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Shades of green: Centralisation, decentralisation and controversy among European renewable electricity visions

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ABSTRACT

To decarbonise its electricity system, Europe must rapidly expand renewables. We analyse the controversy between two organisations, Eurosolar and Desertec, which seemingly pursue the same goal of 100% renewable electricity. We show that they interpret "100% renewables" differently and envision fundamentally different renewable electricity futures, to be reached through different governance pathways driven by different actors. Desertec reacts to mankind's violation of the Earth's carrying capacity and seeks secure decarbonisation through renewables, for which centrally regulated, large-scale imports of controllable concentrating solar power from the desert are necessary. Eurosolar, in contrast, seeks to decentralise the electricity supply and disempower the actors who caused the unsustainable and undemocratic energy system, for which renewables are suited as they are carbon-neutral and decentralised by nature. As the core aim of Desertec, controllable solar power imports through large-scale infrastructure, violates Eurosolar's core aim of decentralisation, a compromise is difficult: this would require one organisation to give up its primary objective. Our results show that the reason for this controversy among renewables proponents lies not in technology or cost, and can thus not be identified or resolved through techno-economic analysis or modelling, but in irreconcilable differences in normative aims and governance choices.

1. Introduction

To reach the long-term climate targets, the European electricity sector must be completely decarbonised by mid-century [1–4]. On the supply side, different combinations of nuclear power, fossil power with CCS, and renewables can achieve this [5] and there are intense political debates which of these is the best. Perhaps the least surprising debate is between proponents of conventional electricity technologies – nuclear power or fossil fuels (with/without CCS) – and renewables: creating a new, renewable electricity system will trigger resistance from those with interests in the old system, and there are strong ideological differences between a nuclear- and a renewables-based future. In some countries, notably Germany, the nuclear issue is among the most heated political conflicts of all and a historical starting point for the political environmentalist movements, and the nuclear-renewables conflict is still a main driver of the energy debate [6].

Visions are emotionally appealing descriptions of the problem to solve, the desired future system and the policies and governance pathways to achieve that future [7–9]. Hence, visions for nuclear/fossil energy or renewables may be very different, and, as we show in this article, also renewables visions may differ greatly. In order to remain "objective", however, mainstream energy system modellers are careful to "distinguish their 'visions' from their calculations" [10] and consider techno-economic features in detail while ignoring, explicitly or implicitly, most governance choices and normative aspects of the energy system [11]. Modern energy scenarios describe how broader societal or political developments affect the energy future [12,13] (e.g. regional rivalry or more global cooperation [14]). The policy recommendations are however often "presented in singular prescriptive ways", and policy-makers often refer to techno-economic energy studies for "proof" that their proposal is, in fact, the best [15].

Yet, renewables differ from conventional power in more respects than their carbon-neutrality. Importantly, they are modular and can be built as rooftop PV arrays or single wind turbines, or in gigawatt-sized farms. Hence, both small, including individual citizens, and large investors such as major energy companies can build and own renewable power stations, with far-reaching differ-

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ences both in impacts (e.g. cost, whether value-creation is localised or remote) and in the governance pathways (e.g. feed-in tariffs enabling small-scale investors, or quota schemes with higher risk favouring large companies) [4,11]. The technical characteristics of renewables add a societal dimension, suggesting that renewables may not be simply *technologies* but that they may also entail a societal, normative – and hence potentially conflict-laden – choice of which type of renewable electricity future is most desirable [16].

One controversy among renewables proponents has been ongoing since the early 2000s between the organisations Desertec Foundation and Eurosolar. This is intriguing, as the two organisations appear to have the same aim. Eurosolar is dedicated to "completely substituting fossil and nuclear energy through renewable energy", which they view as "the challenge of the century to humanity" [17], and Desertec propagates the replacement of nuclear and fossil power with renewables to avoid risks "of nuclear proliferation and of climate change" [18], which "confront mankind with unprecedented challenges" [19].

Still, Eurosolar is among the harshest critics of Desertec, which it perceives as "a mirage"[i] [20], "a step backwards to the conceptual clutter of the early 20th century"[ii] [21], and a "pseudo-progressive [and] tedious detour"[iii] [22]. Rather than a vision for a renewable future, Desertec is "a political weapon against the expansion of local and regional solar and wind power"[iv] [22]. Desertec, in contrast, sees Eurosolar's strategy as "questionable in terms of ethics and sustainability [as it] propagates a Europe unaffected by the eventual future misery of its neighbours, and fosters the illusion of independency on a rather small and crowded planet"; further, Eurosolar's one-sided focus on local and small-scale renewables makes the transition insecure and slow [23]. Instead of rejecting Eurosolar's vision altogether, however, Desertec states that "decentralized and internationally linked renewable energy resources optimally complement each other": given the urgency of the climate and energy crises, we need both [24].

Here, we investigate this apparent paradox and identify the reasons why Eurosolar and Desertec disagree so strongly although they seemingly want the same thing. We seek the reason of the controversy, despite the apparent agreement on 100% renewables, in differences in their visions: what do these organisations want, and how are their visions different? Ultimately, the question arises: are the two visions mutually exclusive, because their core aims clash, or is a compromise possible? We hypothesise that they, behind the headline rhetoric, strive to achieve fundamentally different and incompatible renewable energy futures, through largely diverging governance approaches: we expect that this energy controversy is not primarily about the power mixes, the pie-charts or the costs of the different futures, but about the softer issues such as how the envisioned system and the transition are governed, which problem each vision aims to solve, and who carries out the transition. In short: we expect that the controversy we investigate is rooted in fundamental differences in the visions. By empirically exploring the visions of two organisations in the German renewables policy arena, we seek to convey to scientific electricity system modelling and the energy policy debate that there is a "plurality of social interpretations of energy alternatives, each equally valid under different reasonable perspectives" [15].

Below, we review the literature and reflect on how visions may be classified in a number of different but similar theoretical predictions of vision type taxonomies (Section 2). Inspired by discourse analysis, our method is centred on the concept of storylines, which allow us to efficiently summarise the main arguments of the two visions (Section 3). We describe the organisations and their political impact (Sections 4.1 and 4.3), and identify (Sections 4.2 and 4.4) and compare (Section 4.5) their storylines. In Section 5, we discuss our findings and present conclusions.

2. Background

The mainstream energy system and energy policy research focuses on the technical and economic aspects of renewable energy scenarios [25–29]. Over the last decade, numerous studies have shown that high – up to 100% – shares of renewables are technically feasible and economically attractive in many countries and regions, including Australia [30], Denmark [31], Germany [32], the US [33], Europe [3,34], Europe and MENA (Middle East and North Africa) [35], and even globally [36]. Such techno-economic studies however tend to ignore or "mask the human elements of energy" [26], which calls for "the tool-box of social sciences" to be used to support and improve techno-economic system modelling [11].

Indeed, several social-scientific authors criticise the "disappointing" [37] scope of mainstream energy science, because "conflicts in the domain of energy and climate are not primarily due to lack of scientific facts or objective truth. Instead, they are more due to a clash of priorities, interests, and normative assumptions which create a number of subjective truths" [38]. Although visions are key drivers of the energy policy debate, they are largely ignored by the mainstream literature [7–9]. An energy vision does not address all problems in the world but merely a subset, reflecting the subjective perception and prioritisation of problems. As different persons value problems differently, the subset of problems to solve differs between visions, and the visions themselves can – although they address the same physical reality – be fundamentally different. Hence, there is not one single techno-economic truth, but multiple socially constructed truths with different but valid end-state aims and governance pathways [9,38] (see below). This is a key source of conflict, since "people are unlikely to support a policy that is aimed at solving what they do not see to be the problem" [39].

Authors have gone about classification of visions for electricity decarbonisation in different ways. Battaglini et al. [40], for example, identify two main options for 100% renewables in Europe: bottom-up, decentralised *Smartgrid* solutions focusing on small-scale generation, and top-down, centralised *Supergrid* approaches, focusing on very large transmission systems and large-scale generation. Yet, they argue that Europe has no time to quarrel about which type of renewables it wants, so that "the two concepts [. . .] can and must co-exist in order to guarantee a transition to a decarbonised economy" [40]: the two visions can and must be merged into a *SuperSmart Grid* vision. This is exactly the same statement as Desertec's reply to Eurosolar's criticism (see Section 1).

Others adopt the position that a transformation of the energy system is not mainly about energy as such, but about governance of the energy system [41–43]. Lovins, for example, distinguishes between *Hard* and *Soft* energy paths and characterises the essence of energy politics as a choice between these [44,45]. The Hard path focuses on ways to supply more energy to satisfy a growing demand in a centralised system based on technological progress. The centralised Hard path remains dominant, both in European energy policy [1] and in system modelling [11]. The Soft path, in contrast, emphasises demand-constraint combined with decentralisation of energy governance and puts energy generation directly under citizen ownership or control. These Paths are not mainly distinguished "by choices of hardware" but "by the socio-political structure of the energy system"; hence, they are technically compatible but "mutually exclusive" because of diverging governance requirements and aims [44].

In the Realising Transitions Pathways project [46,47], Foxon and colleagues define qualitative decarbonisation visions for the UK and then quantify these into vision-driven "transition pathways". Instead of using the standard approach of modelling a cost-optimal decarbonised technical electricity system without asking about governance choices and system structure, they place