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The impact of policy measures on the spatial and temporal expansion of wind energy: a classification of instruments and modeling recommendations

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Policy measures influence the spatial and temporal deployment of wind energy often more than the geo-economical potential. On the national level, the design of renewable energy support schemes mostly determines the most promising locations for investments. These national instruments also interplay with regulation on the local and municipal level, including land development plans, licensing regimes, and local renewable energy targets. While modeling sometimes focuses on the national level, local regulations are most often absent from the analysis. Controversially, measures at the different administrative levels simultaneously foster and hinder the deployment of wind energy in some regions.

The contribution of this paper is threefold. First, we categorize policy measures at different administrative levels that influence the spatial expansion of wind energy. We uncover at which stage of the planning process these instruments play a role and by which mechanism they influence the spatial distribution and the development time. Second, we present and evaluate techniques to reflect such policy measures in spatial and temporal scenario models and discuss how to generalize them across countries and/or jurisdictions. Third, we apply these modelling techniques on the German case to gain insights on the pros and cons of different modelling approaches. The case study incorporates first scenarios from the Kopernikus project Ariadne.