



# Bavaria's wind potential can deliver more than its transition

Despite being Germany's largest state, Bavaria is currently lagging in terms of wind power development, with only 2.6 GW of installed capacity. However, Bavaria has the potential to increase this capacity sixfold and achieve its renewable energy goals.

---

Published date: 4 December 2023

Lead author: Sarah Brown

Other authors: Clara Mewes

Translation

---

# Contents

	1
About	2
Highlights	2
<u>Introduction</u>	<b>4</b>
<u>Analysis</u>	<b>5</b>
Increased wind generation would bring gas import savings and energy sovereignty	6
European neighbours demonstrate how to run a power system on renewables	7
<u>Conclusion</u>	<b>9</b>
<u>Supporting Materials</u>	<b>10</b>
Methodology	10
Acknowledgements	11
Sub-heading goes here	11
Image credit	11

## About

This report examines the untapped potential of onshore wind in Bavaria and how increased deployment could strengthen the region's energy sovereignty and reduce the costs of continued high dependence on imported gas.

---

## Highlights

# 6x

---

If the call to reduce the distance to 800 metres between turbines and residences was adopted across the state, then wind capacity could jump almost sixfold to 15 GW

# 22 TWh 27%

---

Bavaria could generate 22 TWh of wind, accounting for 17% of Germany's total wind power and 22% of its onshore wind

---

The additional wind generation would enable Bavaria to slash its current gas consumption by 27% and, therefore, increase its energy sovereignty

**Bavaria already benefits from producing a significant share of its electricity from solar. With only a minor adjustment to its wind turbine restrictions, it could substantially increase its renewable generation and reduce its current dependence on imported fossil gas. Bavaria must seize this opportunity to not only cut costs for consumers but also enhance its energy sovereignty.**

**Sarah Brown**

Europe Programme Director, Ember



**Bavaria is well equipped to reach its 2040 net zero target: it has a strong administration, economic power and huge potential for renewable energies. Bavaria now needs to set the right framework conditions to utilize this potential, especially regarding wind energy, in order to remain a strong business location and to preserve livelihoods and prosperity.**

**Carolin Friedemann**

Director and founder of  
the Munich-based Initiative Climate  
Neutral Germany (IKND)



## Introduction

# Bavaria aims to reach net zero by 2040

This goal is enshrined in the [Bavarian climate law](#). Yet, in the past 20 years, the Bavarian state government has hampered the energy transition. A selection of politicians has vocally lobbied against the deployment of windmills and enhanced grid infrastructure.

The [10H rule](#), introduced in 2014, established that the minimum distance between a wind turbine and the nearest settlement must be ten times the height of the turbine. Modern large wind turbines can reach heights of 200 metres. Consequently, permitting for onshore wind projects has almost completely come to a standstill. Despite boasting one of the largest solar and hydro power capacities, Germany's largest state has one of the lowest wind power capacities in the country, compared to its size, at 2.6 GW.

The Bavarian government has set a target to double the amount of electricity generated from renewables from 40 TWh to 78 TWh by 2030. This goal was recently reaffirmed in the [coalition agreement](#) between the two conservative governing parties, the Christian Social Union (CSU) and the Freien Wähler (FW) in October 2023. While the plans include an increase in solar power from 13 TWh to 40 TWh they only stipulate the installation of 1,000 new wind turbines. The numbers clearly indicate that the renewables target will not be reached through solar alone. A significant but achievable rise in wind power ambition is the solution.

Some policy progress has been made. While the 10H rule remains in place despite [recent calls to abolish it](#), the restrictions were relaxed in November 2022 and in select areas the required distance between turbines and residential properties has been [reduced to 1000 metres](#). In priority areas, this has been dropped further to 800m since June 2023 and some local mayors across party-lines are calling for this to be introduced across the region.

## Analysis

# Bavaria has enough wind potential to deliver on renewables targets

Traditionally, there have been assertions that the wind does not blow enough in Bavaria to justify installing wind turbines. However, analysis shows that this can be challenged.

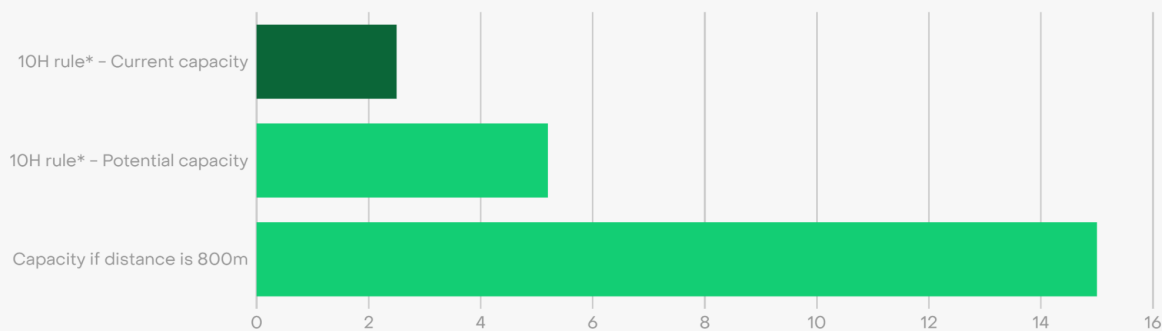
Data from the [Joint Research Centre](#) shows that, even under the extremely high restrictions of the 10H rule, Bavaria could double its existing installed wind capacity from 2.6 GW to 5.2 GW and that this would increase annual wind electricity generation from 4 TWh to 8 TWh. This demonstrates that more wind power could be delivered even with these strict conditions.

If the distance restrictions were reduced to 1000 metres across the region, existing wind capacity could be more than tripled to 9 GW - increasing annual wind power generation to 14 TWh (+10 TWh).

Ember calculations estimate that if the call to reduce the distance to 800 metres was adopted across the state, then the potential capacity could jump almost sixfold to 15 GW (22 TWh). This is an increase of 18 TWh compared to Bavaria's current wind generation.

## Even a small reduction in the distance between wind turbines and residential areas could substantially increase onshore wind capacity in Bavaria

Wind capacity in gigawatts (GW)



Source: Ember analysis of Joint Research Centre ENSPRESO data

\*The 10H rule, introduced in 2014, established that the minimum distance between a wind turbine and the nearest settlement must be 10 times the height of the turbine. Modern large wind turbines can reach heights of 200 metres.

EMBER

Initiative  
1000  
Klimaneutrales Deutschland

Germany generated 126 TWh of its electricity from wind in 2022, 100 TWh of this was onshore. So with 22 TWh of wind, Bavaria would account for 17% of Germany's current total wind power and 22% of onshore wind.

The 2030 Bavarian renewable electricity target of 78 TWh requires an increase of 38 TWh from current renewable generation levels. With 27 TWh of this expected to come from solar, that leaves a gap of 11 TWh. Our analysis shows that this could predominantly (~90%) be met by onshore wind if restrictions were relaxed to 1000 metres across the region and that this could even be surpassed if an 800 metre distance rule was introduced.

## Increased wind generation would bring gas import savings and energy sovereignty

Bavaria has the second highest regional gas consumption in Germany at [105 TWh](#) and produces 14 TWh (18%) of its electricity from fossil gas. If the distance restrictions were reduced to 800 metres, sufficient wind capacity could be installed to more than replace this 14 TWh of gas generation. As a result, Bavaria would be significantly less dependent on

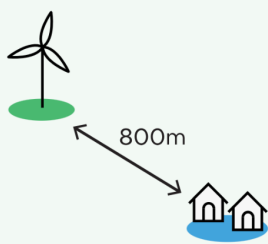
imported gas. Instead, this electricity demand could be met through local renewable sources - achieving greater energy security and sovereignty.

This additional wind power would also cut financial risks and consumer costs through reduced exposure to expensive and volatile imported gas prices. Bavaria could slash its current annual gas consumption by at least 28 TWh (27%). This would equate to yearly savings of €1.3 billion based on expected 2024 gas prices alone. If we see gas prices return to 2022 levels then the annual gas cost savings surge to €3.4 billion.

### Roadmap to Bavaria's energy sovereignty

Increasing wind capacity and reducing gas consumption

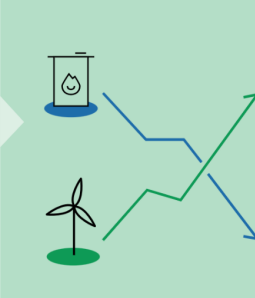
Reducing the distance between wind turbines and residential areas to **800m**, would mean...



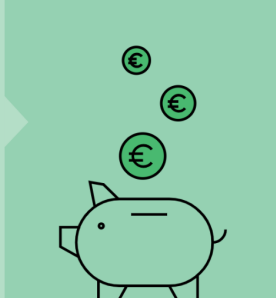
an increase in Bavaria's wind capacity by **6x** and...



would slash current annual gas consumption by **27%** ...



... which equates to yearly savings of **€1.3 billion**.



Source: Ember

EMBER

Initiative  
1000  
Klimaneutrales Deutschland

## European neighbours demonstrate how to run a power system on renewables

The shift from fossil fuels to renewables has accelerated across the EU since Russia invaded Ukraine. In 2022, a record 57 GW of wind and solar was installed and they [generated more electricity](#) than gas for the first time.

It has also been demonstrated that power systems can run exclusively on renewables. Greece's entire electrical grid ran on 100% renewables for five hours in October 2022, the



---

Netherlands saw 140 hours in June 2023 when wind and solar produced more than the entire country's consumption, and Portugal set a national record in November when all its electricity needs were met through renewables for 131 consecutive hours. The Netherlands also achieved a 50% share of its electricity generation from wind and solar for the first time in July, while Germany came close with a record 49% share.

## Bavaria risks being left behind

In February, [Poland cancelled its 10H rule](#) that had been in place since 2016. The distance restrictions for onshore wind turbines have been reduced to 700 metres. In addition, the new law stipulates that the developer must offer at least 10% of the installed capacity of the wind turbine to the residents of the municipality thereby significantly reducing their energy bills.

Bavarian residents could be reaping similar benefits if the government adopted the minor amendment to existing onshore wind regulation that is being called for.

## Supporting Materials

# Methodology

Bavarian potential wind capacity data (GW): ENSPRESO - WIND - ONSHORE and OFFSHORE. European Commission, Joint Research Centre (JRC) [Dataset] PID: <http://data.europa.eu/89h/6d0774ec-4fe5-4ca3-8564-626f4927744e>. [NUTS2 regions DE21-DE27]

Calculation for potential wind capacity (GW): share of land x suitable area x power density of wind farms

Potential wind capacity with 800m distance restrictions: interpolation has been applied to the suitable areas for multiple different distance rules contained in the ENSPRESO data to estimate the suitable area (km<sup>2</sup>) in Bavaria if a 800m restriction rule was introduced across the state. This calculated suitable area has then been inserted into the above formula to determine the implied potential wind capacity (GW) for 800m distance restrictions

Power density of onshore wind farms: 3 MW/km<sup>2</sup>

Capacity factors of onshore wind turbines: 10% to 22.5%

Gas power plant efficiency rate: 50% (Higher Heating Value/Gross Calorific Value)

German gas prices: PEGAS Trading Hub Europe (THE) settlement prices on 17 November 2023

Solar capacity is expressed GW<sub>dc</sub> (direct current)

# Acknowledgements

**Contributors:** Nicolas Fulghum, who reviewed the data. Clara Mewes, policy expert, Initiative Klimaneutrales Deutschland, who co-wrote the report and translated it into German.

## Image credit

ARphotography / Alamy Stock Photo

© Ember, 2023

Published under a Creative Commons ShareAlike Attribution Licence (CC BY-SA 4.0). You are actively encouraged to share and adapt the report, but you must credit the authors and title, and you must share any material you create under the same licence.