



Original research article

Imagine all these futures: On heterogeneous preferences and mental models in the German energy transition

Eva Schmid^{a,*}, Anna Pechan^b, Marlene Mehnert^{a,c}, Klaus Eisenack^{b,d}^a Potsdam-Institut für Klimafolgenforschung, Postfach 601203, 14412 Potsdam, Germany^b Carl von Ossietzky Universität Oldenburg, Postfach 2503, 26111 Oldenburg, Germany^c Université Paris 1 Panthéon-Sorbonne, Place du Panthéon 12, 75231, Paris, France^d Humboldt-Universität zu Berlin, Unter den Linden 6, 10099 Berlin, Germany

ARTICLE INFO

Article history:

Received 25 November 2015

Received in revised form 7 November 2016

Accepted 22 February 2017

Available online 6 March 2017

Keywords:

Mitigation

Electricity infrastructure

Stakeholder engagement

Participatory scenario development

ABSTRACT

The implementation of theoretically designed low carbon energy transitions provided by scientific policy advice proves to be challenging in practice. For the case of Germany prominent rhetoric frontlines separate proponents of centralized and decentralized solutions for decarbonizing its electricity infrastructure. This paper investigates whether the claim that incumbent actors favor centralized and challengers decentralized solutions finds supporting evidence on a small sample of practitioners from different fields of the German electricity system. It further aims to identify qualitative infrastructure scenarios for its long-term future based on the practitioners' mental models of system effects. We find empirical evidence for the postulated claim; yet there are no clear-cut camps. Disagreements across elicited mental models of practitioners from the same fields render the identification of internally consistent scenarios impossible for the full sample. The largest possible subsamples lead to three related visions of a substantially transformed electricity system dominated by decentral, small and medium-scale solutions coexisting with some centralized, large-scale infrastructures. The strong heterogeneity in preferences and mental models we uncover leads us to conclude that transparent and participatory public discourse on underlying worldviews, norms and values is paramount for accelerating institutional reform paving the way for energy transitions in Germany and globally.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

In scientific policy advice it is well understood by energy system analysts how low-carbon transitions can be achieved around the globe. In theory the technical feasibility of mitigating greenhouse gas emissions has been established by a multitude of quantitative, techno-economic modeling studies on different scales, e.g. globally [1], for Europe [2,3] or for Germany [4,5]. However, in practice the implementation of low-carbon solutions appears to be much more challenging than these modeling studies suggest. A root source for inertia are conflicting visions regarding what is a 'desirable' future energy system and by means of which governance and ownership structures to realize them [6,7]. Yet the actors who make transitions happen and the institutions in which they are embedded are hardly addressed in quantitative, techno-economic modeling

studies. These aspects do take center stage in sociological literature dealing with societal change and stability. Here, descriptions of how to get to a particular future are qualitative and known as narratives or storylines. Such verbal accounts convey meaning through simplifying complex situations into chains of events [8] and contain elements such as a protagonist and a challenge [9,10]. Following the call for integrating social sciences in energy transition research [11] this research combines theoretical insights and methods from both techno-economic and sociological energy research disciplines. Its overarching aim is to better understand how involved actors' mental models of desirable energy futures relate to each other and what the consequences are for realizing low-carbon energy transitions.

Two prominent storylines of how to realize an energy system based on renewables are known as the centralized versus the decentralized energy transition [6,7]. In its pure, archetypal form the decentralized energy transition sees citizens and municipalities realize local, at best autonomous renewable supply in a democratic and independent way whilst fighting the resistance and power of the fossil-nuclear complex [7]. Protagonists of the archetypal centralized energy transition are experts, energy com-

* Corresponding author at: Potsdam-Institut für Klimafolgenforschung, Postfach 601203, 14412 Potsdam, Germany.

E-mail address: eva.schmid@pik-potsdam.de (E. Schmid).

panies and national or supranational policymakers that implement efficient and economic large-scale solutions; the major barrier for implementation is the lack of political will [7]. In this context the aforementioned techno-economic modeling studies, developed by experts, are an important means of justifying the efficiency and economic superiority of large-scale solutions. The applied energy system models implicitly assume homogeneous preferences by employing some variant of economic costs minimization as an objective function. Preferences that play important roles in the decentralized narrative such as regional value creation, regional independence and citizen empowerment are not directly representable in such quantitative energy system models.

A sociological framework that offers the possibility to integrate the technology, actor and institutional perspective on energy futures is the theory of strategic action fields [12]. It aims to understand processes of change and stability in societies. At its core it postulates that incumbent and challenger actors with different resource endowments vie for advantage in constructed meso-level social orders, i.e. strategic action fields. Incumbents are actors that dominate a certain field and favor the status quo characterized by field rules historically influenced to their benefit. Challenger actors are entrants that put fundamental field rules into question and struggle for their renewal or even a restructuring of the field and its purpose [12]. The theory emphasizes the role of social skill of coalition-builders in determining which vision carries through, defined as “the ability to induce cooperation by appealing to and helping to create shared meanings and identities” [12] p.46. Actors in one coalition have compatible mental models of the purpose and rules of their field. Mental models are internal representations that individual cognitive systems create to interpret the environment [13], to reason and to make decisions [14]; essentially they reflect an individual’s understanding of the world [15].

Applying the theory of strategic action fields, our previous literature review for the case of decarbonizing the German electricity sector showed that centralized, European solutions tend to be favored by incumbent actors and decentralized, regional solutions by challenger actors [6]. We concluded that the determining factors for the question of which vision carries through are primarily of institutional nature and will be fought out between affected actors in the political arena [6]. The electricity system as a strategic action field is in a phase of rupture and destabilization due to the imposed decarbonization targets. It is yet open where the resettlement process will lead to in the long-run. So far, the rise of renewables increasing from 6% of electricity consumption in 2000 to 32% in 2015 [16] was pushed by challenger actors that were previously not involved in electricity generation: citizens, farmers, cooperatives and other citizen participation organizations. Jointly they owned 46% of the installed renewable generation capacities in the year 2012 [17]. This development was enabled by the renewable energy law introduced in the year 2000. It was drafted and pushed through with considerable social skill by a coalition around Hermann Scheer, who was a member of the German parliament, founder of Eurosolar and strong proponent of a decentralized, regional energy revolution narrative [18]. In this spirit the German “citizen energy transition” movement emphasizes the principles of local value added, true citizen participation, democratic control and an active role of the demand side [19]. On the other hand the centralization narrative is highlighted by experts, for example the academy of science and engineering highlights efficiency, market solutions, competition and economies of scale [20].

In the literature a number of studies confirm the framing of the German and other countries’ energy transition as an incumbent-challenger conflict: In Germany, a heterogeneous spectrum of challenger actors have entered the electricity system as generators in the past two decades [21]. They are now seeking to establish a renewable energy system based on decentralized structures,

thereby opposing incumbent actors [22,23] even to the point that they question the right for their very existence [7]. An important line of conflict between incumbent and challenger actors concerns the extent to which it will be characterized by decentralized system architecture [24]; a decentralized renewables-based system does not dovetail with the socio-economic characteristics of the incumbent system [25]. Such tendencies are observed also in other energy system in which decentralized solutions are gaining momentum, e.g. in the US incumbents use a variety of strategies to resist the challenges arising from distributed solar generation [26]. In the UK community-led sustainable energy projects have been sprouting in recent years and are on their way to become a key player in the transition if they manage to bundle their activities and interests [27].

Distinguished authors call on science to increasingly learn from practice in order to develop meaningful scenarios for scientific policy advice on energy transitions [28]. To date, there is a large divide between theory and practice in energy future development: academic literature paid little attention to what kinds of energy system futures real-world actors preferably envision and why. Exploratory cases of participatory scenario development that do engage stakeholders in the formulation of narrative input assumptions for a quantitative modeling exercise have been pursued for the German [29], French [30] and Portuguese [31] energy transition. However, they remain inconclusive regarding preferences for centralization or decentralization. Four cases of qualitative scenario development do draw on the systemic knowledge of stakeholders, i.e. their mental models, in the German heat sector [32], and energy system as a whole [33–35]. The only one [35] that explicitly focuses on the aspect of decentralization in energy infrastructures is outdated as its scenarios propose a 30% share of renewables in electricity generation for the year 2025 that has already been achieved in 2015 [16]. In the UK an interdisciplinary approach led to the identification of social values associated with desirable energy futures that may foster their public acceptance [36] but the focus was only on centralized solutions. We are not aware of any literature on the homogeneity or heterogeneity of preferences and mental models of actors in low-carbon energy transitions.

This research aims to contribute to bridging the gap between theory and practice as well as techno-economic and societal disciplines in energy futures research. It investigates the following theoretically motivated questions on a sample of practitioners from the German electricity sector:

1. Do incumbents prefer centralized and challengers decentralized solutions to decarbonizing the electricity infrastructure?
2. Can we identify qualitative scenarios of the future German electricity infrastructure based on elicited mental models of practitioners that are internally consistent?
3. If not, on what do practitioners disagree?

We investigate these questions for the case of the German Energiewende, which aims for reducing CO₂ emissions by 80–95% in 2050 relative to 2005, next to the other policy targets of phasing out nuclear power until 2022 and maintaining high competitiveness and security of supply [37,38]. It is well-suited as a case study of institutional and technological change of a highly interdependent, large-scale and long-lived infrastructure system transitioning to low-carbon in practice. We focus on the electricity sector as it has gone through significant decarbonization developments over the past decades already.

Our research design combines complementary methods from different disciplines in a novel way: As a framework to guide our conception of the energy transition as a societal change process we use the theory of strategic action fields [12]. For eliciting the preferences and mental models of our sample of practitioners we

Download English Version:

<https://daneshyari.com/en/article/6464031>

Download Persian Version:

<https://daneshyari.com/article/6464031>

[Daneshyari.com](https://daneshyari.com)