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Research Paper

Spatial energy planning in Germany: Between high ambitions and communal hesitations

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ABSTRACT

The paper presents the necessities and preconditions for an integrated energy planning process in Germany. The legal requirements and regional governmental frameworks for such a process were analyzed and implemented in a case study in Bavaria. The recommended public participation process was enhanced through a questionnaire, which included a choice experiment projecting tailor-made visualizations of renewable energy sources in the local landscape. The results of the questionnaire and the choice experiment provided in-depth insight into preferred and accepted locations for wind turbines and ground-mounted photovoltaic systems, and furthermore revealed preferences regarding investment models, likely household savings and the promotion of renewable energy solutions. The paper concludes with recommendations for similar planning processes.

1. Introduction

Since 2007, climate change adaptation and mitigation have become core issues of the European Union (EU) and have been implemented in a multitude of ways. Through the Europe 2020 strategy, the EU fosters smart, sustainable, and inclusive growth. Building upon the ambitious 20-20-20 targets envisaged therein, the EU developed the 2030 Framework for climate and energy, which aims to cut greenhouse gas emissions by 40% compared to 1990 levels, to increase the share of renewable energy consumption to 27%, and to achieve energy savings of at least 27% compared to the business-as-usual scenario (European Commission, 2014). Like other European countries Germany set ambitious goals to increase its renewables share to 60% of gross final consumption and 80% of electric consumption by 2050 (BMWi, 2014). These national targets can only be met fully if each federal state pursues equally determined goals (Jonck & Hodsman, 2012; Zaspel, 2014). Therefore, the respective federal states have incorporated their policy objectives in their state government roadmaps. Bavaria is one of the most determined examples, which aims to increase its renewables share of gross final consumption to 20% and the share of electric consumption to 70% by 2025 (Diekmann et al., 2014; StMWi, 2016). Until 2025, solar power is projected to generate 22% to 25% and wind turbines between 5% and 10% of electricity produced, contributing to the goals of reducing CO_2 emissions to 5.5 t per capita (Dirnberger, Hesse, Hummel, Schubert, & Linhart, 2012; Schmidt, Dunkel, & Hofmann, 2014; StMWi, 2016). The renewables expansion is very likely to influence and change Bavaria's cultural landscapes, potentially leading to land use conflicts, and competing interests of infrastructure, nature conservation, recreation, and tourism (Herden, Geiger, & Milasauskaité, 2012). According to German law, these conflicts and the required trade-offs need to be addressed through spatial planning on different levels (Busse, Dirnberger, & Schmidt, 2013). Ultimately, communal planning authorities will face the most stringent coordination task, as the Bavarian provincial government relies on the communal planning sovereignty in a bottom up approach (municipalities may act on their own authority regarding all local affairs within their municipal boundaries under the consideration of regional plans), rather than on strict provincial (top-down) regulations, to lay down plans and designate areas for renewable energy sources within the communities' boundaries (StMWi, 2016; Zaspel-Heisters, 2015). Due to the ambitious national goals, the communities are facing the challenge of trading off their own social, economic, and ecological demands against the necessity of renewables. Therefore, based on the results of a model project in a community in Bavaria, this paper aims to

- investigate the requirements for a suitable planning process on the communal level and its crucial trade-offs,
- illustrate relevant issues with participation during the planning process,
- and discuss the challenges for communities to successfully

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contribute to the goals of the Bavarian Energy Program.

2. Literature review

When analyzing energy planning processes, two aspects need to be considered. Firstly, the role of communication, participation and decision making and secondly, the prevailing regulations of respective legal planning frameworks.

2.1. Participation and trade-offs in energy planning

Two considerations are crucial in the context of the present study: 1. how can participatory processes be fostered and strengthened to become a significant part of any forward planning instrument and a crucial element of behavioral change? 2. how can the true trade-offs between the public's visions, individual interests, commercial, social and ecological aspects and the legal requirements be ascertained and incorporated appropriately?

Since participatory processes have proven to be vital for renewable energy implementation, the importance of engaging the public in energy planning and decision-making has been a vastly developing area of research over the past years, particularly under the paradigm of local acceptance of renewable energies, (e.g. Blanco et al., 2009; Devine-Wright, McAlpine, & Bately-White, 2001; Dimitropoulos & Kontoleon, 2009; Ek & Persson, 2014; Musall & Kuik, 2011). Wolsink (2007) points out that collaborative planning approaches can be used to build institutional capital (e.g. knowledge or relational resources, capacity for mobilization), which facilitates the development of suitable renewable energy systems. It can be assumed that successful energy planning is largely dependent on citizens' acceptance of measures and on the number of citizens participating in the planning process. In general, the public can contribute to communal planning within the scope of urban land-use planning in many European countries (e.g. StMWi, 2016). Public participation can take place with varying degree of involvement (e.g. information, consultation, cooperation, and participation) and intends to ensure that all conceivable interests are taken into account and that participants can identify themselves with the resulting measures (Mackrodt, 2014). However, public involvement in formal planning processes is often rather limited. During the usual two-step participatory process, information is provided to the public, which then has the opportunity to express personal opinions or contribute additional knowledge to the planning process (Pahl-Weber & Henckel, 2008). However, the existing legally required processes have, at least in Germany and Austria, no forum for actual discussion, exchange, dialog, or learning. Rehberg and Hoffmann (2014) justifiably criticize, that participation in communal planning remains still a "niche topic", which only appeals to a small portion of the general public. In the context of climate change adaptation, a deeper understanding of participation is needed to meet future challenges on a communal level.

The burden of a fair trade-off between public goods, such as unspoiled landscape, quietness or high biodiversity, and private interests, such as low energy prices, mainly occurs on the communal level, as certain features may only be assessable on this small scale. On the one hand, this bottom-up approach amplifies self-governance and freedom of choice and is thought to be the most successful strategy for communal climate change adaptation (e.g. Roseland, 2012). On the other hand, devolving planning responsibilities to the local scale may result in *"largely incoherent, fragmented and unstable policy settings"* (González, Daly, & Gleeson, 2016, p. 18), as municipal planning authorities face the challenge of integrating social, economic, and ecological aspects into the planning process. The community needs to create tailor-made, publicly acceptable, feasible, and ecological sound solutions through weighting of and trading off these aspects. Renewable energy systems and their locations have different visual and trade-off impacts (Herden et al., 2012). Hence, identifying suitable renewable energy systems for their jurisdiction and exploring appropriate locations requires a thorough understanding of the environmental and economic impacts of the source, the citizens' valuation of these impacts, and the marginal rate of valuation between them (Busse et al., 2013; Kosenius & Ollikainen, 2013). Overall, the discussion of trade-offs in the context of renewable energy includes impacts such as

- the type of renewable energy and its location and visual impact (e.g. Dimitropoulos & Kontoleon, 2009; Herden et al., 2012; Toke, Breukers, & Wolsink, 2008),
- the renewables' structure (e.g. Söderholm, Ek, & Pettersson, 2007; Toke et al., 2008; Warren & McFadyen, 2010),
- the expected cost-benefits (e.g. Li, Birmele, Schaich, & Konold, 2013; Zoellner, Schweizer-Ries, & Wemheuer, 2008), and
- the applied planning process (e.g. degree of public participation, procedural justice, and levels of trust) (Devine-Wright, 2005; Devine-Wright et al., 2001; Zoellner et al., 2008).

All of these factors have been identified as highly important trade-off impacts for successful communal energy-planning. As these assessments are specific for each community, their evaluation and definition need to build the basis of each energy planning process.

2.2. Regulations and frameworks for energy planning

Since climate change adaptation and mitigation have been incorporated into regional planning, they have become a crucial task for all German communities. Several legal instruments need to be considered during the selection of suitable areas for the implementation of renewable energy infrastructure: the Federal Regional Planning Act ("*Raumordnungsgesetz*"), the Federal Building Code ("*Baugesetzbuch*"), the Renewable Energy Sources Act (EEG), and further regional mandatory planning guidelines. In this paper, we can only briefly describe the main roles and effects of the three statutory instruments.

1. The Federal Regional Planning Act describes and distinguishes infrastructure which is required to be constructed outside of settlements.
2. The Federal Building Code (FBC) provides all instruments to implement adaptation and mitigation measures and to steer the development of renewable energy on the communal level. The FBC also enables communities to develop individual local strategies, which may include the introduction of priority and exclusion zones for wind turbines. In 2015, the code was adapted to empower all federal states to enact regional laws to regulate infrastructure for wind power. Section 3 of the special provision for wind power (§ 249 FBC) allows for an individual definition of all details such as distance to other objects. This approach resulted in a heterogeneous situation across Germany, similar to other federally organized European countries such as Austria or Switzerland. Bavaria implemented the so called 10-H rule. This rule, laid down in section 82 of the Bavarian Building Regulations ("*Bayerische Bauordnung*"), stipulates that wind turbines may only be erected in a distance of ten times their height to residential buildings. This means that if a wind turbine is 200 m tall, the required (minimal) distance to buildings amounts to 2000 m. Outside of this range, wind turbines are only permitted if the community implements a binding land-use plan ("*Bebauungsplan*"), which requires extensive public participation and the approval of the neighboring community.
3. The EEG influences the development of infrastructure for renewable energy sources in an indirect manner. The law regulates revenues and funding for each renewable energy source rather than the planning process itself. Section 51 determines that a guaranteed, high compensation for photovoltaic power can only be provided if the photovoltaic system (PVS henceforth) is constructed in former military areas (conversions areas) or within a distance of 110 m on both sides of highways or railway lines.