EDITIORIAL

Transforming the energy system: the role of institutions, interests and ideas

Since the end of the last century energy systems have been undergoing a process of transformation. This is due to a number of reasons including the increasing pressure to reduce greenhouse gas emissions, new governance regimes to co-ordinate energy (and other) infrastructures and the transformative potential of new technologies such as decentralised electricity generation technologies and the use of information and communication technologies (ICT). The crucial importance of energy generation and consumption for social welfare, environment, climate change and resource exploitation puts these transformation processes high on the social and political agenda.

However, the dynamics of such highly complex and uncertain transformation processes, factors shaping transformation pathways and strategies to influence energy transitions are not yet well understood. A long-term process of technological and infrastructural change such as a transformation of the energy system involves a variety of social and political processes and can be studied from a number of different perspectives. The papers in this special issue of Technology Analysis and Strategic Management aim to broaden our understanding of different dimensions of energy system transformation and provide new empirical insights on innovation processes and on the extent to which they can be co-shaped by different actors.

With this collection of papers we want to address the following key issues:

(1) Institutions – the challenges of meso- and macro-level transition – As one of society’s key technical infrastructures, the energy system is shaped by a complex interaction of social, economic, technological and political factors. Not only is it conditioned by individual technological developments and associated patterns of energy generation, distribution and consumption. As a large socio-technical system it critically depends on the institutional set-up governing these processes and any medium or long-term energy transition will be closely connected to fundamental processes of institutional change. Issues that are of importance at this level include institutional inertia and lock-in, ways of policy co-ordination and the interaction of transformation processes at various levels of governance.

(2) Interests – the alignment of actors and the negotiation of conflicting goals – As a social and political process, the transformation of the energy system is normatively shaped – characterised by goals such as security of supply, regional self-sufficiency, cost-efficient supply and ecological sustainability. The negotiation of these goals and of adequate development pathways is tied to an array of conflicting beliefs, values and interests. Taking a closer look at this arena of debate
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and the micro-level processes of coalition formation and agenda setting therefore highlights the interests and values at stake and the positioning and strategies of actors articulating them.

(3) Ideas – the social dynamics of visions and expectations – While the negotiation of interests and values traditionally has attracted a lot of attention in constructivist technology studies, a growing body of work highlights the importance of visions and expectations particularly in the shaping of nascent technological systems. High expectations and claims with regard to the contribution of emergent technologies to more sustainable energy systems indicate the importance of this dimension for the current energy policy. Often linking a broad set of actors, such expectations may serve as the common currency between otherwise quite diverse fields and communities. Analysing visions and expectations in the transformation of the energy system thus requires the exploration of their role in creating and dissolving path dependencies, their potential in governance processes as well as the dynamics of hype and disappointment.

However, addressing the transition of energy systems from a socio-technical perspective calls for an analysis of the interrelatedness of the three key issues laid out above rather than treating them separately. Thus most papers in this special issue bring together aspects from all three perspectives, though with different kinds of emphasis.

An example is the contribution of Peter S. Hofman and Boelie Elzen, in which they present a methodology for developing socio-technical scenarios. Their aim is to explore different pathways along which electricity systems may transform in a process of interaction between a range of actors and the institutions and rule sets they are embedded in. Their sociotechnical scenarios go beyond and complement various traditional scenario methodologies by taking stock of our current knowledge of the dynamics of system innovations and by emphasising transition paths in contrast to treating scenarios as endpoints of a development. As the authors point out, ‘sociotechnical scenarios can help policymakers gain insight not only in the promise of individual technologies but especially under what set of rules these technologies can move forward through linkages with other technologies or can shape alternative practices as they connect with changing user preferences’.

More specifically, Malcolm Eames and William McDowall explore a methodology to study current visions concerning pathways to a hydrogen economy in London. Experts were invited to develop scenarios of a hydrogen future, back-cast on transition pathways, assess possible impacts in a multi-criteria assessment and reflect on governance and implementation requirements. The authors relate their work to important debates on foresight methodology and reflexive governance. They experimented with ways to ‘open up’ the debate, to include different social perspectives and to appreciate uncertainties, e.g. by confronting interviewees with radical ‘sideswipe’ scenarios in order to reflect on tacit assumptions on which their assessments are based. With the help of their methodology – so the authors claim – a ‘process of articulating and challenging ideas … becomes an opportunity for real deliberation and debate about social and political priorities with respect to new technologies’. They acknowledge, however, that such processes are inescapably political in nature owing to often-irreconcilable interests and that it is highly problematic to expect such processes to result in ‘social consensus’.

Harro van Lente and Sjoerd Bakker focus particularly on the dynamic competition between alternative technological options to fill positions in envisaged future chains of energy provision. Analysing publications on three ways to store hydrogen in vehicles, they debate dynamics of expectations and the competition between technological options. Using Toulmin’s model of argumentation, they analyse claims and describe ‘historical patterns in the competition of the three technologies’. They reflect on how to distinguish characteristic phases of such processes and highlight the possibility of prolonged periods of competition between technological options before
any substantial ‘market activities’ start. In a first ‘expectation phase’ – they observed – scientists and policy spokespersons work hard ‘to secure a position of their options in the relevant agendas’, and this ‘competition’ is about ‘projected performance in envisioned scenarios’.

In their paper on efforts to reduce the environmental and climate change impacts of the Paris Ile-de-France region, Olivier Coutard and Jonathan Rutherford skilfully analyse the interwoven-ness of actor interests, institutional contexts and visions inscribed in spatial planning documents. However, their main contribution to our understanding of energy transition processes is to draw attention to their spatial dimensions, to ‘the different socio-political geographies through which systemic transformations . . . are filtered’. The tensions between different actor groups and governance scales evoked by a regional spatial strategic plan which includes various energy and climate change related provisions show how deeply politicised the transformation of the regional energy system is and how it is ‘cast within a constantly shifting multi-governance framework where the positions and practices of local, regional and national actors are always interdependent and mutually constituted’. Heterogeneous spatial contexts through which radical change operates enable some actors to ‘move’ more extensively and faster than others and result in diverse ‘rhythms of transition’, as the authors put it, that have to be drawn upon to successfully promote systemic energy transitions.

The interdependence of different governance levels as well as place-specific understandings and scopes of action in relation to energy technologies also play a central role in the paper by Anna Schreuer, Michael Ornetzeder and Harald Rohracher. In this paper on negotiation processes related to the local embedding of socio-technical experiments they report on a dialogue process aiming to identify and evaluate potential deployment projects in the area of fuel cell technology in the city of Graz, Austria. Starting from the premise that the introduction of new energy technologies requires local processes of social learning, the authors highlight the different interests and agendas that can be attached to the establishment of such technology learning processes, specifically at the municipal level. In particular, they emphasise that ‘tensions may arise between overarching technology policy goals at the national level and problem-based approaches applied at the municipal level based on prevalent local issues and needs’. Their discussion of different problem framings thus alerts us to some important issues that need to be taken into account for setting up and locally embedding socio-technical experiments around new energy technologies.

Finally, Barbara Praetorius, Mari Martiskainen, Raphael Sauter and Jim Watson present a comparative case study on the deployment of microgeneration technologies in Germany and the UK. Using a ‘technological innovation systems’ approach – and in particular the ‘functions approach’ – they describe and compare the dynamics of the diffusion of small-scale distributed electricity generating technologies in the two countries. They point out important differences and commonalities concerning the driving forces in Germany and the UK. Among other things they underline the importance of establishing legitimacy for the technology in both countries, but also find that ‘the focus for distributed generation in Germany clearly lies on renewable technologies. By contrast, in the UK the lack of a well-established TIS for renewable energy technologies enabled the emergence of a microgeneration technology with micro-CHP (combined heat and power) as the incubator technology supported by incumbent players.’ Thus they also alert us to the methodological problem of delineating a ‘technological innovation system’ and point out that this delineation may in fact vary from one national context to the other.

In sum, the papers collected in this issue draw a rich and nuanced picture of various changes our energy system currently is undergoing and of the challenges it faces. More importantly however, they work on conceptual frameworks which help us understand these social and
technical transformation processes in their systemic interrelatedness and they assess potentials for strategically intervening into these dynamics in order to push energy transitions towards more sustainable pathways.

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