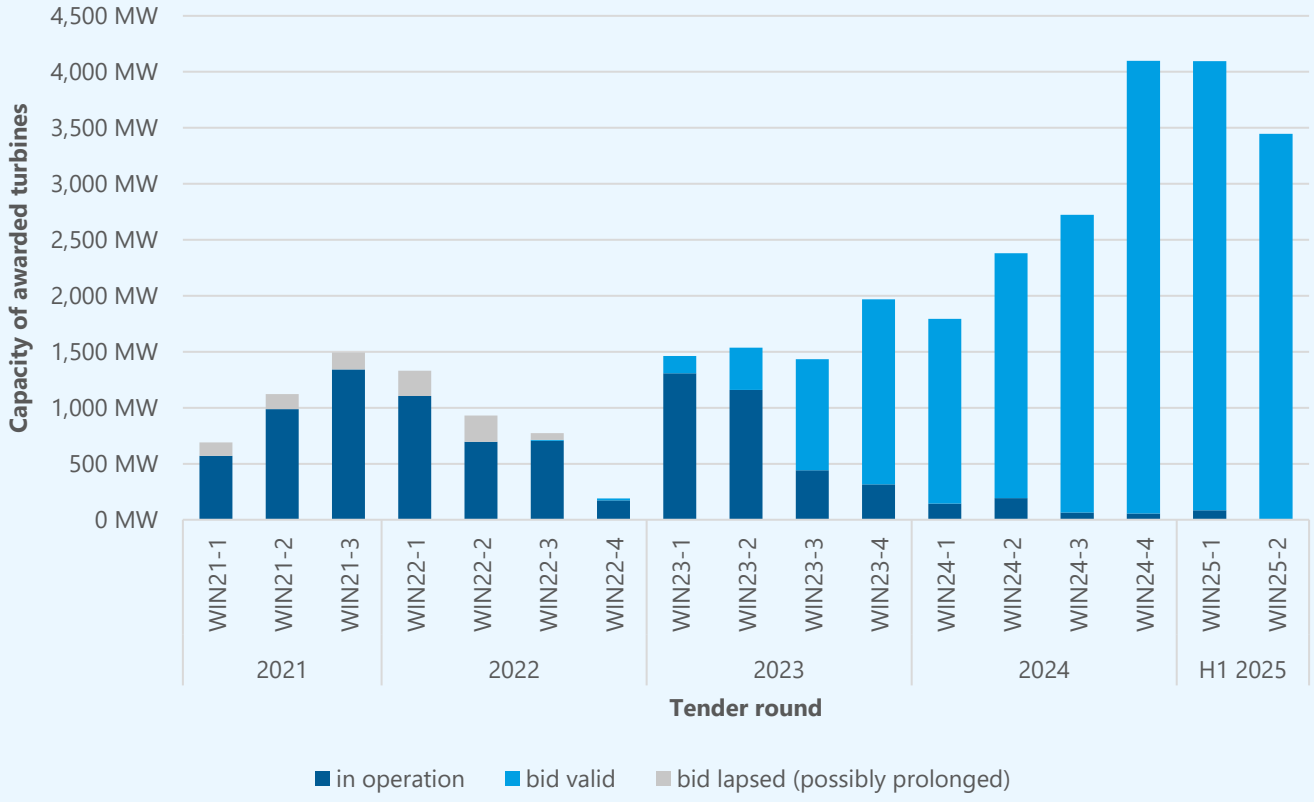
Since 2021, a total of 31.5 GW of wind energy capacity has been awarded, of which approximately 9.3 GW has been realized to date. The deadline for realizing the unused awards of around 0.9 GW has already expired. Unless an extension has been granted, these awards will expire, and the turbines have already secured a new award or can participate in the next tender rounds again.

The regular deadline for realization for the awards from 2021 has expired, with 88% of the awarded capacity having been realized. The realization rate for the 2022 awards to date remains below the previous year's level at 83%. Awards from 2023 must be realized gradually by the end of 2026; to date, 50% of the capacity has been commissioned. Turbines awarded in 2024 and the first half of 2025 are still in the early stages of implementation, so only a small proportion of those wind turbines have been commissioned. On average, the period between contract award and commissioning of the turbines commissioned in the first half of 2025 is 21 months.

Realized capacity* of tenders for onshore wind energy in Germany

	Year	Realized capacity*	Realization rate
Year of tender	2021	2,899 MW	88%
	2022	2,678 MW	83%
	2023	3,226 MW	50%
	2024	457 MW	4%
	H1 2025	86 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)

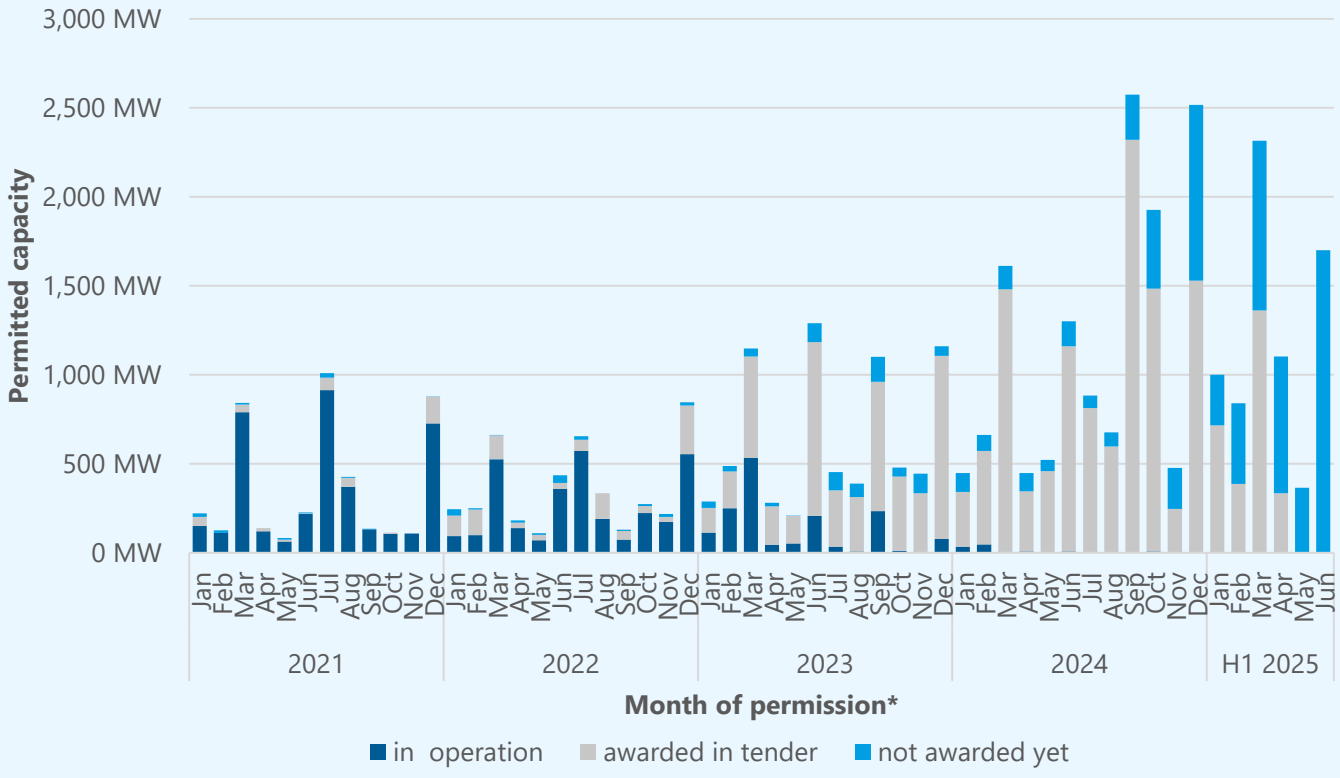
Permitted Capacity and Development Status

In the first half of 2025, 1,196 wind turbines with a total capacity of 7.3 GW were permitted. Compared to the first half of 2024, this represents an increase in permitted capacity of 47%. The permitted volume in the first half of 2025 is already significantly higher than the total annual capacity permitted in 2021 and 2022, and almost as high as that permitted in 2023.

38% of the wind turbines newly permitted in the first half of 2025 have already been awarded subsidies under the EEG. Permits granted in May and June 2025 have not yet been able to participate in a tender round. In addition, other turbines with permits from 2024 have not yet been awarded. This means that over 8 GW of permitted capacity is already available for the upcoming tender rounds in 2025. Most of the permits for wind turbines granted in 2021 and 2022 have already commenced operation. The first commissioning dates have been recorded among the projects permitted in 2023, but most of them are still in the initial phase. This also applies to the turbines that received their permits in 2024. Among the turbines with permits from 2025, no commissioning dates have been recorded yet until mid-2025.

Annual permitted capacity

	Year	Permitted capacity	Permitted wind turbines
Year of permission	2021	4,309 MW	884 WT
	2022	4,340 MW	833 WT
	2023	7,729 MW	1,392 WT
	2024	14,050 MW	2,383 WT
	H1 2025	7,326 MW	1,196 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

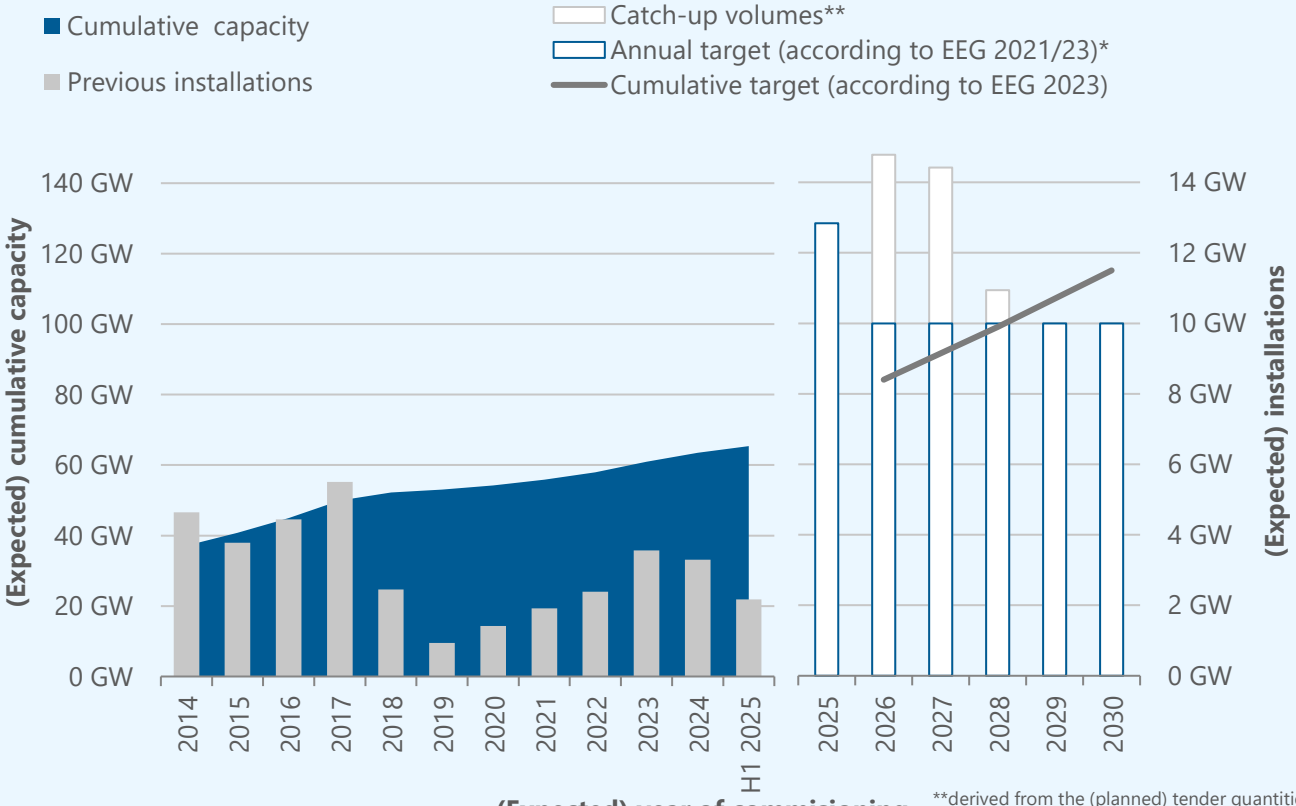
Political Target and Future Tender Rounds

The EEG 2023 sets out the expansion path for onshore wind energy. A cumulative total capacity of 69 GW was planned for 2024 in order to achieve the statutory target. Of this, 63.5 GW had been achieved by the end of 2024. By mid-2025, the 2024 target had still not been achieved: the cumulative total capacity is 65.4 GW.

The next interim target defined in the law is set for 2026 and amounts to 84 GW. By the end of 2026, a net increase of over 18 GW will be required to achieve this target. By 2030, the total capacity across Germany is to rise steadily to 115 GW in accordance with the EEG 2023.

The tender volumes defined in the EEG determine the gross expansion required each year to compensate for the expected dismantling. The EEG stipulates that tender volumes that are not awarded at the scheduled time can be re-tendered in the following year as so-called catch-up volumes. Thus, competition-related reductions in tender volumes and the undersubscription of tender rounds automatically increase demand in subsequent years – until the targets can be achieved.

The two tender rounds in the first half of 2025 (WIN25-1 and WIN25-2) have already been increased to accommodate catch-up volumes from 2023 and 2024. Due to the undersubscription of the tenders in 2024, the following tender rounds (up to WIN26-1) will also be increased by catch-up volumes. The remaining two tenders for onshore wind energy in 2025 (WIN25-3 and WIN25-4) are expected to have a tender volume of around 3.4 GW.



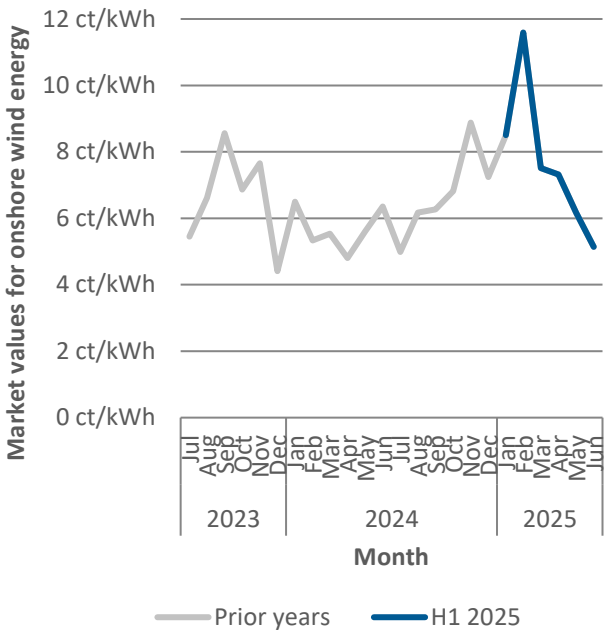
**derived from the (planned) tender quantities in the year before the previous year
**Tender volume corrected in accordance with § 28 EEG

Expected installations in 2024 and political targets according to EEG 2021/23

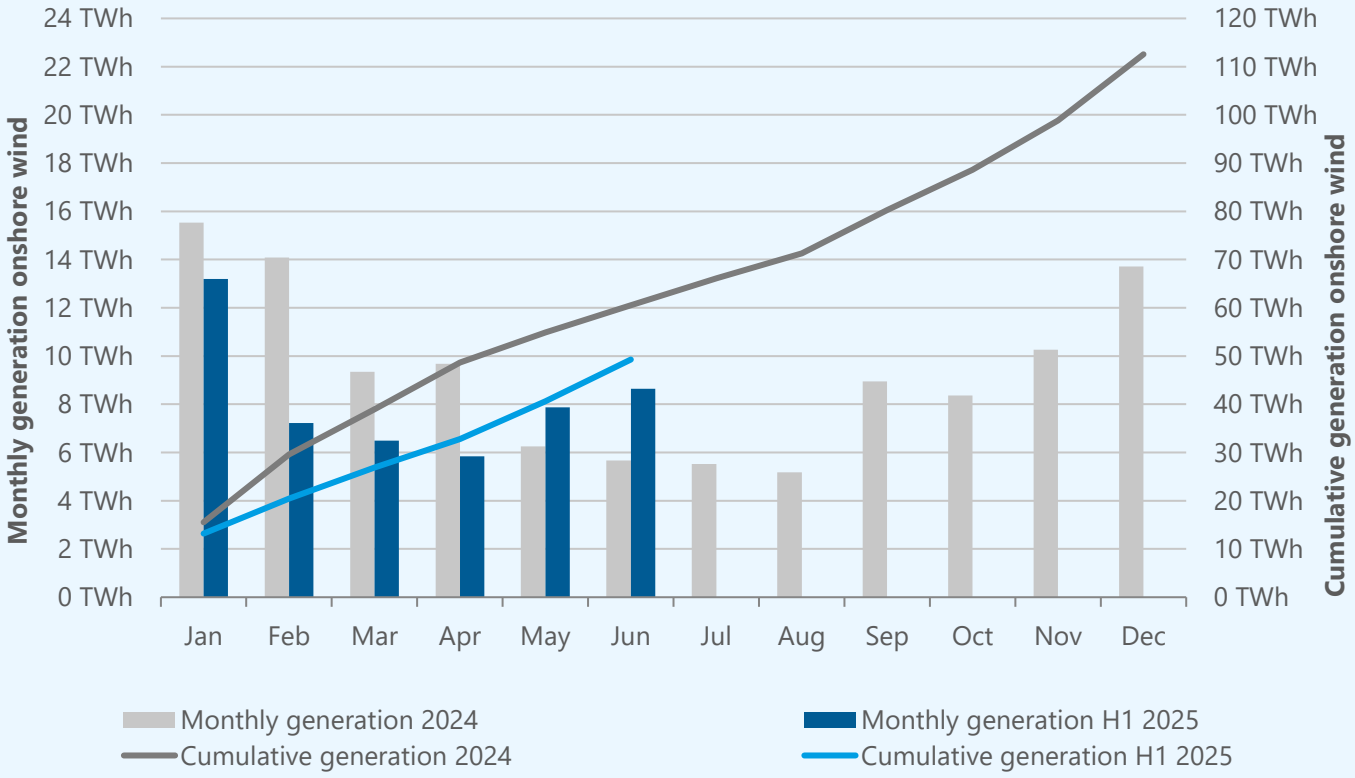
Power Generation and Market Values

In the first half of 2025, onshore wind turbines installed in Germany generated 49.3 TWh of electricity. In comparison, onshore wind energy generation was almost 19% lower than in the first half of the previous year. The reason for this is a below-average windy spring, with less electricity generated than in the previous year, particularly in February, March and April. Nevertheless, onshore wind energy remains the most important source of energy for electricity generation in Germany, accounting for 22.4%.

During the first half of 2025, market values initially rose to 11.6 ct/kWh in February, before falling back to the previous year's level. The average market value in the first half of 2025 was 7.71 ct/kWh, an increase of 24% compared to 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 200 experienced experts.