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# Decentralised laboratories in the German energy transition. Why local renewable energy initiatives must reinvent themselves

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## ABSTRACT

This study addresses research demands for a more critical empirical assessment of the innovation capacity of the decentralised, sub-national level. In Germany, the extensive involvement and contributions of new locally-rooted renewable energy initiatives have been one of the most striking features of the country's energy transition process. This study analyses the enabling conditions, current challenges and future prospects of decentralised experimentation in the German energy system. It finds that whereas the national support scheme has for a long period protected decentralised deployment of renewable energies by locally-rooted actors in the energy field, recent reforms of the scheme now threaten their further participation in the energy market. The paper observes that decentralised initiatives not only struggle to adjust to the new framework conditions. They have also not yet sufficiently addressed the new governance challenges arising from the fact that renewable energies have reached a stage of systemic importance for the whole power system, which requires decentralised initiatives to make their own efforts compatible with overall energy system transition needs. The study concludes that in order to remain an important innovator in the German energy transition, decentralised initiatives have to prove their ability to provide solutions to the systemic challenges of the energy transition process, such as horizontal and vertical multi-level coordination and decentralised contributions to the security of supply.

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## 1. Introduction

Germany is perceived as a frontrunner in the transformation of its electricity system from a fossil and nuclear fuel-based system into an energy system based on renewables. In December 2013, the German coalition government announced an official target to increase the share of renewable energies in the German power mix to reach 40–45% by 2025 and 55–60% by 2035.

Renewable energies have become a dominant energy source in the German electricity market, providing 30% of the total electricity produced in 2015, more than any other single energy source (AG *Energiebilanzen*, 2015). So far, decentralised activities have been a major driving force for the rapid growth of renewable energy capacity in Germany, based on a multiplicity of small-scale initiatives at the local or regional level. Consequently, the German renewable energy market is characterised by a plurality of actors and the emergence of new locally-rooted actors, such as energy

cooperatives.

Setting the course for the achievement of Germany's ambitious targets and addressing the challenges arising from it is one of the country's major political, societal and technological tasks for the coming decades. The process is characterised by uncertainties regarding the structure of the future energy system, specifically the degree of decentralisation or centralisation and the adequacy of the instruments chosen to stimulate the desired course.

The purpose of this paper is to analyse the role, enabling conditions, current challenges and future prospects of decentralised experimentation in the multi-level governance of Germany's energy transition. It investigates why, and under which conditions decentralised experiments have served as a major driving force in the deployment of RES in Germany, with a specific focus on the role local governments and the national support scheme for RES have played in enabling and protecting decentralised RES initiatives. Looking at the impact of decentralised experimentation, we identify a growing need for multi-level governance coordination in order to address the challenges of temporal and spatial disparities between power generation and demand, system integration of RES, as well as distribution and land-use conflicts. We then discuss

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whether local governments are sufficiently prepared to address these multi-level governance requirements and how current reforms to the national political framework are affecting decentralised RES experimentation. The paper concludes by discussing strategies to preserve the dynamism of decentralised experimentation as a vigorous driver of Germany's energy transition.

## 2. Material and methods

This paper is based on the results and ongoing trans- and interdisciplinary discussions from two current research projects: “EnAHRgie – Conception of sustainable land use and energy supply at the municipal level. Implementation in the model region Ahrweiler” and “Helmholtz Alliance ENERGY-TRANS – Future infrastructures for meeting energy demands. Towards sustainability and social compatibility”. The study presents findings from seven expert interviews conducted as part of the EnAHRgie research project with local stakeholders from the county of Ahrweiler, a 100% RES region in the Western German state of Rhineland-Palatinate. Interviewees included representatives of the county administration, the municipal utility, a citizen energy cooperative, a wind energy project manager, a regional energy agency and a politician. In addition, comprehensive desk studies were conducted for the paper, which featured an analysis of relevant academic literature, policy advisory studies, policy documents, legal texts and statistics.

## 3. Theoretical debates on decentralised “laboratories of innovation” in climate governance and low carbon energy transition research

The role of decentralised initiatives and their capacity as societal innovation laboratories is gaining increasing attention in theoretical debates on climate governance and in transition research.

Scholars of polycentric governance investigate the roles and interlinkages between the distinct policy levels in multi-level/multi-actor governance systems in order to explore the challenges of cross-jurisdictional governance of common-pool environmental resources, such as the climate system (e.g. [Andersson and Ostrom, 2008](#); [Ostrom, 2010](#)). Laboratory federalism theory suggests that decentralised jurisdictions can function as efficient laboratories for experimentation and innovation, leading to more knowledge about suitable policy solutions and reducing the risk of erroneous policies in federal political systems ([Oates, 1999](#); [Saam and Kerber, 2013](#)). Similarly, lessons from policy diffusion research point to the global importance of decentralised model production, showing that under certain conditions, decentralised innovations can be adopted by other jurisdictions, triggered by horizontal processes of policy learning and diverse diffusion mechanisms, such as regulatory or ideational competition ([Kern, 2000](#); [Tews et al., 2003](#)). Literature on policy diffusion pronounces that such bottom-up and decentralised innovation diffusion processes can be perceived as an alternative or complementary mechanism of convergence to hierarchical and (inter)national state-centred negotiation ([Busch et al., 2005](#); [Tews, 2015](#)).

Transition management theory also highlights the political relevance of experimentation at the decentralised level for driving societal innovation ([Rotmans et al., 2001](#); [Geels, 2010](#)). This strand of theory argues that in order to address the uncertainties of complex transition processes, such as a low carbon energy system transformation, setting up a predefined and all-encompassing “master plan” is neither meaningful nor feasible. Rather, adapting to the uncertainties of ongoing transition processes requires freedom for constant experimentation and innovation at various levels including the decentralised level. Experimentation is needed

to destabilise lock-in mechanisms in the existing system, to induce shifts in behavioural patterns of consumers and producers and to explore, test and evaluate new approaches allowing for adjustment to dynamic socio-political framework conditions and technological progress (*ibid.*).

The widespread assumption and positive narrative that the decentralised, sub-national level provides an adequate space to experiment with innovations is however challenged by recent research that points to research gaps with regard to its empirical foundation. [Jordan et al. \(2015\)](#) find that literature on sub-national experimentation has a tendency to show over-enthusiasm for the innovation potential of the decentralised level. Other studies also identify a lack of substantial and systematic evaluation of decentralised efforts to design scalable innovations and scaling-up programs ([Spicer et al., 2014](#); [Management Systems International, 2012](#)).

Without providing empirical evidence of the decentralised level's actual contribution to the management of systemic challenges, the decentralised level's innovation potential in polycentric governance systems cannot be verified. Thus, there is a demand for more empirically informed research on the systemic governance challenges that can be addressed at the decentralised level. Related to that, more research is required on the degree of transferability of decentralised innovations and the necessary scaling-up mechanisms. Research also needs to strengthen the empirical assessment of the interplay between the policy levels and the different modes of policy coordination in multi-level governance systems. Several studies highlight the need to improve coordination between policy levels (municipalities, provinces, central state, supra- and international level) and actors (state and non-state stakeholders) in order to avoid inconsistencies, fragmentation and inefficiencies in societal low carbon energy transition and climate strategies ([Corfee-Morlot et al., 2009](#); [Ohlhorst et al., 2013](#)).

This paper adds to the debate on how to integrate the distinct capacities of decentralised bottom-up initiatives and hierarchical top-down coordination ([Ostrom, 2005](#); [Zürn and Faude, 2013](#)). Investigating decentralised experimentation in the German energy transition process, the study outlines the previous contributions of decentralised energy transition activities. The work introduces new challenges arising from increasing demand for multi-level governance coordination and modified political framework conditions. Finally, it discusses the potential future role of decentralised innovation in the German energy system.

## 4. A favourable political environment triggers decentralised innovation

The rise of new, decentrally organised energy actors, specifically small-scale investors in RES such as private households, farmers and citizen energy cooperatives has been one of the most striking features of the German energy transition process. According to a survey carried out by [Trend:research GmbH and Leuphana Universität Lüneburg \(2013\)](#) by the end of 2012 nearly half (46.6%) of the total RES capacity installed in Germany was owned by citizens and citizen energy cooperatives (see [Fig. 1](#)). The study defines more than one third of this capacity as ‘citizen energy in the narrow sense’, i.e. it was set up by local and regional initiatives in which citizens have the majority of the decision-making power.<sup>1</sup>

Locally-rooted and citizen-led projects often pursue broader targets beyond mere returns on investment. According to

<sup>1</sup> For their definition of ‘citizen energy in the wider sense’, the authors of the study include an additional 11.6% of RES capacity from minority investments by citizens in nationwide projects (see [Fig. 1](#)).

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