

EGU22-9573, updated on 11 Aug 2022

<https://doi.org/10.5194/egusphere-egu22-9573>

EGU General Assembly 2022

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Impact of Legislation and Social Acceptance on Wind Potentials in Germany

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In the climate protection act of 2021 Germany has set the goal to become climate neutral by 2045 [1]. To meet this target, the renewable energy sites in Germany must be significantly expanded. At the same time, the acceptance of wind turbines is heavily discussed. For example, the construction of wind turbines inside forests or distances to residential buildings are topics in societal discussions. Furthermore, the different legislation in the individual federal states lead to unequal wind expansion possibilities.

This paper assesses the impact of legislation on the onshore wind energy potential in Germany considering residential buildings for the first time. To this end, different scenarios for high resolution land eligibility analyses are developed with the open-source tool GLAES [2] using a 10 m*10 m resolution and high accuracy GIS-data. Firstly, the impact of different exclusion zones in the analysis is evaluated. The distance to residential land use and the use of forests and protected landscapes are especially influential for the results. Secondly, we investigate the impact of different legislation in the individual German federal states. A comparison to national energy system studies shows that a nationwide application of for example Bavaria's legislation leads to insufficient wind capacity potentials to reach climate neutrality by 2045. Thirdly, we evaluate the distribution of the wind potential when the current federal states' legislation is applied which uncovers large inequalities.

[1] Bundes-Klimaschutzgesetz (KSG). 2021. Accessed: Jan. 05, 2021. [Online]. Available: <https://www.gesetze-im-internet.de/ksg/KSG.pdf>

[2] D. Ryberg, M. Robinius, and D. Stolten, 'Evaluating Land Eligibility Constraints of Renewable Energy Sources in Europe', *Energies*, vol. 11, no. 5, p. 1246, May 2018, doi: 10.3390/en11051246.