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Preserving Decentralised Laboratories for Experimentation under Adverse Framework Conditions

Why Local Initiatives as a Driving Force for Germany's Renewable Energy Expansion Must Reinvent Themselves.

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Abstract

This paper analyses the enabling conditions, barriers and future prospects of decentralised experimentation with renewable energy sources (RES) in the German energy transition, with a specific focus on the multi-level governance framework. It investigates why, and under which conditions, decentralised experiments have served as a major driving force in the development of RES in Germany, highlighting the instrumental role local governments and the national support scheme for RES have played in supporting and protecting decentralised RES initiatives. Looking at the impact of decentralised experimentation, this paper argues that the scope of decentralised renewable energy development is now such that there is an obvious need for multi-level governance coordination to address the emerging challenges of temporal and spatial disparities between power generation and demand, as well as distributional and land-use conflicts. The authors observe that many local and regional governments have not yet sufficiently considered the coordination required to make their own efforts compatible with overall energy system transition needs. They may lose their function as important facilitators for RES experimentation if they do not start engaging in new approaches to stakeholder participation, coordinated regional energy flows and system integration of RES. Moreover, bottom-up experimentation with decentralised energy system structures is also threatened by recent changes in the political framework conditions at the European and national level which have led to a reform of the German support scheme for RES, including, amongst others, a phase-out of the feed-in tariff scheme and its replacement by an auction scheme. Against the backdrop of these adverse political framework conditions, the paper concludes by discussing strategies to preserve the dynamics of decentralised experimentation as a vigorous driver of the German energy transition.

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1 Introduction

Renewable energies have become the dominant energy source in the German electricity market, providing 157 terawatt hours (TWh) or 25.8% of the total electricity produced in 2014, more than any other single energy source (AG Energiebilanzen, 2014). The rapid increase of renewable energy sources (RES) in the power mix is a key component of Germany's widely recognised energy transition ("Energiewende"). In December 2013 the German government coalition 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.

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

The scale of such an unprecedented transformation means that a predefined and all-encompassing "master plan" is not fitting. Rather, the uncertainties of a transition towards an energy system based on RES means that there must be freedom for constant experimentation and innovation, to explore and test new approaches and to allow for adjustment to dynamic socio-political framework conditions and technological progress (e.g. Rotmans et al. 2001). So far, decentralised experimentation has 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. As a consequence, the German renewable energy market is characterized by a high actor plurality and the emergence of new decentralised actors such as energy cooperatives. The role of decentralised initiatives and their capacity to innovate as "laboratories for experimentation" in federal systems (cf. Oates 1999, Saam & Kerber 2013) has been increasingly discussed in energy and climate governance research. In particular the city level has been highlighted as a critical site for the development and diffusion of innovative energy and climate governance approaches (Kousky & Schneider, 2003; Alber & Kern, 2008; Schreurs 2008, 2010; Anguelovski & Carmin, 2011; Acuto, 2013; Cástan Broto & Bulkeley, 2013; Jänicke, 2013). In their analysis of 627 urban climate change experiments in 100 cities worldwide, Castán Broto and Bulkeley (2013) identify that a plurality of actor groups are engaged in setting up innovative approaches to reducing greenhouse gas emission locally. They conclude that local climate and energy experiments open up "new political spaces for governing climate change in the city" (ibid.: 92), within and beyond formal decision-making processes.

An area that requires more research is how to govern the horizontal and vertical integration of decentralised experimentation in the energy transition process. Key questions include the degree to which local and regional initiatives rely on support and approval at

higher policy levels such as state and central governments and at which point mutual alignment becomes desirable or even necessary. Anguelovski and Carmin (2011) argue that most urban climate action is motivated by internal goals and that most cities set up climate strategies rather independently, while only a minority of the initiatives are top-down or externally induced by national governments, donors, non-governmental organizations (NGOs) or transnational municipal networks. Hakelberg (2014) specifies that while cities often utilize transnational municipal networks as sources of knowledge, frontrunner cities in particular tend to develop local action plans largely independently of subordinate policy levels, while latecomer cities depend more on the guidance and support of the national government. Hakelberg also finds that regional coordination and information flows between neighbouring cities have not yet widely evolved.

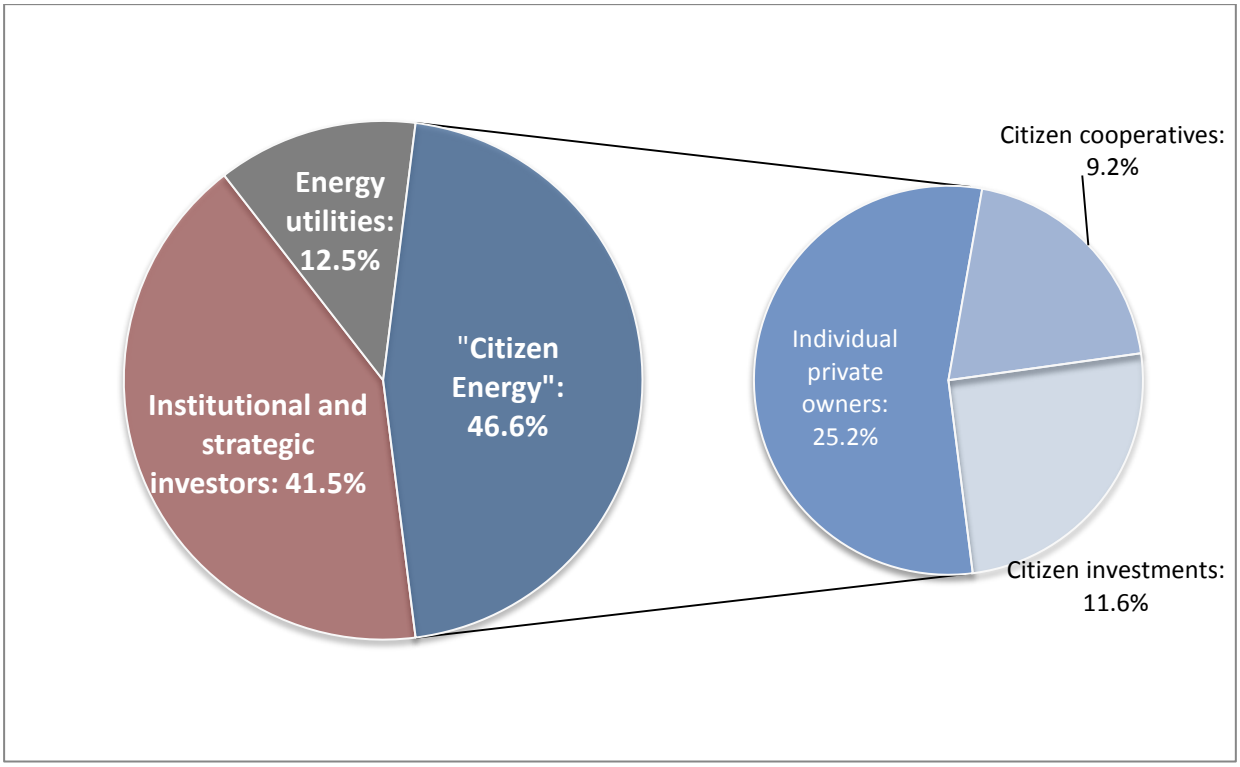
This paper analyses the role, conditions and future prospects of decentralised experimentation in transforming the energy system in Germany, with a specific focus on the multi-level governance framework. It investigates why, and under which conditions, decentralised experiments have served as a major driving force in the deployment of RES in Germany, highlighting the instrumental 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, this paper argues that there is a growing need for multi-level governance coordination of decentralised renewable energy deployment, 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. The authors observe that many local and regional governments have not yet sufficiently considered multi-level governance requirements to make their own efforts compatible with overall energy system transition needs. These bodies may lose their function as important facilitators for the energy transition from below, if they do not start experimenting with new approaches to stakeholder integration, regional energy flows and system integration of RES. Moreover bottom-up initiatives for a decentralised energy system are also threatened by recent changes in political framework conditions at the European and national level which will lead to a phase-out of the price-based feed-in-tariff/premium system and the abolishment of incentives for on-site direct marketing of RES-electricity. Against the backdrop of these adverse political framework conditions, the paper concludes by discussing strategies to preserve the dynamism of decentralised experimentation as a vigorous driver of Germany's energy transition.

2 Decentralised experimentation in renewable energy governance as a key driving force in the German energy transition

2.1 The expansion of renewable energies in Germany is to a large degree promoted by new decentralised actors

One of the most striking features of the German energy transition process is that it is characterized by the rise of new, decentrally organised energy actors, specifically small-scale investors in RES such as private households, farmers and citizen energy cooperatives. According to a survey carried out by trend:research GmbH and the Leuphana Universität Lüneburg (2013) nearly half (46.6%) of the total RES capacity installed in Germany is owned by citizens and citizen energy cooperatives (see Figure 1).

Figure 1: Ownership structure of installed renewable energy capacity in Germany (2012)



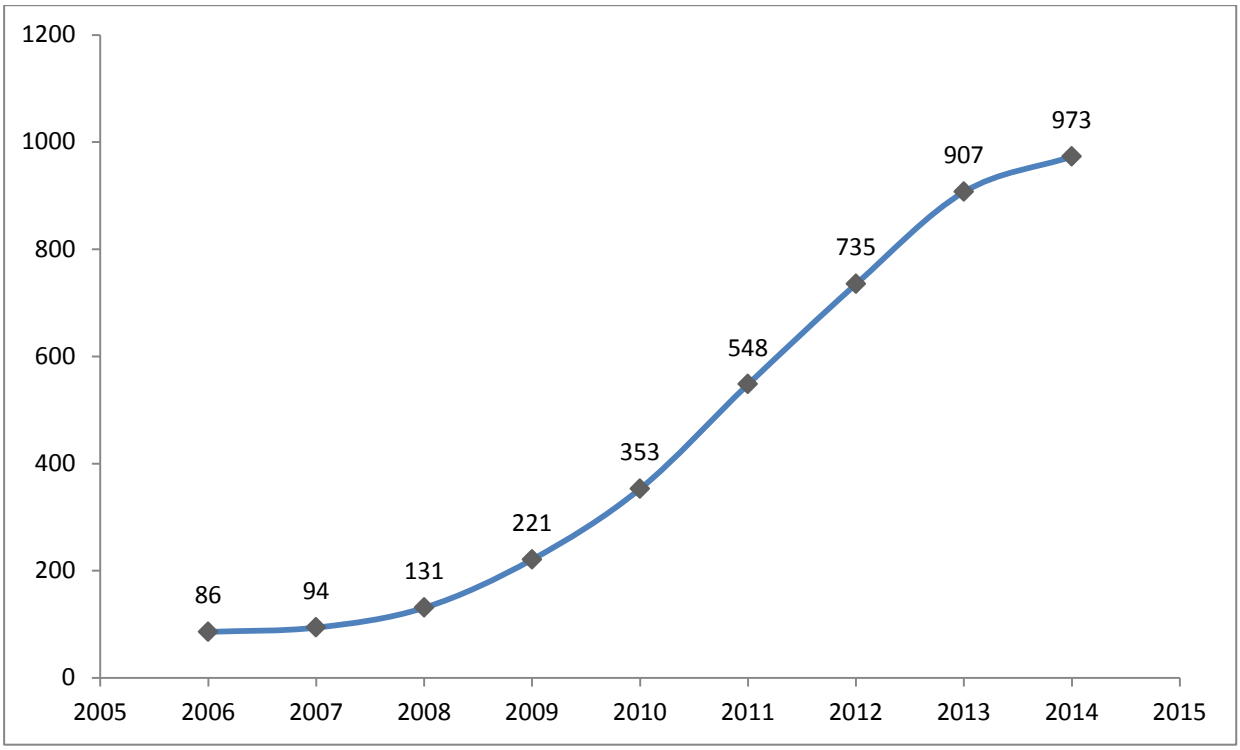
Source: Own illustration based on: Trendresearch, Leuphana Universität Lüneburg (2013)

According to the study, more than one third (36.4%) of the RES capacity can be defined as 'citizen energy in the narrow sense', i.e. it has been set up by local and regional initiatives

in which citizens have the majority of the decision-making power (25.2% has been initiated by individual citizen projects and 9.2% by citizen energy cooperatives)[1].

Locally-rooted and citizen-led projects often pursue broader targets beyond mere return on investment. In a survey measuring the motives for joining citizen energy cooperatives, the participants highlight their desire to contribute to the German energy transition and global climate protection as well as to the prosperity of their region, alongside personal financial reasons (ibid.: 61). The formation of citizen energy cooperatives has gained increasing popularity since the mid-2000s. In the seven years between 2007 and 2014, the total number of registered energy cooperatives in Germany has grown more than tenfold from 94 to 973, peaking in the years of 2011 (195 newly registered cooperatives), 2012 (187) and 2013 (172) (see Figure 2).

Figure 2: Number of citizen energy cooperatives in Germany, 2006-2014



Source: Own illustration based on Müller & Holstenkamp (2015)

The long-term boosting of decentralised renewable energy development has been strongly influenced by the political environment, both at the local and at the national level.

[1] For their definition of 'citizen energy in the wider sense' the authors of the study include an additional 11.6% RES capacity from minority investments of citizens in nationwide projects (see trend:research GmbH and the Leuphana Universität Lüneburg 2013).

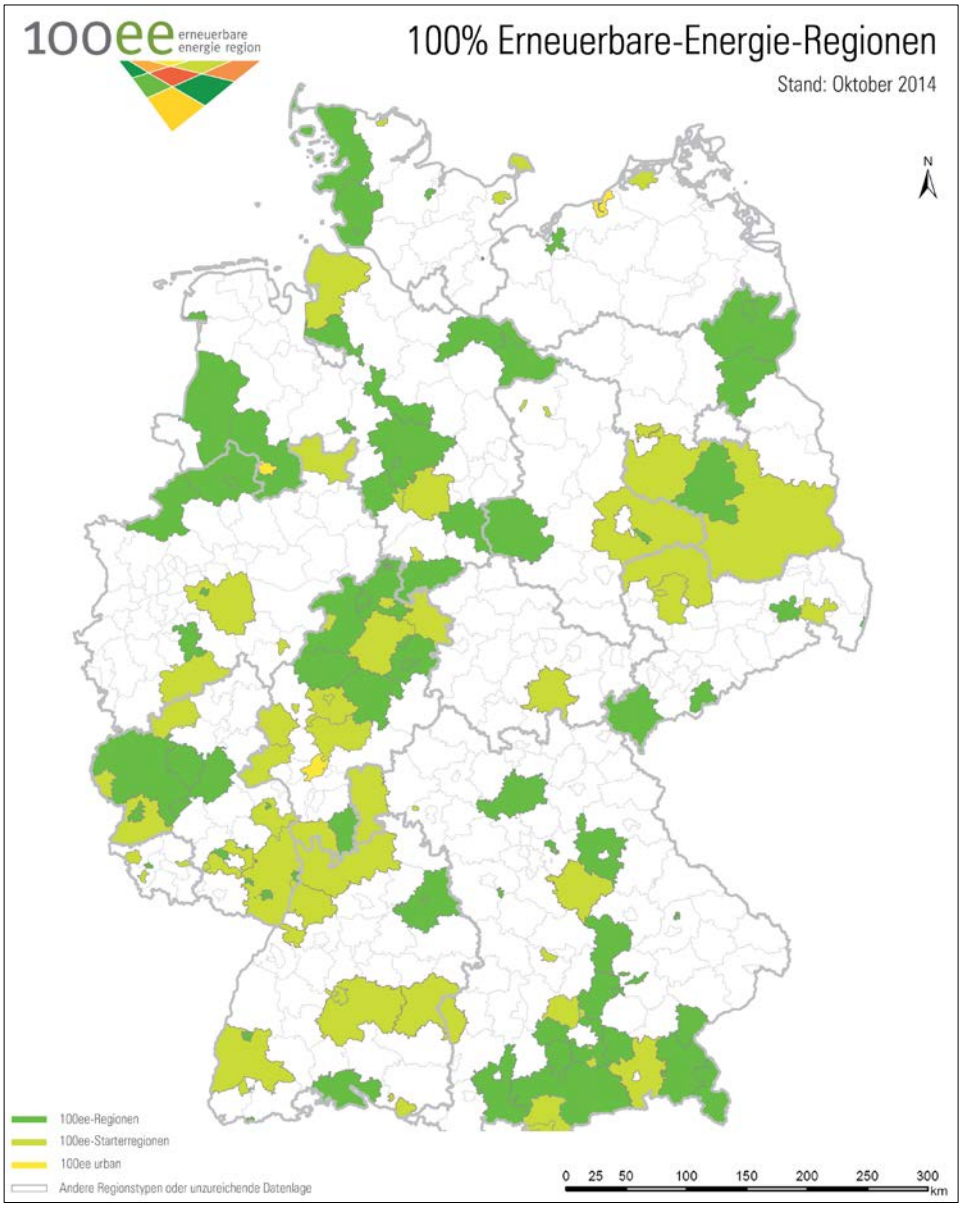
2.2 Local governments have fostered decentralised renewable energy supplies

At the local level, many municipalities and counties have strongly argued for the expansion of renewable energy supply. Local and regional governments in Germany's rural regions, that lack industries and face economic difficulties due to liabilities and demographic change, have been particularly interested in embracing renewable energy development as a means of generating trade tax revenues, local added value and employment. These governments have actively promoted the local expansion of renewable energies through both formal and informal measures.

One example is Dardesheim, a town in Sachsen-Anhalt, where the local council decided in 2006 to pursue the target of generating all of the energy consumed by the town from local renewable energy sources. The local authorities facilitated the setting up of a large wind park with a capacity of 66 MW which now produces a huge electricity surplus, i.e. more than 4000% of the town's electricity demand. The council members convinced the investor to design the wind park in a way which would involve local citizens, many of whom were able to sell their land and invest in the wind park, taking advantage of favourable investment conditions. As an additional investment opportunity the local council provided the rooftops of municipal buildings for the setting up of private photovoltaic applications. To make the benefits of the renewable energy strategy visible to all local citizens, including those that were lacking the funds to directly participate in the projects, the council decided to invest a major share of the annual tax revenues from the wind park in local infrastructure, refurbishing all squares and streets in the town centre. Moreover, the local mayor has also served as a key contact person for both international media and visitors, personally introducing them to the town's renewable energy projects.

Other measures local authorities have introduced to promote decentralised renewable energy expansion are the initiation of RES feasibility studies, thereby reducing the transaction costs for potential investors in RES in the region (e.g. Lüchow-Dannenberg, a county in Lower Saxony), the setting up local energy cooperatives (e.g. Weissach im Tal, a municipality in Baden-Württemberg), and the foundation of municipal energy utilities and the repurchasing of distribution grids (e.g. Bad Neuenahr-Ahrweiler, a town in Rhineland-Palatinate) (see also Berlo & Wagner, 2013; Waller, 2013).

Figure 3: Map of 100% Renewable Energy Regions in Germany



Source: Institut dezentrale Energietechnologien (2014); This map shows members of the 100% Renewable Energy Regions network coloured according to their status: advanced regions (dark green) "Starter Regions" that emulate the advanced regions (light green) and urban areas (yellow). The ratings were based on an analysis of their RES targets, implementation activities, achievements and regional features.

The popularity of decentralised renewable energy deployment amongst local authorities is illustrated by the rapid diffusion of the approach to pursuing a local supply from 100% renewable energy sources. This concept involves feeding the same amount of locally sourced renewable energies (or more) into the grid that the regions consume annually. The 100% renewable energy approach has been adopted by a large number of local governments throughout Germany (see Figure 3). The 100% Renewable Energy Regions network currently comprises 146 members. Together they are home to 25 million inhabitants (about 31% of Germany's total population) and an area of 127,000 km^2 (about 36% of Germany's total

land mass) (Institut dezentrale Energietechnologien, 2014; Statistische Ämter des Bundes und der Länder, 2014). Empirical research on 100% Renewable Energy Regions indicates that the early adopters of this approach were often structurally weak and rural regions, which were motivated by the prospect of fostering local added value and economic development (Beermann, 2009). The achievements of these local initiatives in adding renewable energy capacity are considerable, particularly in the electricity sector. Several regions already cover 100% or more of their own power demand from local renewable energy sources.

It is however noteworthy that most of the 100% Renewable Energy Regions stay connected to the national grid. There are only a few pilot initiatives that have experimented with local energy autarky[2]. The reliance of most 100% Renewable Energy Regions on the overall German energy system is also reflected by the strong dependence of these initiatives on the national support scheme for renewable energies rather than on other forms of direct local marketing without remuneration from the feed-in tariff scheme.

2.3 The national support scheme for RES has protected decentralised renewable energy expansion

Until the most recent reform of the Renewable Energy Act (EEG) in 2014 Germany has applied a price-based support scheme for RES. Support schemes for renewables can generally be divided into either price-based or volume-based systems (ecofys 2014). In contrast to volume-based support schemes that determine quantity targets for the expansion of RES (e.g. quota and auction systems), in price-based schemes the support level is administratively fixed; either independently of the market price by a set remuneration for every kWh of RES-electricity produced as in the case of a guaranteed feed-in tariff (FIT), or linked to the market price with an additional fixed or floating premium, the so-called feed-in premium (FIP). For a long period the German support scheme was based solely on a FIT, which guaranteed producers a set remuneration depending on the specific RES technology for a certain time period (usually 20 years). In 2012 the FIT was supplemented by the introduction of a floating FIP, which producers could optionally choose, in order to stimulate the market integration of RES.

This price-based support scheme, which was complemented by a purchase guarantee and priority feeding-in of renewable electricity into the grid, offered a high degree of planning security for investors and thus, functioned as a shelter for small-scale renewable electricity producers to develop a niche. The returns were apparently not seen as high enough for traditional energy utilities to want to invest in the then niche-segment of the electricity

[2] One example is Feldheim, a village close to Berlin.

market (Kungl, 2014). As the above mentioned ownership structure analysis shows, energy utilities run only 12.5% of Germany's total installed renewable energy capacity (see Figure 1). Rather, the FIT protected projects that were set up by individual citizens, citizen co-operatives or local governments, all of which were not purely driven by maximum profit seeking. When asked about which conditions ensured the successful development of 100% Renewable Energy Regions, local stakeholders highlighted stable national framework conditions, such as the FIT scheme, as equally important as local factors, such as the existence of policy entrepreneurs and comprehensive citizen participation (Beermann, 2009). Against this backdrop the current instrumental shift in the German support scheme from a price-based scheme to a volume-based auction scheme for competitive price determination, will be a serious challenge for the further expansion of decentralised renewable energy initiatives (see chapter 4.2).

3 Decentralised renewable energy development — from a niche to a challenge to Germany's energy system

The expansion of decentralised renewable energy production in Germany has proven to offer a range of benefits including reductions in greenhouse gas emissions, and the boosting of local economic development, citizen empowerment and community life (Beermann, 2009; Hirschl et al. 2010). Meanwhile, the market diffusion of renewable energy technologies for generating electricity has reached the stage at which the need for policy-coordination between distinct levels of jurisdiction has become obvious (Ohlhorst et al. 2013). The so far rather uncoordinated expansion of distributed RES-capacity fundamentally challenges the overall system integration of RES and requires new political approaches—both at the local and the federal level. From the security-of-supply and technical perspectives there is a need to better balance or even synchronize supply and demand for electricity due to the increasing share of volatile RES. A remodelling of the grid infrastructure is necessary, both in terms of quantity in linking the centres of generation with the centres of demand, and in terms of quality in fostering the on-site balance of supply and demand at decentral levels in smart grids.

The most pressing political challenges related to increasing decentralised RES capacity include local, state and national governments' incoherent and competing energy strategies; the lack of a clear vision of the future energy system architecture; increasing occurrences of land-use conflicts; and the unequal distribution of the gains and burdens of renewable energy development. Without better coordination of bottom-up experimentation and the overall governance framework, the energy transition in Germany will lead to cost-inefficiencies and rising social and environmental conflicts.

3.1 Competing interests in the German federal system — spatial disparities between generation and demand

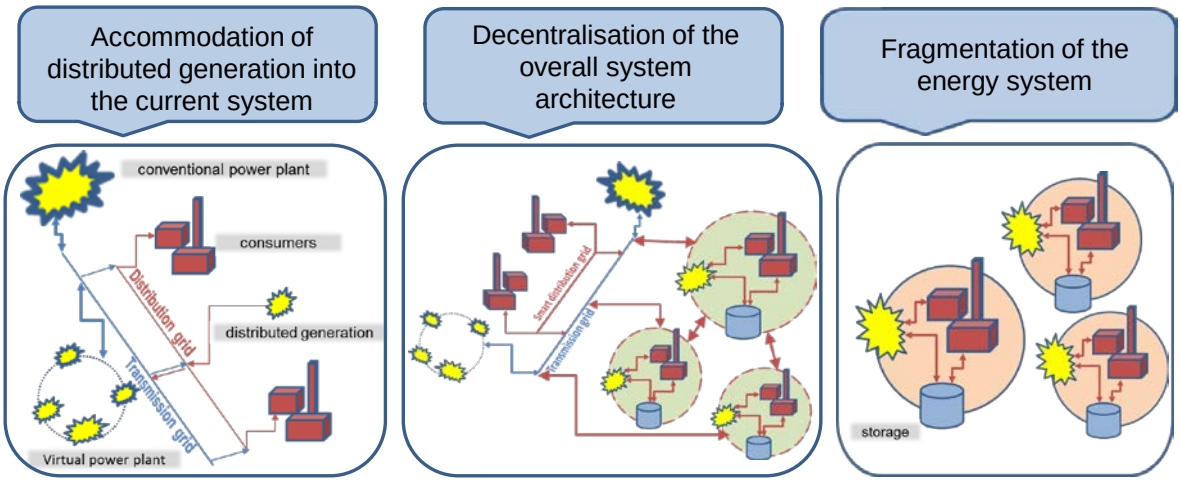
The most obvious political challenge is the lack of multi-level coordination, i.e. the multiplicity of renewable energy expansion strategies made by municipalities, counties, states and the federal government which often lack reference to one another. So far, governments in different jurisdictions have primarily followed their own interests when making decisions about renewable energy targets and implementation policies. As many of the regions with the most ambitious renewable energy strategies are located in the less industrialized, rural North and East of Germany, the problems of grid overload and the lack of transport capacity to the more industrialized and populous regions in Western and Southern Germany are becoming increasingly evident. In order to foster a more balanced renewable energy development between peripheral rural and more industrialized areas in Germany the multiple energy strategies at the local, state and national policy levels need to be more closely aligned.

In Germany's federal system the alignment of political strategies is however not an easy task. The absence of consensus between the different actors and policy levels on how to design the future energy system and market makes this challenge even more difficult to overcome.

3.2 Lack of a guiding vision of the energy system architecture

There is a lack of an *explicit* guiding vision of the direction of energy system transformation in terms of system architecture in Germany, and specifically whether it should it be more decentralised or more centralised (see Figure 4 for an overview of three competing visions on the degree of decentralisation in the future energy system architecture). Answering this question requires fundamental political considerations about not only a cost-efficient spatial allocation of RES capacities across Germany/Europe and the necessary network links or qualities, but also about the variety of actors' motivations to engage in energy transition issues, the distribution of costs and benefits, the public acceptance of infrastructure measures and conflict management.

Figure 4: Expert discourses on different system architecture options



- No optimisation between generation and on-site consumption intended
- Grid structure remains rather unchanged
- Centralised control over the grid (TSO)
- Pooling of distributed energy resources (e.g. virtual power plant)

- Striving for a synchronisation of local generation and on-site consumption in order to relieve the overall grid (as system service)
- Grid structure more decentralised/ interaction between various voltage levels of the grid (TSO+DSO)
- Growing overall grid control by operators at the lower grid levels (DSO)
- DSO responsible to balance supply and demand (active grid management)

- Full synchronisation of generation and consumption (micro-grids, power parks)
- Electricity island/ self-sufficient and separated sub-systems
- Full internal control of the subsystems
- Economic viability of higher voltage grid level is questionable

Source: © Kerstin Tews; own illustration based on Leprich et al. 2005, IZES et al. 2008 (TSO = Transmission System Operator; DSO = Distribution System Operator)

Local and regional initiatives, for example the 100% Renewable Energy Regions, are broadly perceived as the core of a decentralised energy system architecture. However, in the current stage of system transformation a mere focus on generation capacity will not achieve the quality required of a decentralised energy system. The main, although contentious, rationale of a more decentralised energy system is that the fluctuating supply of renewable energies such as wind and photovoltaic can be balanced with a more flexible management of supply and demand in smaller spatial entities which are easier to steer. This will, however, not necessarily lead to fully independent, autarkic subsystems at the local or regional level. Rather, it seems likely that the use of flexibility options for the system integration of RES, such as local or regional load and demand management, may provide services for the overall energy system stability (see Figure 4).

Introducing regionalised energy flows and the development of the necessary smart grids would reduce the need for supra-regional high-voltage grid infrastructure. So far, however, the German federal government has failed to provide adequate incentives for making use of flexibility options at the decentral level and the development of a smarter grid infrastructure. Rather, the grand coalition of conservative Christian Democratic parties (CDU and CSU) and Social Democrats (SPD) is discussing the construction of high voltage trans-

mission power lines that are intended to transport electricity from Germany's Northern and Eastern regions to the Southern regions. However, the concept of balancing energy supply and demand via a dense network of high-voltage transmission lines (the so-called "copperplate" model) is also highly controversial and has evoked citizen protests in the areas where the lines are to be built.[3]

3.3 Unequal distribution of costs and benefits

A major reason for the protests against the construction of power transmission lines and other large energy infrastructure projects is the perception that the gains and burdens of the renewable energy deployment are unequally distributed within and between municipalities, counties and states. This challenge also needs to be addressed through the introduction of new coordination mechanisms. The mass introduction of decentralised renewable energy capacity has evoked conflicts between actors that enjoy the benefits of the local promotion of renewable energies, such as developers and operators of renewable energy plants, and actors that feel exposed mainly to the burdens of renewable energy development, such as noise, shadows, building operations and the devaluation of real estate in areas close to renewable energy plants and high-voltage power lines (Thom 2013). To negotiate these distributional conflicts new arenas, mechanisms and guidelines need to be established that take into account the interests of all relevant stakeholder groups and foster compromises and reconciliation (see Renn et al. 2014).

3.4 Land-use conflicts

Innovative coordination mechanisms are also required to resolve land-use conflicts arising from the large-scale production of renewable energies such as wind parks, ground mounted photovoltaic and biomass. Potential operators of renewable energy plants increasingly compete with agriculture, tourism, as well as nature and landscape protection bodies for the use of limited land. In Germany's federal political system, decisions about priority areas for renewable energy plants are negotiated between municipalities, counties, 'planning regions' (that include several municipalities and counties) and subnational states, depending on the specific polity set up in the respective states (Klagge et al. 2013, Liebrenz 2013, Thom 2013). In some cases, such as the minimum distance between wind turbines and residential buildings or their construction in nature reserves, regulatory requirements at the state and federal policy levels limit local decision-making. As in distribution conflicts, the use of the land available needs to be negotiated in new governance arenas. The following

[3] This led to a divide within the coalition government, in which the Social Democrat and Minister for Economic Affairs, Sigmar Gabriel, strongly supports the project whereas Horst Seehofer, the head of the CSU, the regional branch of the Christian Democrats in Bavaria, opposes the initiative due to local opposition in his state.

questions need to be addressed: What are the demands on land-use in areas that are suitable for renewable energy deployment? How do conflicting land-use demands affect the scope of decentralised renewable energy deployment and target setting? Which institutions and stakeholders need to be involved? What guidelines and instruments for conflict resolution can be applied?

4 Observed deficits in multi-level governance coordination

The challenges described above highlight that new coordination mechanisms must span all relevant policy levels, both horizontally and vertically.

Regional governance approaches are increasingly required to coordinate the interests of local citizens and stakeholders, whose interaction and mutual influence often exceeds the spatial boundaries of political-administrative jurisdictions. Coordination is also required between the strategies and priorities of the different political-administrative levels of the German federal system and its European neighbours, plus the European Union. Moreover, a social discourse is needed on the development of guiding concepts for the design of a future energy system that is mainly based on volatile RES. These guiding concepts must take into account not only considerations related to the most cost-efficient spatial allocation of generation capacities across Germany or Europe, but also the varied interests and goals of the diverse actors engaged in the energy transition so far.

We argue that local and regional governments are not yet sufficiently prepared to address the new task of a multi-level coordination. Furthermore, we illustrate that although the recent reform of the national support scheme for RES towards a volume-based scheme with a competitive determination of the support level has some coordinating effect, it also threatens to stall decentralised experimentation.

4.1 Local and regional governments need to start experimenting with new approaches to stakeholder participation and regional coordination of energy flows

Municipalities and counties need to intensify citizen and stakeholder participation and address regional coordination of energy flows and system integration of RES to improve the horizontal and vertical integration of decentralised renewable energy development.

Support from local citizens is generally a prerequisite for the realisation of renewable energy model communities. In Germany's political system, the introduction of local renewable energy strategies is a voluntary and non-binding governance tool for municipalities and counties. The involvement of key stakeholders in the design of local energy concepts, and awareness and acceptance of the concepts by the local population are therefore crucial preconditions for the projects' success. Several 100% Renewable Energy Regions in Germany have demonstrated that a high degree of stakeholder and citizen participation strongly

facilitates the successful implementation of local renewable energy concepts. Ensuring this participation does however require the investment of additional time and resources at the beginning of the initiatives[4] (Beermann, 2009). An evaluation of the German government's National Climate Protection Initiative (NKI) has in turn shown that when local energy concepts are set up by technical experts, such as engineering consultancies, without the involvement of local stakeholders and citizens, their impact is limited (Öko-Institut e.V. et al., 2012).

In order to realise a true "energy transition from below", local initiatives also need to better utilize their capacity as laboratories for decentralised energy solutions and prove that they are able to foster regional coordination of energy flows. Thus, municipalities and counties need to extend their focus beyond the mere installation of additional local renewable energy capacity and (re)consider their role in the overall energy system. Local initiatives need to demonstrate their potential to improve energy security by establishing manageable regional supply systems based on an integrated generation-*and*-demand-management (see also Leprich et al. 2005; IZES et al. 2008). This requires an analysis of local and regional potential in terms of renewable energy production, energy demand and grid infrastructure, to define the adequate spatial dimension of a regionalised supply structure. In many cases the adequate spatial dimension may exceed the legal borders of jurisdictions. Decentralised initiatives such as 100% Renewable Energy Regions therefore need to foster alignment and mutual compensation with their neighbouring regions and address the questions of if, and how, their ambitious local renewable energy expansion targets are compatible with the energy strategies of their planning region and state.

So far, very few local initiatives have taken on the ambitious task of considering regional cooperation and system services. This is again exemplified by the 100% Renewable Energy Regions, many of whom are primarily inward-looking in their target setting and choice of implementation measures (Ohlhorst et al. 2013). Most of these regions implicitly take the national grid for granted, seeing it as a back-up and regulator that balances regional energy supply shortfalls or overproduction. At the same time they have largely neglected to reflect on their own role and contributions to actively shaping the move towards a more decentralised German energy system.

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[4] The town of Dardesheim, for example, has demonstrated that the financial involvement of local citizens in particular can significantly enhance citizen acceptance of local renewable energy projects. Initially, many people in Dardesheim were sceptical about the idea of constructing a wind park so close to their town. In consultation with the local council the wind park investor decided to redesign the formation of the wind turbines so that more local land owners benefited from selling their properties, even if this led to marginal efficiency deficits in terms of electricity production. Local citizens from Dardesheim and the surrounding municipalities were also offered a special rate of return for investing in the wind park. As a result, the project to transform Dardesheim into the "Town of Renewable Energies" ("Stadt der Erneuerbaren Energien") now enjoys very high approval rates among the local population (Beermann, 2009).

As mentioned above, the German energy transition is an ongoing societal reform project which does not follow a pre-defined master plan. This gives decentralised initiatives great scope to serve as model projects and exert influence on other policy levels (both horizontally and vertically). Yet, the dependence on the future energy market design also forces local initiatives to apply flexible governance tools and mechanisms that are able to adjust to changing framework conditions.

To further develop and experiment with innovative solutions to a decentralised energy system architecture local and regional actors need a friendly political environment, i.e. one with facilitating political framework conditions. As recent policy choices at the EU and the German federal level however suggest, these framework conditions seem to pose barriers rather than new facilitating opportunities for bottom-up-driven processes.

4.2 Changing national framework conditions threaten to stall the "energy transition from below"

Recently the German government made a fundamental instrumental shift regarding the support scheme for renewable energies. The reform of the EEG was adopted by the parliament on June 27, 2014. Not only will direct marketing be mandatory for all newly installed renewable energy facilities with a capacity of more than 100 kW by 2016, but also by 2017, instead of a fixed feed-in tariff, support will be granted as a premium in addition to the market price. The level of aid granted will be determined by a competitive bidding process. Thus, Germany will introduce a volume-based auction system, which fundamentally differs from the previous price-based support scheme with administratively fixed prices for RES (see chapter 2.3).

This instrumental shift can not only be explained by domestic factors. Rather, the move has been forced to a great extent by supranational pressure from the European Commission (EC) (Tews 2014). The EC has made repeated attempts to harmonize national support schemes on renewable energies and to promote volume-based quota systems, as they were perceived as the most adequate instrument choice for an integrated energy market. Nevertheless, such volume-based economic instruments were not the preferred choice of the majority of European countries. Where implemented, for example in Great Britain and Poland, the volume-based quota-system did not perform well (ecofys 2014: 81). Instead, price-based feed-in-tariff systems diffused among member states (Bechberger et al. 2003, Tews et al. 2003, Busch 2005), due in particular to their effectiveness in promoting additional renewable energy capacity.

However, the EC's efforts to bring about regulatory harmonization have intensified since the end of 2013. These efforts included the revision of the state aid guidelines[5], as well as the opening of infringement procedures against national support schemes, in particular against the German FIT scheme[6]. The new guidelines on state environmental and energy aid contain provisions which seriously interfere with member states' national authority to shape support schemes for RES. The guidelines specify design features for national RES support schemes which ensure that they meet compatibility requirements and foster "market integration" of renewable energies. The German government reacted to these EC state aid guidelines by transforming the German support scheme into a volume-based auction system.

It would, however, also be a mistake to attribute this instrumental shift in the German support scheme for renewable energies only to supranational pressure. In fact there has also been a long-lasting domestic debate on the need to introduce cost and volume controlling elements into the German scheme with the "market integration" of RES becoming a crucial indicator of their maturity. Thus, the necessity to adapt to the existing market structure became a dominant and highly influential position among the actors in the energy fields (Kungl, 2014; Wassermann, Reeg & Nienhaus, 2015).

Nevertheless, it was primarily the EC's pending infringement procedure and the subsequent standstill requirement[7] that led to a very hasty reform of the German support scheme and a rejectionist stance by the government toward stakeholder proposals for al-

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5 The Commission's state aid guidelines define exemptions to the general prohibition of state aid in the internal market and define specific justifications for state aid, which supersede competition rules. Since the introduction of the Single European Act in 1986 state aid guidelines have been an effective means for the EC to extend its own scope for action against member states. As a type of European "soft law" these guidelines are not directly binding for the member states. However, due to their binding effect on the Commission's decisions regarding whether national provisions conform with state aid rules, they have a meaningful law-shaping effect on the national policies of member states (see Hartlapp and Bauer 2011).

6 In parallel with the publication of the draft state aid guidelines, the Commission opened a state aid infringement procedure against Germany in December 2013. In order to understand the relevance of this infringement procedure within the struggle over support schemes, it is important to note that the German FIT scheme has been recognized by many scholars and practitioners as a role model for subsequent national adoptions of similar FIT/FIP-based support schemes in several other European countries. Although, ostensibly, the procedure was linked to the exemptions granted for German electricity-intensive companies regarding the renewable energy surcharge, there is some evidence suggesting it was in fact motivated by a desire to further substantiate the Commission's demand for more market-based and harmonized support schemes (for more details see Tews 2014).

7 The Commission's decision to initiate an infringement procedure resulted in the so-called "standstill requirement" (Article 88, TFEU), which results in the immediate suspension of the respective national provision. In the case of the infringement procedure against Germany, the EC's decision suspended further multi-billion Euro exemptions to German energy-intensive companies until the final outcome of the infringement procedure had been reached or a timely amendment of the national legal provision (The Renewable Energy Act) with prior notification and approval by the European Commission made (for further information see Tews 2014).

ternative instruments which may have conflicted with the Commission's state aid rules (Tews 2014).

This instrumental shift is perceived by many stakeholders as a serious threat to the further engagement of the new local actors who have driven the transition thus far. From a stakeholder assessment of the redesigning of the EEG and studies on the performance of different design options for RES support schemes (ecofys 2014, IZES 2014, AEE 2014a) one can derive the following risks:

- Higher transaction costs for investors taking part in auctions
- Higher risks for investors due to the uncertainty related to the winning of bids at auction
- Exclusion of smaller players due to the expense/risks for cooperatives and private actors
- The threat to the process of decentralisation of the energy system through spatial concentration of generation facilities
- Exclusion of less mature RES technologies
- Questionable effectiveness of actual project implementation and cost-minimizing effect as demonstrated by the implementation of auction schemes in other countries (ibid.).

The German government has publicly declared that it will pursue actor plurality in its future energy system and will not threaten subnational efforts towards a low-carbon energy transition. However, we argue that the recent shift in the German renewable energy support scheme will seriously threaten further engagement and investment at the decentralised level. Auction systems risk discriminating small operators and citizen initiatives and may thereby negatively impact the development of decentralised experimentation and the popularity of the energy transition among the German population. Müller and Holstenkamp (2015) demonstrate that the trend towards the formation of energy cooperatives is already declining; with the number of newly registered energy cooperatives having dropped to 66 in 2014 (see Figure 2). Additionally, the investment activities of existing energy cooperatives have significantly decreased. According to a survey of energy cooperatives by the Deutscher Genossenschafts- und Raiffeisenverband (DGRV) cooperatives abandoned investments totalling some 300 million Euros in 2014 (AEE and DGRV, 2014).

In January 2015 the German government published its ordinance for the launch of the first pilot bidding round for ground-mounted photovoltaic systems. This pilot auction scheme is intended to gain the experience required for the introduction of mandatory auction scheme for all new renewable energies in 2017. The complex requirements for participating in this scheme already show that the mechanism requires substantial bureaucratic effort, as it is hugely challenging to incorporate all the peculiarities related to German plan-

ning and construction law in a system of tenders. In contrast to the German Energy Minister Gabriel's public declaration not to threaten the plurality of actors investing in RES, the ordinance does not contain any special provision for smaller actors' participation. The German Renewable Energy Federation is concerned that citizen energy cooperatives and local authorities may not be able to afford the immense transaction costs of preparing legally secure bids (BEE, press release, 21.01. 2015). And decentralised actors may face further problems in submitting competitive bids due to their limited ability to diversify risks compared to bigger energy utilities.

Furthermore, the requirement to sell RES electricity at the European Power Exchange EPEX Spot in order to receive the market premium does not correspond with the concept of a decentralised energy transition. As a mandatory model, direct marketing at the wholesale market suppresses regional marketing models for green electricity which aim at stimulating system integration of RES through regional supply structures.

Also other provisions in the revised EEG, such as the withdrawal of the green electricity privilege (GEP) and the introduction of a surcharge on the self-consumption of PV-electricity, hamper the development of business models that promote green electricity locally and regionally. The green electricity privilege (GEP) offered exemptions or lower rates of the EEG-surcharge[8] to electricity suppliers if at least 50% of the whole electricity portfolio they provide to their end-users is generated by RES, including a minimum of 20% volatile RES. Thus, the GEP offered RES producers an alternative form of direct marketing outside the wholesale market and without remuneration from the support scheme. But most importantly for the decentralised deployment of RES was the GEP's goal of stimulating system integration of renewable energies by offering suppliers of green electricity incentives to balance fluctuating renewable energy supply through dispatchable power plants and/or demand-side management measures (see Hummel 2012). Thus, the GEP's approach of directly selling green electricity to retailers provided an ultimate guarantee of origin for end-user who wanted to buy green electricity and support decentral RES production in Germany. In addition the GEP's requirement to fulfil quotas was also an incentive for electricity suppliers to develop regional approaches to balancing supply and demand in smaller spatial entities which are easier to steer. However, the provision was fully eliminated in 2014 due to conflicts with EU competition law, signalling the end of one of the very few economic incentives to regionally control energy balances through the use of flexibility options such as demand and supply-side management.

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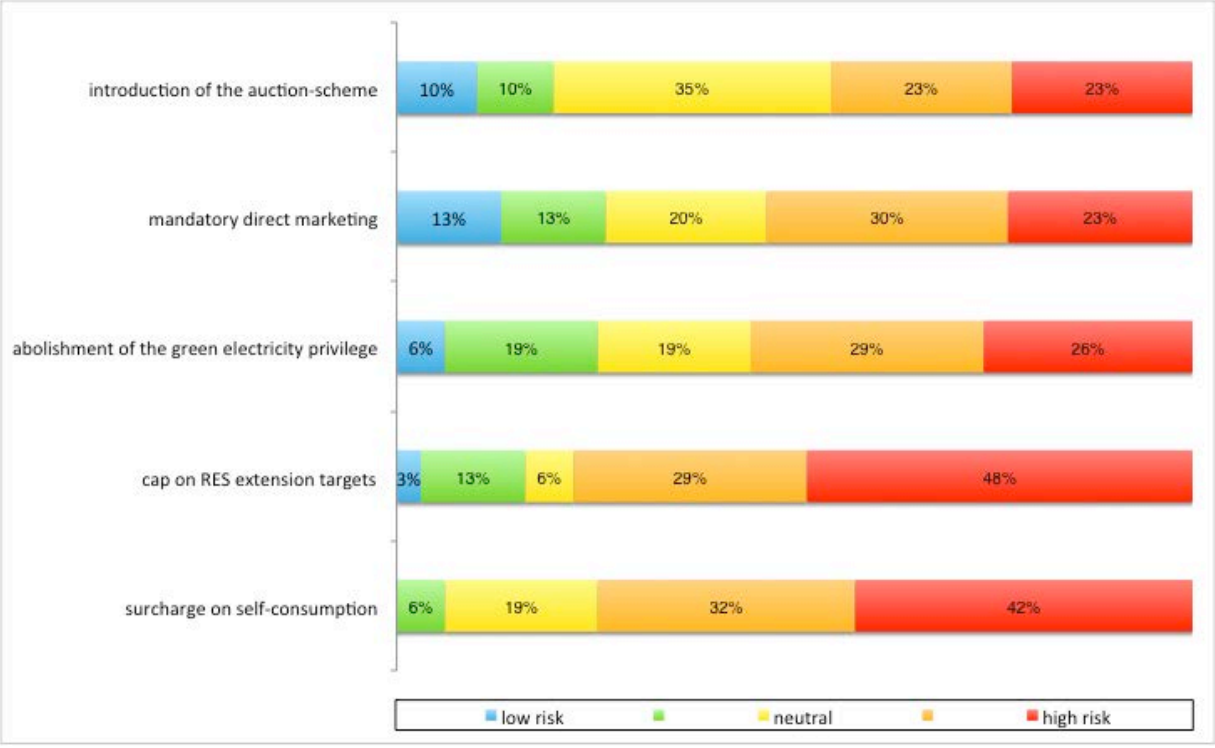
[8] The EEG-surcharge (measured per kWh) is paid by electricity consumers that are not exempted by special regulations. Currently (as of 2015) the surcharge is 6.17 cents/kWh. The surcharge is calculated annually by transmission grid operators and reflects the differential between grid operators' expenditures for funding payments to RES operators and the revenues from selling RES electricity on the wholesale market.

Figure 5: Results of an AEE-survey: Assessment of the level of risk to municipal renewable energy development associated with different instrumental changes resulting from the revised EEG (n=31)



Source: Own illustration and translation, based on the published results of an AEE-survey among 89 energy municipalities in July 2014 (AEE & DGRV, 2014).

Regional and local actors seem not yet fully aware of these new barriers that the reform of the German support scheme for RES imposes on decentralised energy initiatives. Nevertheless, according to a small ad-hoc survey which the Agentur für Erneuerbare Energien (AEE) conducted among local authorities, there is already a perception that the political environment for bottom-up energy transition initiatives is becoming increasingly unfriendly (see Figure 5).

5 Conclusion: How can decentralised experimentation survive in adverse conditions?

The new political framework conditions have severely reduced the scope for bottom-up experimentation in the development of decentralised energy system structures.

The most recent policy choices made in Europe and Germany provide evidence of the EC and German national government's implicit visions for the design of the future energy system. These visions foresee an integration of RES in existing structures, characterized by large-scale markets and infrastructures (Tews 2014, Wassermann et al. 2015). New actors in the energy field who promoted the vision of decentralised structures with a decentralised balance of demand and supply have repeatedly criticized this narrow focus on making

RES market-compatible. Various researchers have also pointed to the shortcomings of this focus; they distinguish between market integration and system integration of RES, pointing out that due to RES' volatile nature they will never fit with the current wholesale market design based on marginal cost (Leprich et al. 2012; Hauser & Zipp, 2013).

However, as Wassermann et al. (2015) state in their analysis of German actors' strategies to influence the regulatory framework, actors supporting a more decentralised energy system were unable to construct the necessary political "coalitions with government units in order to find support for their suggestions of alternatives" (ibid.: 73). We argue that advocates for decentralised structures have not only failed to convince national government actors of their arguments, but they have also largely failed to communicate the needs of a decentralised energy system to the relevant political, civic and economic actors at regional and municipal levels. As mentioned above, many of the 100% regions appear not to have yet realized that the decentralisation, which they intend to pioneer, goes far beyond the mere installation of distributed renewable capacities.

Even before the German government fully abolished the GEP, regional marketing was only a niche-approach pursued by a small number of producers of RES electricity providers (AEE 2014b: 23). Most of them, including citizen cooperatives and municipal utilities, had already decided in 2012 to use the market premium model to directly sell their green electricity on the wholesale market[9] (Wassermann et al. 2015: 72). In 2014, 87% of installed wind capacity and 16% of installed photovoltaics were sold on the wholesale market (50hertz et al. 2014). Thus, the majority of RES producers have used a marketing model which consolidates path dependencies, i.e. large-scale and centralised instead of decentralised structures.

In fact, the framework conditions for the experimentation with the GEP or other regional marketing models had become more restrictive and only attractive for those RES-facilities with a low or phased-out remuneration from the FIT-scheme as far back as 2012 (Hummel 2012, AEE 2014b, Wassermann et al. 2015). It is however even more vital that in future bottom-up energy transition efforts local actors are more aware of the fact that how they sell green electricity shapes the structural development of the energy system and in particular, whether it becomes more decentralised or not. When local and regional initiatives, such as the 100% Renewable Energy Regions, recognise that it is not sufficient to just "produce and forget" RES, and decide to actively shape the energy transition from below, they

[9] As this requires a high level of professional skills and knowledge most of the producers of RES use intermediary actors, which provide direct marketing services, and thus RES producers mainly function as passive followers of their strategic selling activities on the wholesale market (Wassermann et al. 2015: 69).

have to start experimenting with innovative new business models for regional marketing and the use of flexibility options to regionally balance demand and supply.

We have shown that currently the political framework conditions are unfavourable for such risky experiments. However, the energy transformation process does not follow a predetermined path. Nobody can predict whether current political decisions on market mechanisms will perform well in practice. Experimentation in niches is a proven way of stimulating the innovations which are required to destabilise existing lock-in mechanisms. Against this backdrop, advocates of an energy transition from below - energy cooperatives, municipalities, 100% Renewable Energy Regions and green electricity providers – have to build alliances with one another and with governmental actors at several levels. They can then leverage these alliances to lobby more effectively for a regulatory framework which offers room for the experimentation and innovation required for an energy transition that extends beyond traditional centralised and large-scale structures.

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