



Two ways to success expansion of renewable energies in comparison between Germany's federal states

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ABSTRACT

Expansion of renewable energies is a central pillar of the German energy transition towards a non-nuclear renewable system. The expansion rate is co-determined to a significant degree at the level of the federal states, and varies considerably from state to state. Apart from the existence of natural energy resources and general economic conditions, do parties in government play an important role for the development at the state level? We consider potentially influential factors in a fuzzy-set Qualitative Comparative Analysis (fsQCA) focusing on the expansion of renewable electricity production in all 16 federal German states from 2004 to 2014. As a result, two promising ways for accelerated expansion of renewable electricity production can be identified. On the one hand, a group of economically less developed states have succeeded in promoting expansion and uses it as part of an economic modernization strategy. Within the economically more developed states, however, the party-political composition of the state governments (Green party's involvement) plays a significant role. These results also have implications for other (federal) countries beyond Germany, pointing to tailor-made policy strategies that consider these specific circumstances.

1. Introduction

Increasing the share of renewables in the energy mix¹ is one of the central pillars of the German energy transition toward a "non-nuclear renewable system" (Eichelbrönnner and Henssen, 1997, p. 468). This undertaking entails high conversion costs (temporary subsidies for renewable energy sources), as well as significant measures for adaptation (extension of electricity networks, Wurster and Köhler, 2016, p. 285). Even though Germany has already advanced relatively far along this path in an international comparison (Cox and Dekanozishvili, 2015, p. 167), significant regional disparities are evident between individual federal states. There is much variation when considering per capita expansion of electricity production from renewable energy sources for the period from 2004 to 2014 (see Fig. 1). In addition to the differences between the federal states, Fig. 1 also draws attention to temporal variation in the expansion dynamics within individual states. The outcome not only varies between the federal states' present status of electricity production from renewable energy sources but there are also significant shifts in the federal states' rankings over time (and, accordingly, over periods of government in the states).² Whereas some

states, like Brandenburg, Mecklenburg-West Pomerania, and Lower Saxony were able to improve their position over time, others, like Bavaria, experienced a relative decline.

These divergent trends in policy outcome require an explanation, especially because they indicate that, in addition to state-specific, time-invariant determinants (general economic and geographical conditions), time-variant effects over different periods of government might be responsible for developments in renewable electricity supply in the individual federal states. Measures that different government coalitions take (policy output) may have an important impact. Thus, we concentrate on the following research question, which seem relevant for a deeper understanding of the German energy transition toward more renewable energies:

What (party-) political factors, in addition to the existence of natural energy resources and general economic conditions, have significantly influenced increases in electricity production from renewable energy sources within German states?

The answer to this question appears not only important from a theoretical perspective (supplements to the growing comparative policy

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¹ Up to the year 2025, approximately 40–45% of the electricity consumed in Germany must be produced from renewable energy sources; up to the year 2035, this share is to reach 55–60% (Bundesministerium für Wirtschaft und Energie, 2016b).

² Besides the expansion of renewable electricity production, we tested the expansion of electricity generating capacity in the federal states as a potential outcome. While the variation is almost identical, we ultimately decided for the expansion of electricity production, as this indicator is available for more years.

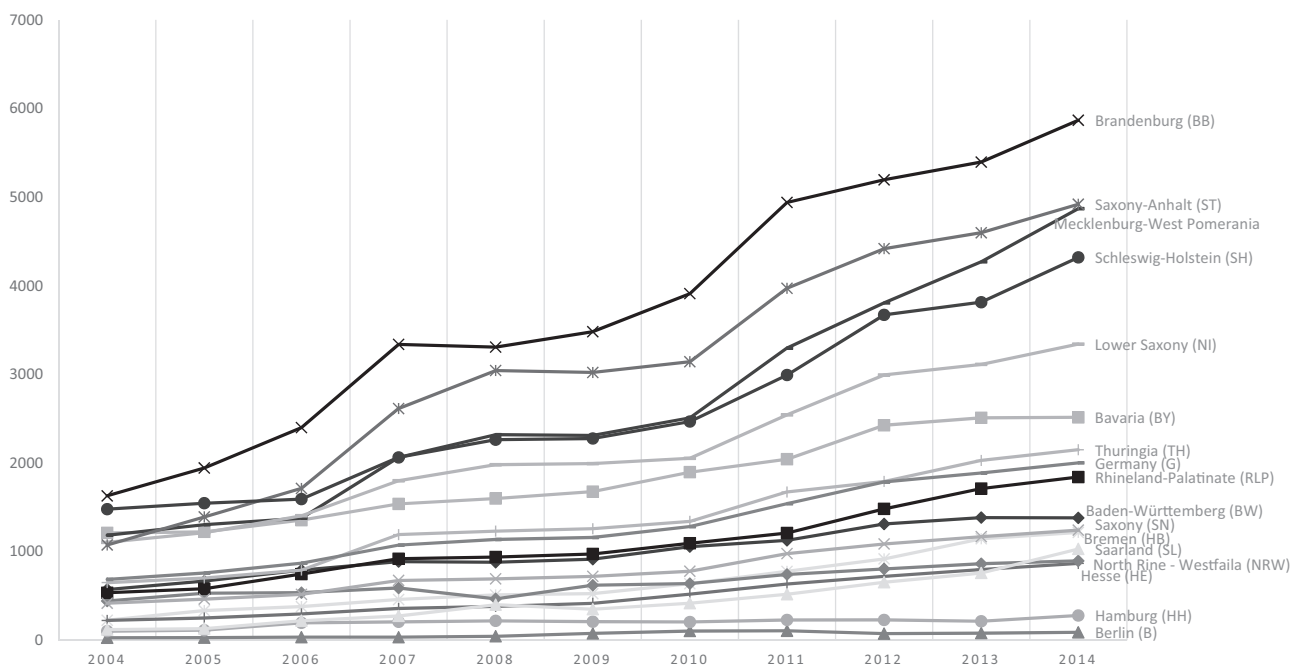


Fig. 1. Expansion of per capita electricity generation from renewable energy sources in a comparison between federal states (in kWh).

analysis literature at the level of the federal states: Schneider and Wehling, 2006; Hildebrandt and Wolf, 2008, 2016; Bräuninger and Debus, 2012; Hörisch and Wurster, 2017), but is also relevant, from a practical perspective, for understanding the conditions of successful renewable energy expansion (see on this also Goetzke and Rave, 2016, Andreas et al., 2017).

The analysis proceeds as follows. The next section is dedicated to the specific structures and developments in the federal states' energy sectors. It then identifies the special challenges associated with the German energy transition, and discusses possible determinants of the expansion dynamics of renewable energies in the electricity sector at the state level based on policy analysis theories. This focus on the characteristics of the energy sector, economic components, and (party-) political factors is presented and then bundled in research hypotheses. This is followed in Section 3 by a detailed description of the methodological approach, before the data used and operationalization of the conditions are discussed in Section 4. Section 5 then analyzes various configurations of success in a *fuzzy-set Qualitative Comparative Analysis* (fsQCA) that considers the expansion dynamics of renewable electricity production in all 16 federal states in the period from 2004 to 2014.³ A conclusion (Section 6) summarizes the results, and points out further research perspectives and important policy implications.

2. Accounting for variation in the expansion of renewable electricity production

2.1. Electricity sectors in the German federal states

As an exceptional economic area (Jochum and Pfaffenberger, 2006, p. 21) the energy sector is characterized by natural monopolies, a line-bound infrastructure, and high hurdles for storage of material requiring transport (Wurster and Köhler, 2016, p. 284f.). In Germany, the electricity sector was long characterized by significant market restrictions (this changed after EU induced liberalizing policies in the late 1990s), high institutional stability (interwoven division of responsibilities between the federal, state, and municipal governments) and continuity of

³ See for a similar methodical approach at the level of European member states Andreas et al. (2017).

key actors (dominance of semi-public, supra-regional, affiliated energy companies and municipal utilities). In addition, the sector proved very stable and saw mainly incremental changes in the energy mixture generated from different sources. The post-war dominance of domestic coal was superseded successively by oil and natural gas from abroad, while electricity produced from nuclear power also gained importance from the 1970s onward (Wurster, 2010, p. 275 et seq.). Whereas the diversification strategy initiated in the 1970s in the wake of the oil price shocks clearly lost momentum in the 1980s, the electricity feed-in law (StrEG) adopted at the beginning of the 1990s served as the first important legal basis for promoting renewable energies at the federal level. The ensuing rapid expansion of renewable energies was intended to fundamentally change Germany's electricity sector (increase in decentralized production, emergence of new electricity providers) and, thus, constituted a real structural breakthrough.

It became clear at an early stage that, in addition to the central government, the federal states play an important role in promoting renewable electricity generation. Accordingly, it was initially federal states that encouraged expansion of renewable energy through their own programs, years before the adoption of the electricity feed-in law.⁴ In addition to the possibility of influencing federal legislation via the upper house of the German parliament,⁵ the federal states possess independent regulatory competencies and instruments to influence the development of renewable energy in their territories.⁶ Their importance for the development of renewable energies in Germany is underlined by the fact that they provide about one-third of total state research funding in this area (Bundesministerium für Wirtschaft und Energie, 2016a).

⁴ In 1987, North Rhine-Westphalia took the initiative with its "program for rational use of energy and inexhaustible energy sources", which included broad-based promotion of energy efficiency, energy saving, and use of renewable energy sources, and served as orientation for further state programs in subsequent years (Mez et al., 2007, p. 99).

⁵ This results from the competing legislative responsibilities between the federal and state governments in this policy field (Wurster and Köhler, 2016). Thus, in negotiations, the federal states repeatedly succeeded in enforcing their own interests via the upper house. As an example, see the amendments to the Renewable Energy Sources Act (EEG; Dagger, 2009, p. 189–205 and 289 f.).

⁶ Accordingly, the federal states are able to adopt state-specific energy laws and employ numerous instruments for implementing energy policy (laws concerning planning, regional development, approvals, etc.).

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