



Short communication

The pace of governed energy transitions: Agency, international dynamics and the global Paris agreement accelerating decarbonisation processes?

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ABSTRACT

The recent debate on the temporal dynamics of energy transitions is crucial since one of the main reasons for embarking on transitions away from fossil fuels is tackling climate change. Long-drawn out transitions, taking decades or even centuries as we have seen historically, are unlikely to help achieve climate change mitigation targets. Therefore, the pace of energy transitions and whether they can be sped up is a key academic and policy question. Our argument is that while history is important in order to understand the dynamics of transitions, the pace of historic transitions is only partly a good guide to the future. We agree with Sovacool's [1] argument that quicker transitions have happened in the past and may therefore also be possible in the future globally. The key reason for our optimism is that historic energy transitions have not been consciously governed, whereas today a wide variety of actors is engaged in active attempts to govern the transition towards low carbon energy systems. In addition, international innovation dynamics can work in favour of speeding up the global low-carbon transition. Finally, the 2015 Paris agreement demonstrates a global commitment to move towards a low carbon economy for the first time, thereby signalling the required political will to foster quick transitions and to overcome resistance, such as from incumbents with sunk infrastructure investments.

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1. Introduction

A recent thought-provoking paper by Sovacool [1] challenges a 'conventional truth' in the field of transition studies: that transitions take at least 30–50 years [2,3], if not centuries as some historical examples show [4]. By arguing that transitions can occur much faster, Sovacool's paper is stimulating a very welcome debate, since the urgency of climate change requires swift energy transitions. Not surprisingly, much thinking over the last ten years has therefore been about whether it is possible to speed up transitions through means of policy as well as wider societal mobilisation [5].

In this short communication – despite sharing some of the criticisms voiced in Grubler et al. (this issue) – we agree with Sovacool's [1] argument that quicker transitions in certain circumstances have happened in the past and may therefore also be possible in the future globally. We offer three main reasons for the possibility of low-carbon transitions of the energy system occurring faster than

was the case for historical transitions, and elaborate these in the subsequent sections: First, historical transitions have not been governed, but were emergent processes as a result of new fuel sources being discovered, new services becoming available, or by technologies reducing their relative cost (Fouquet, this issue). However, in the ongoing low carbon transition, there is a wide variety of actors engaged in active attempts to govern the transition towards low carbon energy systems, including policy makers but also a variety of other actors. Second, in an increasingly interconnected world, national developments can much more easily influence the global economy, thereby creating dynamic feedback mechanisms which can work in favour of speeding up the global low-carbon transition. Finally, we argue that the global climate agreement struck at the international climate conference in Paris in December 2015 seals a global paradigm shift in thinking about limiting climate change which has the potential to set in motion a significant acceleration of current decarbonisation trends.

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2. Enter agency: from emergent to governed energy transitions

While history is important in order to understand the dynamics and patterns of transitions, we argue that the pace of historic transitions is only partly a good guide to the future (also see contributions by Fouquet and Bromley in this issue). One key difference between historic energy transitions and the ongoing low carbon transition is that historic transitions have not been planned or governed but were emergent processes. Typically economic historians argue that transitions were driven by the development of new energy sources (e.g. the discovery of natural gas in the North Sea), the availability of better energy services (such as electric lighting compared to using candles), or the decrease of relative costs compared to alternatives (e.g. coal heating instead of wood) ([4]; this issue). In contrast, in the ongoing low carbon transition, there is a wide variety of actors currently engaged in active attempts to govern the transition towards low carbon energy systems. Sovacool [1] points to the important role played by public policy in several of his examples and Grubler et al. (this issue) acknowledge the benefits of well-coordinated public policies and institutions. Also Fouquet (this issue) points out that governments in specific instances have created the institutional setting to stimulate energy transitions to low-polluting energy sources. We argue that important actors in governing energy transitions do not only include policy makers, but also businesses, such as clean tech companies or finance sector actors, as well as actors from civil society, such as grassroots initiatives or environmental groups.

Policy-makers at international, national, regional and local levels have been trying to promote change towards low carbon energy around the world for years: whether this is in the form of incentivising new nuclear power stations (such as in the UK), equipping fossil fuel power stations with carbon capture and storage (such as in Canada) or focussing on the deployment of renewables (such as in Germany or Denmark). Also policies to increase the efficiency of consumer products are key for transitions (e.g. Japan's top runner policy) [6]. Having recognized their future global market potential, many countries are attempting to be pioneers in low carbon technologies, and support the establishment of domestic lead markets, such as for solar PV or onshore wind [7]. Another striking example of a country having recognized the market potential for low carbon technologies is China whose 13th five year plan heavily emphasises innovation in low carbon and clean technologies. This may not come as a big surprise, as China has already for several years been the largest investor in the deployment of renewable energy technologies, with its investment in renewables exceeding \$102.9 billion in 2015 (or 36% of the world total). But China is not alone. Developing countries altogether invested a total of \$156 billion which exceeded for the first time the investment in developed economies (\$130 billion) in 2015 [8]. In addition, the establishment of new public institutions such as the International Renewable Energy Agency (IRENA) as a sister organisation to the International Energy Agency (IEA), or the independent Climate Change Committee in the UK responsible for recommending carbon budgets, further underlines the multiple activities originating from public sector actors. Finally, there is also much activity at the local level with a growing number of cities pledging to become 100% renewable energy powered or to reduce their greenhouse gas emissions by 80% by 2050, as set out in the Paris City Hall Declaration which was signed by nearly 1000 mayors of cities from five continents in 2015 [9].

Also businesses are acting on carbon. For example businesses started to disclose their greenhouse gas emissions (e.g. under the Carbon Disclosure Project), commit themselves to internal carbon reduction targets (e.g. German electric utilities inspired by the EU 2020 targets) [10], and are bringing forward radical low carbon

innovations which have started to revolutionize markets (such as the electric mobility boom caused by Tesla in the US). In addition, new business models for 'prosuming' low-carbon energy are being developed around the world, including for off-grid access to electricity from solar PV on rooftops in developing countries, thereby serving multiple objectives. Also the financial sector has started to adjust to the new realities posed by climate change, an example being pension funds divesting from their fossil-fuel investments (e.g. the Norwegian state pension fund). A final example of the increasing engagement of the business sector with low carbon energy solutions is the applications for patents in renewable energy technologies which have increased significantly after 1997 due to innovators' expectations of future climate policies resulting from the Kyoto Protocol [11]. This is promising as Fouquet (this issue) argues that 'markets might take the lead in certain sectors and services in the transition to low carbon energy sources'.

Actors from civil society are also working towards low carbon energy transitions, actively pushing for ambitious action on climate change. For example, there are initiatives like the carbon tracker, a think tank in London, which attempts to focus attention on the financial risks of investing in ultimately 'unburnable carbon' [12]. Also, large foundations, such as the Gates Foundation, have pledged to invest in the development of low carbon solutions, thereby providing additional impetus to public R&D funds for low carbon innovation. An example of a grassroots movements is the international spread of transition towns in which citizens contribute to the low-carbon transformation of their city [13]. This movement started in Totnes in the UK but now encompasses 1258 registered groups across several continents. In addition, a growing number of citizens and community cooperatives have acted as investors in renewable energy, thereby actively supporting the low carbon transition and shifting power structures in the electricity sector, such as in the case of Germany [14]. This distributed ownership of renewable power generation technologies in Germany – in 2012 the renewable power generation capacity of 73 GW was mainly owned by citizen and cooperatives (47%) as well as institutional and strategic investors (41%) while only 12% was owned by energy suppliers [15] – may partly help explain the continuously high public acceptance rates for Germany's transition towards renewable energy: in 2016, 93% of respondents saw the *Energiewende* as an important or very important topic, and 55% thought it progressed too slowly, despite 69% expecting rising energy costs [16]. The maintenance of such high acceptance levels has been argued to become the main currency of low carbon transitions [17]; also see Bromley, this issue).

We argue that taken together this level of activity of a variety of types of actors across a range of different governance levels, has led to significant momentum behind the low carbon transition which is likely to accelerate the process and which is unprecedented compared to historical transitions. However, to recognize this momentum it may be important to specifically investigate the latest trends in energy statistics (e.g. the past 3–5 years rather than the averages over the last 15–20 years) and to interpret them within the context of broader socio-technical changes.

3. Add international dynamics: from national to global energy transitions

Sovacool [1] and Smil (this issue) both are in agreement that under certain circumstances *national* energy transitions can be fairly rapid, but Smil argues that *global* energy transitions necessarily are prolonged and multidecadal processes. Also Grubler et al. (this issue) claim that change of entire technology systems is inevitably a lengthy process. We agree that historically this has often been the case but also believe there is some cause for

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