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Spatial targeting, synergies and scale: Exploring the criteria of smart practices for siting renewable energy projects

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ABSTRACT

Policies and strategies to develop renewable energy and the rates of successful deployment vary from country to country. Academic literature is rife with examples of recurring problems and malpractice in the implementation of renewable energy projects. We could see each national and sectoral effort as an 'experiment' in the early phase of our attempted transition to a low carbon energy system. What lessons can we learn from a comparative analysis of these experiments? This paper seeks to draw generic lessons not from what has gone wrong but from national case studies that stand out in a best way. Through a European academic network, we have selected and analysed 51 'smart practice' case studies of renewable energy development from 20 countries. We present the outcomes of both qualitative and quantitative analysis of these case studies (smart practice criteria) and discuss a set of generic findings concerning specific types of smart practices and problems of potential transferability of projects to other regions. With regards to policy relevance, the findings can be used for evaluating portfolios of renewable energy projects developed to date and for setting guiding principles for project design, spatial planning and consent by means of cross-national learning and fertilization.

1. Introduction

Growing awareness of anthropogenic climate change and the exhaustion of easy-to-extract and cheap to refine fossil fuel reserves have led to a growing interest in the development of cleaner and cheaper energy sources. This energy transition is not merely technical or supply-side; it has impacts on all spheres of human society, including on industrial networks, infrastructures, social practices, regulations, symbolic meanings, and landscapes (Smil, 2010). Growing the renewable energy sector has altered landscapes and land use dynamics, brought about new land use conflicts (Calvert and Mabee, 2015; Frantál and Kunc, 2011; Van der Horst and Vermeylen, 2012) and disconnections between policy makers and stakeholders (Warren, 2014).

Renewable energy is spatially diffuse and the desire to harness it at scale, creates new productive demands on locations and landscapes that may already struggle to accommodate different interests of development and conservation. Most industrially developed countries have now adopted targets for renewable energy as part of their commitment to reduce greenhouse gas emissions, and are thus looking for methods to accommodate growing numbers of renewable energy facilities on their territory, and to reduce stakeholder conflicts and public opposition arising from these developments (Abdmouleh et al., 2015).

There have been significant differences between countries in the level of successful deployment and the extent of controversies and public opposition (Toke et al., 2008; Marques and Fuinhas, 2012; Darmani et al., 2014). While some countries have already almost exhausted their realizable potential and the on-land space for new developments in some respects (e.g., for large wind parks or large hydro power plants), other countries are far behind, reluctant or just starting out. So there is clearly scope for international comparisons and learning. But learning from comparative analysis is not necessarily straight forward, given that there are often significant national differences in economic, legal-procedural, socio-political and cultural-historic contexts.

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Focussing on the siting of (more) renewable energy projects in (already crowded) diverse landscapes, the aim of this paper is to explore what international lessons can be gleaned from specific projects that are nationally perceived to be innovative and successful. More concretely, we seek to synthesise wider lessons from a range of nationally perceived ´best practice´ projects, and examine how can these examples be analysed in order to yield guidance for other countries? It is important to bear in mind, however, that the"wicked problem" of sustainability and the inherent tensions between development and conservation means that it would be naïve and overly simplistic for this study to seek mathematically optimisable solutions or concrete answers with universal validity.

In the theoretical departures, we theorize and critically discuss the nature and principles of smart practice analysis, its advantages over the best practice approach and its methodological limitations. Then we provide a complex definition of smart practice in the planning and siting of renewable energy production systems. In the empirical part, we focus on the following research objectives: (i) Identifying and classifying specific criteria (indicators) of smart practice, (ii) Deriving more generic criteria or factors of smart practice, (iii) Creating a typology of smart practice projects, (iv) Assessing a potential transferability of smart practices to other regional contexts. The presented results have been structured into subchapters reflecting these research objectives. Finaly, we conclude with policy-relevant recommendations.

2. Theoretical departures: from ´best practice´ to ´smart practice´ in renewable energy development

In the context of management, Kerzner (2004, p. 46) defined best practices as 'reusable activities or processes that continuously add value to the deliverables of the projects. Best practices can also increase the likelihood of success of each and every project.' Best practices are not necessarily ideal or perfect, but they represent what has been or is being implemented elsewhere and has been proven to work (Veselý, 2011). The various definitions of 'best practices' show that their rationale is based on not only constant learning, feedback and reflection of what works and why but also, no less important, on what does not work (Stenström and Laine, 2006). The identification of best practices is usually linked to examples of applied innovations and would typically suggest that there is a potential for rapid wider diffusion.

When it comes to the question of how to identify best practice, the literature is somewhat ambiguous (Myers et al., 2004). Bretschneider et al. (2005) argue that a best practice design can be characterised by two conditions. The first is to obtain empirical information on all the relevant cases. The second condition requires 'a complete and accurate statement of the causal relationships linking inputs to outputs', in order to ensure the comparability of cases. It is, however, commonly agreed that both conditions are hard to achieve and that they should only guide the design of the study (Bretschneider et al., 2005; Bardach, 2000, 2004).

This methodological challenge is further exacerbated by a controversy about the meaning of best practice. Bardach (2000, 2004) suggested that the term ´best practices´ is misleading. There is an ontological aspect to this; how can we really know what is the 'best'? And even if at one particular moment in time the number of options are sufficiently limited to help experts reach a strong consensus around what is the least worst option (semantically 'the best' of the lot), how can we know that this label still sticks when conditions, policies, technologies etc. continue to change?

Given that the term 'practice' refers to an activity that is executed by a particular group of practitioners, it can be argued that best practice always depends on the particular context in which a particular practice is situated. A ´smart practice´ may therefore be a more useful concept for academics to explore. Although 'smart' is also a rather vague and popular term in management, it can be distinguished from the 'best' practice by its greater focus on the processes that produce agreeable outcomes.

The task of the researchers is to explore the 'smartness' of a given practice, to verbalize it and evaluate for applicability in the context of the target site (Bardach, 2000; Veselý, 2011). The key task of smart practice analysis should particularly be to identify the 'essential aspects' of a given practice that causally produce the desired effects (without them there would not be any positive effect). It is important to distinguish the essential aspects of a given practice from so called supportive aspects, which may increase the effectiveness or sustainability of a given practice but do not guarantee the valued effects on their own (Veselý, 2011, p. 107).

Barzelay and Campbell (2003, p. 14) have argued that smart practice analysis should seek to identify the causal mechanisms and processes that help to overcome the 'tendency of political, technical, and organizational systems in the public sector to perform unsatisfactorily with respect to evolutionary adaptation.' The idea of evolutionary adaptation already contains within it, firstly, the notions of learning from experience and achieving improvements over time by abandoning practices that have not worked well and the adoption of practices that have proven to be more successful. Secondly, it implies the ability to adjust to dynamic exogenous factors, which reflects the experience that what works well here and now may not work there or tomorrow. Thirdly, it implies that there is value in experimentation, since this creates more opportunities to learn from a wider set of experiences.

Smart practice studies can be found across disciplines. Authors have already depicted smart practices also in renewable energy development, yet mostly with a focus on individual renewable energy production systems and within one or similar regional contexts. For example, Wolsink (2007), He et al. (2016), González et al. (2017) and Frantál et al. (2017) have focused on successful measures in the promotion of either on-shore or off-shore wind farms; Cabraal et al. (1996) and Tsikalakis et al. (2011) highlighted smart practices in solar schemes; and Dolman and Simmonds (2010) examined wave and tidal energy. The criterial of smart practice and negative side-effects of projects in bioenergy, biomass and biogas production have been recently explored by (Ciervo and Schmitz, 2017; Martinát et al., 2017). Abdmouleh et al. (2015), Kitzing et al. (2012) and Griffiths (2017) studied best practices concerning national renewable energy policies in general. Thapar et al. (2016), on the other hand, focused more on the perspective of developing countries, identifying innovative practices followed in India which have enabled accelerated renewable energy capacity with minimal financial obligations. Valentine (2013) focuses on wind energy policies applied in Denmark as an example of the gradual best practices; and best practices of micro-hydro power in the case of developing countries were studied by Khennas and Barnett (2000).

Focusing on best and worst practices in designing auctions for renewable energy as one of the supportive schemes, del Río (2017) argues that best practices of auction design usually involve trade-offs between criteria. Overall, these results suggest that the choice of a specific design element is not a win-win decision and depends on the priorities of the respective government. Proposals of best practices for development of off-grid energy systems in remote communities that might be primarily utilized in developing countries have been presented by Akinyele and Rayudu (2016). Tan et al. (2016) studied best practices in promoting sustainable urbanization in China and they pointed out that different regions (have to) adopt different methods for achieving different outcomes.

Based on the insights of such previous studies, as well as the above mentioned definitions, *smart practice* in the planning and siting of renewable energy production systems, would at least have to (i) effectively produce energy based on renewable sources; (ii) seek to minimize environmental harm in each stage of its production, operation and disposal (life cycle); and (iii) seek to decrease potential conflicts among individual users (or groups of users) of the landscape where it sited, throughout participation, collaboration and planning.