

## Newsletter 20, June 2016

This is the 20th newsletter from the steering group of the Sustainability Transitions Research Network. The newsletter is divided into the following sections:

- Words from the Chairman
- Environmental Innovation and Societal Transitions
- Network news
- Event announcement
- New research projects
- Publications

We welcome all members to submit news items for the next newsletter. You can use the website [www.transitionsnetwork.org](http://www.transitionsnetwork.org) (submit projects, output or news), or send a message to [sustainabilitytransitions@gmail.com](mailto:sustainabilitytransitions@gmail.com). The advantage of using the website for submission is that the information also becomes available online.

The STRN steering group

## Words from the Chairman

Dear transition research colleagues,

The attention for sustainability transitions continues to increase. At the recent Berlin conference on global climate governance (May, 2016), many political science speakers emphasized that the Paris agreement has shifted the debate of policymakers and stakeholders towards ways of *achieving* the targets, which leads to more attention for system change and transitions.

A recent expert group report for the European Commission, chaired by Carlota Perez, further positions system innovation as the most promising option for 'green growth', which aims to address Europe's socio-economic problems as well as sustainability. The report, titled *Changing Gear in R&I: Green Growth for Jobs and Prosperity in the EU*, heavily draws on ideas from the STRN community:

"In the case of promoting green growth, it is particularly important to understand the other aspect of innovation, which is their inter-relatedness when considering new sustainable transport, energy, waste, building, and agro-food systems. (...) The literature on system innovation notes that many green innovations are initially deployed in relatively small technological or market niches and then face uphill struggles against deeply embedded systems that have been around for decades. This is a common problem in transitions. (...) An understanding of both innovation systems and system innovation provides criteria for effective policy-making to enable a successful transition. It teaches us the need for systemic institutional innovations to create a coherent context for convergent actions. Next to policies that nurture innovations directly (e.g. R&D funding, demonstration projects, knowledge sharing, vision articulation), it is necessary to adjust the selection environments (e.g. taxes, subsidies, regulations, standards, infrastructure investments, skills). The policy mix needs to provide clarity about future directions and adjust incentives accordingly." (p. 13-14).

Last, but not least, the European Environment Agency is getting very interested in and engaged with sustainability transitions. Earlier this year, they started a project on 'mapping the knowledge base of sustainability transitions/transformations', which involves several STRN-scholars (reports are due in September 2016). They are also attracting academics for their Scientific Advisory Committee to support their work on sustainability transitions. Four of the five posts that the EEA recently advertised were formulated in this area. Two of the EEA posts were advertised on socio-technical systems, one on socio-ecological transitions, and one on sustainability.

On the academic front, it is encouraging to see that top journals are supporting and publishing work on sustainability transitions. *Nature Energy* and *Nature Climate Change* have published a joint Special Collection on the role of the social sciences in addressing energy and climate change. The editorial abstract, titled 'The role of society in energy transitions', states that: "A research agenda that integrates understanding of the social processes with technical analysis of climate and energy systems is necessary to catalyse a transition to a low-carbon world." Several papers in this special issue are about transitions, including some from STRN-scholars. I have included these papers at the end of the publications section.

Looking at the publications mentioned in this newsletter, it also seems that the community is further mainstreaming towards core environmental and sustainability journals. This is great in terms of diversification and scientific impact. While innovation studies journals (e.g. *Research Policy*; *Technological Forecasting and Social Change*; *Technology Analysis & Strategic Management*) were important outlets for early work on sustainability transitions, these now seem to be a minority. Most of the entries in the publication section are in a much wider range of journals including domain-specific journals (energy, transport, water, agro-food) and sustainability journals. This not only exports our ideas towards other communities, but is also likely to lead to conceptual innovation, as these papers engage with ongoing debates in those communities. In sum, the diversifying sustainability transitions community is strong and healthy, benefiting from high political and scientific attention, and shaping debates in wide range of outlets and venues. This newsletter again bears testimony of this, and I hope you enjoy reading it.

**Frank Geels**, Chairman of STRN ([frank.geels@manchester.ac.uk](mailto:frank.geels@manchester.ac.uk)).

## Environmental Innovation and Societal Transitions

Volume 19 of *Environmental Innovation and Societal Transitions* was just published. It contains eight original research papers:

- Empirical determinants of eco-innovation in European countries using the community innovation survey - *J. Horbach*
- Why did more sustainable cements fail so far? Disruptive innovations and their barriers in a basic industry - *U. Dewald and M. Achternbosch*
- What drives eco-innovation? A review of an emerging literature - *J. Hojnik and M. Ruzzier*
- The politics of niche-regime conflicts: Distributed solar energy in the USA - *D.J. Hess*
- User-led innovation in civic energy communities - *G.W. de Vries, W.P.C. Boon and A. Peine*
- The spatial dynamics of niche trajectory: The case of wave energy - *M. Fontes, C. Sousa and J. Ferreira*
- A practice approach to study the spatial dimensions of the energy transition - *F. Faller*
- Challenges in mobilising financial resources for renewable energy: The cases of biomass gasification and offshore wind power - *K. Karltorp*

We look forward to receive your submission. In particular, we welcome topics for new special issues of EIST. Please contact me directly to discuss any ideas. Further note that EIST will soon make a transition to a new article submission system (EVISE), along with other Elsevier journals. Finally, don't forget to read (and if relevant cite) EIST. **Jeroen van den Bergh**, Editor-in-Chief [[jeroen.bergh@uab.es](mailto:jeroen.bergh@uab.es)]

## Network News

*Any news related to ongoing activities of STRN*

### **STRN Steering Group – Call for (Self-)Nominations**

Part of the new STRN governance structure (described in the 19<sup>th</sup> newsletter and a recent blog on STRN website <http://www.transitionsnetwork.org/files/STRN%20Governance%20June16.pdf>) is a continuous renewal of the Steering Group. The Steering Group (SG) consists of approximately 15 scholars and provides advice on the development of the network. SG members also take on specific tasks, e.g. organization of IST conference and workshops, renewal of the STRN research agenda or maintaining exchange with other research communities. We want to open the renewal process up to the wider STRN community. We therefore invite STRN members to (self-)nominate candidates for election as SG members in the upcoming period from *Fall 2016 to 2018*. For this term there are four open positions for researchers who want to contribute actively to further developing the STRN community. Two of the four positions are available for early career researchers (PhD candidates or Post-Docs). For the other two positions, we are looking for experienced and committed transition researchers. We particularly invite applications from female STRN scholars. We ask each candidate to provide a brief (up to 1 page) profile, which presents her-/himself including background, research interests, motivations, (expected) year of PhD, and (for senior candidates) a demonstration of relevant expertise (e.g. via publications on transitions). Please send your application to [jmarkard@ethz.ch](mailto:jmarkard@ethz.ch) no later than July 31<sup>st</sup>. New SG members will be elected by the current SG in August.

### **Update from the TransLACASAF network**

Since the last update, the TransLACASAF network has expanded its members to 103, prepared for a session around methodologies for the next IST 2016 in Wuppertal and held two webinars focusing on renewable energy uptake in the Philippines and Indonesia as well as investigating sanitation regimes in Nairobi. A session at the next IST 2016 will focus on the methodological challenges working in the TransLACASAF region. The session will be interactive, involving games and a World Knowledge Café format to discuss different methods used in transitions research in this context. Jens Marquardt presented his PhD research on 'How power shapes energy transitions in the Philippines and Indonesia. It called to the donor community to analyse governance issues and coordinate efforts to be effective. Limitations of transition studies were noted to conceptualise power relations were discussed. Mara van Welie and Pauline C. Cherunya presented on '*Sanitation regimes in urban Africa: identifying the regime structures in the informal settlements of Nairobi.*' The presentation, which is work in progress as a first output of two PhD projects, was based on developing a framework for analyzing the complex and spatially differentiated situation of the basic services sector in developing cities – with sanitation in the city of Nairobi as an empirical case. The framework combines the sociotechnical regime concept and elements from practice theory. The framework presented works with the assumption that basic service sectors of developing cities have multiple regime structures whereby none can be seen as the dominant regime. A description of the sanitation regime of Nairobi in structural and dynamic terms was presented. Further, if you would like to join the network please email to: [transitions.lac.as.af@gmail.com](mailto:transitions.lac.as.af@gmail.com) or if you are interested in further information about the presentations please contact Jens Marquardt ([jens.marquardt@fu-berlin.de](mailto:jens.marquardt@fu-berlin.de);) or Pauline Cherunya ([Pauline.Cherunya@eawag.ch](mailto:Pauline.Cherunya@eawag.ch)) directly.

## Event Reviews

*Review of events interesting to the STRN community*

### **Transition Design Symposium 17-19 June, 2016, UK**

This weekend I attended the first European transition Design Symposium, held at the Schumacher College in the UK. I came across the event via an STRN email. It was my first foray into this aspect of transitions thinking, which is based on the central premise of the need for societal transitions to more sustainable futures. It is solutions orientated, particularly with regard to the role of designers (in a broad sense). I started, and left, the symposium with the feeling that whilst this was very much still in the embryonic stage, it is an emerging field of immense importance to the sustainability transitions community.

Papers prepared in advance of the conference were debated by panel members and participants. Highlights included Dan Lockton's paper (on Transition Lenses), Sevrá Davis's paper (on the integral nature of changing mind-sets and how to empower adaptors, actors and agitators). Lucy Kimbell's paper on the obstacles facing the Transition Design agenda provoked a heated discussion on the role of universities. I also liked Tom Crompton's paper on Values in Transition Design which asked, "what happens if our assumptions about people's values are wrong?" He highlighted findings of a recent Ipsos MORI poll (Common Cause Foundation, 2016), well worth reading.

Group work covered in-depth discussions of the role and characteristics of transition designers, the paradox of the urgency of the challenge, the role of design education and our incumbent education systems, the power and politics of transition, the role of consciousness and the practicalities of transition design.

Cameron Tonkinwise, Director of Design Studies, Carnegie Mellon University closed the symposium by concluding that transition design is not just about design thinking, scenarios and prototyping, but also about problem reframing and materialising interventions. He made the point that all levels within a multi-level, multi stage framework, have to be materialised. However much change, mind-set shift, policy change is required, it will manifest in human scale products and communications. Perhaps we all need to dwell more on the thought that everything is mediated by design. That is why I left the symposium sharing his belief that design is essential to transition.

Cameron ended on a salutary warning that, whilst there is something special about the set of agencies afforded by designers, they are also the handmade tool of capitalism, materialising social relations into mass consumption and pointed out that we are currently trying to throw transition design against this. **Briony Turner (briony.turner@kcl.ac.uk)**

## New research projects

*Information about ongoing research activities such as the start of new research projects*

### **Heat, Incumbency and Transformations (HIT)**

The University of Exeter's Energy Policy Group last week started its newest project investigating the role of incumbency in a transformation to sustainable heating in the UK. Both heat and incumbency are two particularly under-researched areas in the transitions debates and this project looks to contribute to these important areas of knowledge. The project team is Dr Bridget Woodman, Richard Lowes and Prof. Catherine Mitchell. The project runs for 2 years and has a number of high impact and policy relevant outputs. More details can be found

here: <http://geography.exeter.ac.uk/research/groups/energypolicy/research/hit/>

### **TRAFOBIT – The role and functions of bioclusters in the transition to a bioeconomy**

Within the five-year project, a research group consisting of three PhD students, a post doc and the research group leader will examine the role of so-called “bioclusters” in the transition to a bioeconomy. In these bioclusters businesses, governments, research institutes and universities work together on environmental innovations aiming to replace our current fossil based sources of carbon with renewable ones. Although bioclusters have become a popular tool for governments to promote economic collaborations, learning, innovations and employment in a region, the transition perspective has been largely missing for the literature. The aim of the project is to explore these innovation and transition processes through an international comparison of bioclusters in Germany, Bulgaria, England, France, Sweden and The Netherlands. Of special interest are issues of power and politics in clusters, the role of place specificity in transitions and issues of path development and cluster evolution. The methodological results will concern the development and adaptation of statistical network models for the study of transitions. This project starts on July 1<sup>st</sup> at IAMO – the Leibniz Institute of Agricultural Development in Transition Economies. The project is funded by the German Federal Ministry of Education and Research. For more information contact the research group leader Frans Hermans: [hermans@iamo.de](mailto:hermans@iamo.de)

### **Towards a future-oriented “Energiewende”: An anticipatory multi-level approach to the decentralised renewable energy transition (FutWend)**

A new transitions research project starting in September 2016 is conducted by Futures Research Centre (FFRC) of University of Turku, Finnish Environment Institute (SYKE) and Natural Resources Institute Finland (Luke). We will study external drivers, actors, mental models, policies and institutions that increase the share of decentralised renewable energy and affect sustainability in energy transition. They are analysed across the landscape, regime and niche levels of the multi-level perspective on socio-technical transition (MLP) framework. The project has:

- The theoretical and methodological objective of developing the MLP framework to a future oriented integrative tool;
- The empirical objective of analysing the transition from centralised fossil based energy towards decentralised renewable energy up to 2030; and
- The societal objective of providing and disseminating policy-relevant information regarding the prerequisites and obstacles of the energy transition.

We focus on three case technologies that are at different stages of socio-technical transition in Finland: Biogas, ground source heat pumps and woodchips burning. We explore the current and emerging roles of consumers, producers and prosumers of energy, and the roles of international energy markets, policies and public framings shaping expectations and actions. The project employs a Delphi study, policy document analysis, key informant interviews, a national survey, and media content analysis. Our aim is to develop sustainability transition studies by the systematic integration of alternative futures at all critical sub-systems and process phases. By envisioning and elaborating alternative futures, and examining how they are taken into account, this approach also increases the agility of sociotechnical system transition. The project is based on a transdisciplinary approach sensitive to stakeholder knowledge. Duration: 2016-2019. Funding: The Academy of Finland For more information, please contact: [petri.tapio@utu.fi](mailto:petri.tapio@utu.fi), [timo.assmuth@ymparisto.fi](mailto:timo.assmuth@ymparisto.fi), or [vilja.varho@luke.fi](mailto:vilja.varho@luke.fi).

## Publications

*Announcement of new publications such as article, PhD theses and books*

**PhD thesis: Peter Walsh (2016), *Wicked planning problems and the reform of planning systems: a case study of Sydney*. Swinburne University of Technology, Melbourne.**

City planning can be an integrating force for many other urban system elements central to sustainability challenges. But more often its captured by short term (self-interest based) fears and argument. From the viewpoint of the STRN family, this thesis adds to the growing literature on city-scale transition theory and practice. From a city planning viewpoint (the author a long term planning system actor), it seeks to make (the “remote” and “difficult”, but much needed) sustainability transitions (ST) conceptions more accessible and useful. The empirical investigation was anchored by an examination of Sydney’s spatial development history, explaining the marked increase in planning-related problems over the past 30 years or so. Theoretical investigation started with mainstream planning theory, linked-up with (less mainstream) relational and institutional planning conceptions, and then “meshed” these fields with ST theory. The resulting conceptualisation has been framed as a new process model for planning system reform projects: the Planning System Transition (PST) framework. Three pieces of empirical research were involved in the conception and testing of the framework. The first involved interviews with 28 elite, cross-sectoral, planning system actors which demonstrated direct translation problems with ST ideas (presented in isolation), but was able to help build and proof-tested the PST approach. Next, the PST framework was used as a tool to probe a recent major planning system reform exercise for Sydney (2011-2014). It proved helpful in untangling what went wrong in this (failed) episode, and how blockers (of transformative change) might be avoided next time. A further case study used an investigation of a major set of deliberative democracy exercises with random citizens (on the topic of planning reform) to indicate how, and why, these kinds of alternative democratic processes provide one of the more likely avenues for reducing the effects of exaggerated fears, and tackling resistance to sustainability-oriented reform. This thesis draws attention to dedicated (regime-mandated) urban system reform projects. In particular, it finds positively on the potential of ST theory to assist city planning reform. But it also highlights the critical requirement for ST concepts to be contextualised appropriately with both scholarly and practical planning insights. It provides an applied process model to assist in the particulars of this task. The thesis can be downloaded at:

<http://researchbank.swinburne.edu.au/vital/access/services/Download/swin:48716/SOURCE1>

**PhD thesis. Sengers, F. 2016. *Transforming Transport in Thailand: Experimenting for Transitions to Sustainable Urban Mobility*. PhD dissertation. Eindhoven University of Technology**

Over the past decades Thailand’s cities have developed in line with the principles of ‘unrestrained motorization’ – relentless growth of private cars and motorcycles without effective land-use planning and control. As a counter force, however, a set of alternative mobility systems, which are collectively geared to undermine this regime of unrestrained motorization, have burst onto the scene in the last few years and are gaining momentum. This dissertation follows the wheeling and dealing of actors who are experimenting to establish four such alternatives: (1) informal transport, (2) Bus Rapid Transit, (3) cycling and (4) participatory land-use planning. Empirically, the dissertation reveals how these mobility experiments are being conducted and to what extent such effort contribute to socio-technical transitions toward sustainable urban transport in Thai cities. Conceptually, the dissertation contributes to the development of a geography-informed perspective on mobility transitions. It is argued that that the development of urban transport in Thai cities requires major overhaul. Establishing sustainable transport requires the streets to be reclaimed by an array of more radical alternatives that harbor a greater potential to these cities into a more environmentally benign, socially inclusive and livable places. To study how these radical alternatives are (or are not) gaining a foothold, the central concepts of ‘sociotechnical

transitions' (i.e major shifts in the way societal functions such as transportation are fulfilled) and 'experimentation' (i.e hands-on projects to establish new transition paths) are mobilized. It is also argued that challenges remain with regards to developing a more spatially-nuanced or 'geography-informed' understanding on urban transitions in a globalizing world. These empirical and conceptual challenges are addressed in the consecutive chapters. According to this dissertation, a fully-fledge systemic change toward sustainable urban transport in Thai cities is not unfolding at this moment the potential for such a mobility transition is limited in the short run. Some of the investigated experiments were either unsuccessful or not followed up so far and there are heavy political constraints that frustrate a concerted effort toward major overhaul of urban transport in cities throughout the country. Yet, the increasing momentum of the investigated niches and the experimental mindset of the change agents building these niches do provide a glimmer of hope for the longer run. The empirical chapters also contribute to the development of a geography-informed perspective on mobility transitions by bringing to the fore a more nuanced understanding of the role of place, space and scale in experimenting for sustainable urban transport. This complements the 'classic' transitions perspective, which stresses the 'timing' between transition processes, with an emphasis on these processes as (1) locally situated and territorially anchored, and (2) multi-scalar and transnational. A key conceptual contribution is the articulation of an explicitly spatial perspective on niche development, which complements traditional socio-cognitive 'local-global' niche model by sensitizing us to the spatialities of knowledge transfer, actor networks and embeddedness. Other relevant insights are derived from explicit engagement with contexts in the global south (transition pathways that diverge from the global north are opened up), with transnational linkages (change agents who travel across borders to facilitate experimentation and niche building) and with 'the urban' (a dual understanding of the city as both context and object of transition).

**Book: Gailing, L. and Moss, T. (eds.), 2016, *Conceptualizing Germany's Energy Transition: Institutions, Materiality, Power, Space*. Palgrave Pivot.**

This is the first book to explore ways of conceptualizing Germany's ongoing energy transition. Although widely acclaimed in policy and research circles worldwide, the *Energiewende* is poorly understood in terms of social science scholarship. There is an urgent need to delve beyond descriptive accounts of policy implementation and contestation in order to unpack the deeper issues at play in what has been termed a 'grand societal transformation.' The authors approach this in three ways: First, they select and characterize conceptual approaches suited to interpreting the reordering of institutional arrangements, socio-material configurations, power relations and spatial structures of energy systems in Germany and beyond. Second, they assess the value of these concepts in describing and explaining energy transitions, pinpointing their relative strengths and weaknesses and exploring areas of complementarity and incompatibility. Third, they illustrate how these concepts can be applied – individually and in combination – to enrich empirical research of Germany's energy transition.

**Book: Evans, J., Karvonen, A., and Raven, R.P.J.M. (eds.), 2016, *The Experimental City*, Routledge,**

This book explores how the concept of urban experimentation is being used to reshape practices of knowledge production in urban debates about resilience, climate change governance, and socio-technical transitions. With contributions from leading scholars, and case studies from the Global North and South, from small to large scale cities, this book suggests that urban experiments offer novel modes of engagement, governance, and politics that both challenge and complement conventional strategies. The book is organized around three cross-cutting themes. Part I explores the logics of urban experimentation, different approaches, and how and why they are deployed. Part II considers how experiments are being staged within cities, by whom, and with what effects? Part III examines how entire cities or groups of cities are constructed as experiments. This book seeks to contribute a deeper and more socially and politically nuanced understanding of how urban experiments

shape cities and drive wider changes in society, providing a framework to examine the phenomenon of urban experimentation in conceptual and empirical detail.

**Book: Sauer T., Elsen, S. and Garzillo, C. (eds.), 2016, *Cities in Transition: Social Innovation for Europe's Urban Sustainability*, Oxford: Routledge.**

*Cities in Transition* focuses on the sustainability transitions initiated in 40 European cities. The book presents the wealth of insights gathered through hundreds of interviews and questionnaires. Four key domains—local energy systems, local green spaces, local water systems and local labour markets—have been the focus of the field research investigating local potentials for social innovation and new forms of civil society self-organisation. Examining the potential of new organizational frameworks like co-operatives, multi-stakeholder constructions, local-regional partnerships and networks for the success of such transitions, this book presents the key ingredients of a sustainable urban community as a viable concept to address current global financial, environmental and social challenges.

**Book: Genus, A. (ed.), 2016, *Sustainable Consumption: Innovation, Design and Practice*, Springer**

This book originates from the work of contributors to initiatives and global networks promoting and pursuing lines of enquiry that recognise and probe relationships between sustainable consumption, design and production, and the implications of those relationships for new economic activity and the way we live and govern ourselves. It features contributions from social scientists (e.g. from the fields of innovation studies, geography, environmental policy and sociology) and practitioners, serving to generate a short-list of research perspectives and topics around which future research and actions in practice will be orientated. The book consists of ten chapters divided into three parts, focusing on: perspectives/methodological insights; empirical work integrating consumption and production; and site-specific practitioner-oriented case studies. The conclusion examines the key aspects of policy, research and practical implications.

**Special issue: Audet, R (Ed.). 2016. *Pour une sociologie de la transition écologique [For a sociology of ecological transition]*, *Cahiers de recherche sociologique* 58.**

This journal issue makes a case for the sociological analysis of the emergence of the transition category in public discourses, in social practices and in social sciences. More specifically, it examines the potential contribution of environmental sociology in understanding this emergence and, in return, how the transition category happens to question the current paradigms in environmental sociology. The list of papers is available here: <http://www.athenaeditions.net/pages/nouveautes/crs-58.html> The paper copy can be ordered from the editor (Athéna Éditions), all the articles will be on-line soon.

**Rosenbloom, D., Berton, H., and Meadowcroft, J., 2016, *Framing the sun: A discursive approach to understanding multi-dimensional interactions within socio-technical transitions through the case of solar electricity in Ontario, Canada*, *Research Policy*, 45(6), 1275–1290**

In response to calls to develop more politically-informed transition studies, a burgeoning literature on discourse-transition complementarities and niche-regime interactions has recently emerged. This paper draws these strands of literature together in order to develop a discursive approach that investigates the process by which actors use language to build or erode the legitimacy of socio-technical innovations and their niches within transition episodes. Conceptualizing this process in terms of *multi-dimensional discursive interactions*, we adopt a discursive approach to further scrutinize: (1) the way in which actor groups depicted within the multi-level perspective struggle to frame innovations using narrative work and (2) how these narratives are formed through the ideational capacity of actors to link the content and context of an innovation. We demonstrate this approach by applying it to the case of PV diffusion in Ontario, Canada. Our findings contribute to the development of a more politically-sensitive view of transitions as well as recent work on incumbent-challenger

interactions and discourse-transition crossovers. Beyond this, we corroborate and extend several observations in the transition literature, including the semi-coherent nature of the regime, the social construction of the landscape, and the prevalence of fit-and-conform orientations within niche empowerment strategies. However, findings also indicate that strategic orientations can be subtle and intermeshed, perhaps explaining why fit-and-conform orientations appear more prevalent.

**Larsen, T., Hoffman, S., Lüthi, C., Truffer, B. 2016. Emerging solutions to the urban water challenge of an urbanizing world. *Science* 352, (6288) 928 - 933.**

The top priorities for urban water sustainability include the provision of safe drinking water, wastewater handling for public health, and protection against flooding. However, rapidly aging infrastructure, population growth, and increasing urbanization call into question current urban water management strategies, especially in the fast-growing urban areas in Asia and Africa. We review innovative approaches in urban water management with the potential to provide locally adapted, resource-efficient alternative solutions. Promising examples include new concepts for stormwater drainage, increased water productivity, distributed or on-site treatment of wastewater, source separation of human waste, and institutional and organizational reforms. We conclude that there is an urgent need for major transdisciplinary efforts in research, policy, and practice to develop alternatives with implications for cities and aquatic ecosystems alike.

**Jolly, S., Spodniak, P. and Raven, R., 2016, Institutional entrepreneurship in transforming energy systems towards sustainability: Wind energy in Finland and India, *Energy Research and Social Science*, 17, 102-118**

A growing body of literature has examined the dynamics of wind energy development across different mature and emerging institutional contexts. However, so far only few have paused to reflect on the differences between developed and emerging economies. Building upon the literature on institutional entrepreneurship, this paper compares institutional strategies in wind energy development in Finland and India by using the typology of political, technical and cultural work. We highlight the role of institutional approaches in studying sustainable energy transitions in mature and emerging institutional contexts, while being sensitive to the role of heterogeneous actors in shaping institutional arrangements. Our findings offer implications for debates in the institutional entrepreneurship literature by exploring how actors shape their institutional environment in different contexts, and the extent to which emerging institutional contexts provide more opportunities for institutional entrepreneurship. Finally, this paper underscores the need for developing insights into enabling conditions for successful collective institutional entrepreneurship and for developing typologies of institutional strategies which are generalizable across both mature and emerging institutional contexts.

**Becker, S.L. and Reusser, D.E., 2016, Disasters as opportunities for social change: using the multi-level perspective to consider the barriers to disaster-related transitions, *International Journal of Disaster Risk Reduction*, in press**

We examine the suitability of using the multi-level perspective to describe disaster-related transitions and their barriers in an institutional environment that expects disaster responders, such as government agencies, to adhere to the increasingly established principles of disaster risk reduction. We created a process-tracing test based on disaster and transition literature and applied it to two cases: Cyclone Nargis and Hurricane Katrina. In applying this test we found that multi-level perspective is a valid way to describe disaster-related transitions. We also determined that both the concepts of build back better and disaster risk reduction influenced the transitions. Moreover, a lack of resources and a strong government desire for control presented obstacles to transition. These disaster-related transitions have implications for policy considerations. Knowledge from this article can inform future studies on disaster response and recovery.

**Elzen, B. and Bos, B., 2016, The RIO approach: Design and anchoring of sustainable animal husbandry systems, *Technological Forecasting and Social Change*, in press**

This paper discusses an approach to develop new 'integrally sustainable' animal production systems and stimulate their uptake in practice. It consists of a design approach called RIO, and a set of 'anchoring' activities to stimulate their uptake in niches and in the regime. In the period 2001–2015 we have applied the approach in various animal production sectors, and adapted and improved it while doing. The general aim of the paper is to assess the applicability of the RIO/anchoring approach to induce sustainability transitions. We conclude that RIO is especially suited for areas characterized by a 'heterogeneous' set of sustainability challenges (in our case, environmental burden, animal welfare, public acceptance, profitability). A RIO approach can then render 'integrally sustainable' alternatives that generate wide interest in the regime. Anchoring activities can successfully stimulate a variety of initial changes. This does not suffice, however, and a conducive institutional environment is key to facilitate the initial uptake of the novel systems. With relatively simple and cheap financial instruments, governments can help to create such a conducive environment.

**Walrave, B. and Raven, R., 2016, Modelling the dynamics of technological innovation systems, *Research Policy*, in press**

Currently there is no formal model describing the dynamics of technological innovation systems. This paper develops a system dynamics model that integrates the concept of 'motors of innovation', following the literature on emerging technological innovation systems, with the notion of 'transition pathways' that was developed as part of the multi-level-framework thinking. As such, the main contribution of this paper is a cross-over of two key-frameworks into a system dynamics model that can serve as underpinning for future research. The model's behaviour is illustrated by means of analyses of TIS dynamics in the context of different transition pathways, under different resourcing conditions. The paper also provides a future research agenda, persuasible by means of experimentation and/or further development of the presented model.

**Bolton, R. and Hannon, M., 2016, Governing sustainability transitions through business model innovation: Towards a systems understanding, *Research Policy*,**

This paper examines the role of innovative business models in the transformation of socio-technical systems. Focusing on decentralised energy technologies, we explore business model innovation in the context of a transition towards a more sustainable energy system. We conduct an empirical study of two Energy Services Company (ESCo) models for the deployment of combined heat and power with district heating (CHP/DH) infrastructure in the UK. Based on these case studies we illustrate the different ways in which Local Authorities develop business models to create and capture value from more efficient resource use and to deploy sustainable technologies. Drawing from systems theories in the business model and socio-technical literatures, we analyse the interfaces between business models, energy infrastructure and institutions. We propose that a systems based approach to the analysis of business models as embedded in their socio-technical contexts can offer new insights into the dynamics and governance of sustainability transitions.

**Hellsmark, H., Frishammar, J., Söderholm, P. and Ylinenpää, H., 2016, The role of pilot and demonstration plants in technology development and innovation policy, *Research Policy*, in press**

Pilot- and demonstration plants (PDPs) represent bridges between generating basic knowledge and technological breakthroughs on the one hand, and industrial applications and commercial adoption on the other. This paper reports on a longitudinal study of how two technological fields that received significant public funding evolved—biochemical conversion of biomass and thermal conversion of black liquor. In doing so, this study makes two contributions. First, it provides a framework for analyzing the roles of various types of PDPs in developing new technology. The framework highlights the learning processes taking place

at and around these plants and how they contribute to reducing different types of risks. It also elaborates on the importance of actor networks and institutional preconditions, and how both network performance and institutions can be influenced through various strategies. Second, the article contributes with new insights into the challenges of innovation policy in a PDP context. A policy mix is often required because policy cannot be considered meaningfully at a single level of government and will therefore be influenced heavily by limited foresight and politics (both nationally and locally). Therefore, policy must address both the need for parallel and iterative public funding of R&D and different types of plants, as well as attempts to directly influence collaborative processes in actor networks.

**Werbeloff, L. and Brown, R.R., 2016, Using policy and regulatory frameworks to facilitate water transitions, *Water Resources Management***

There are persistent calls across policy, industry and academia for urban water transitions in order to deliver increased sustainability, liveability and resilience. However, realisation of such transformational change is difficult, and there are a number of undesirable or unsuccessful transition trajectories that can manifest. Drawing on a contemporary stormwater quality management transition in South-East Queensland, Australia, this qualitative research paper provides an empirical exploration of a transition in struggle. The paper examines why and how this transition trajectory unfolded, focusing specifically on the evolution of culture, structure and practice changes from the 1970s to the present-day. The paper makes two scholarly contributions, firstly confirming the dynamic nature of transformational change and indicating the need to design transition initiatives across the culture, structure and practice domains to co-evolve and thereby build a robust and mutually reinforcing transition foundation. The results also reveal the critical role of regulation in providing a safety net for the transition and enabling continued progress even when commitment to policy goals wavers. These results also provide practical insight for practitioners engaged in the implementation of transition processes, and reveal the need for transition advocates to deliberately and proactively engage with regulatory frameworks to embed a novel practice.

**Mander, S., 2016, Slow steaming and a new dawn for wind propulsion: A multi-level analysis of two low carbon shipping transitions, *Marine Policy*, in press**

The key enabler of international trade, shipping is heavily reliant on fossil fuels and responsible for approximately 2% of global carbon emissions. For the sector to reduce its emissions in line with climate change objectives, a wholesale transition is required from the current carbon intensive shipping system to one with a lower climatic impact. Drawing on the multi-level perspective from the socio-technical transitions literature, this paper focuses on two technological developments which could reduce the emissions from shipping – slow steaming and wind propulsion. Outlining the landscape changes which may hinder or support the incorporation of each of these innovations into the broader shipping regime the paper shows how slow steaming has been accommodated within this regime, in response to high oil prices and the economic downturn. In the longer term it concludes that additional policy measures may be required to ensure slow steaming persists should landscape pressures reduce. Oil prices, and the environmental agenda, are driving the development of wind propulsion, but more needs to be done to support those companies which seek to demonstrate and commercialise modern incarnations of the original pioneers of the seas.

**Caprotti, F., 2016, Protecting innovative niches in the green economy: investigating the rise and fall of Solyndra, 2005–2011, *GeoJournal*, in press**

This article examines the establishment and development of a protected ‘green’ niche around the solar manufacturing industry in the United States in the 2000s. The paper uses the case of Solyndra, an innovative solar manufacturing corporation founded in 2005 and that went bankrupt in 2011, as a window into identifying the key factors that led to the failure of Solyndra. Solyndra was, at the time, the largest recipient of loan funding from the US

Department of Energy, making it into the main representative of a key strategic industry identified as a target for federal support as part of US stimulus funding after the 2008 financial crisis. The analysis of the Solyndra failure case presented here highlights the need for strategic transitional niches to be shielded longitudinally by a strategic, entrepreneurial state, and considered in light of transnational exogenous factors. The article also argues for the importance of analysing discursive strategies that perform strategic niches as belonging to specific societal pathways.

**Hatzl, S., Seebauer, S., Fleiss, E. and Posch, A., 2016, Market-based vs. grassroots citizen participation initiatives in photovoltaics: A qualitative comparison of niche development, *Futures*, 78, 57-70**

Photovoltaic citizen participation initiatives (CPIs) receive increasing attention as a form of social innovation, contributing to a sustainable decentralized energy future. However, their ability to outgrow a protected niche characterized by feed-in tariffs, to regime level, is unclear. Drawing on qualitative interviews with key actors, the present study classifies Austrian CPIs in terms of them being market-based (profit-oriented business) or grassroots initiatives (civil-society based community activism), and compares these two types with respect to the three key processes of strategic niche management: actor network formation, learning, and expectations management. Market-based CPIs exhibit a relatively heterogeneous external actor network. They follow a policy of business development, engage in highly professionalized learning, and access a large, widespread customer base. In contrast, grassroots CPIs leverage a tightly-knit network of local actors, engage in informal learning and shared expectations. In some CPIs, market-based and grassroots motivations converge. Both types seem capable of achieving regime level, either through individual growth or by aggregation of multiple small-scale initiatives. As yet, few CPIs have outgrown their local niche status. This is mainly due to a lack of intermediary actors which may institutionalize knowledge and resources to support the foundation of new CPIs.

**Xu, G., Xu, X., Tang, W., Liu, W., Shi, J., Lio, M. and Wang, K., 2016, Fighting against water crisis in China—A glimpse of water regime shift at county level, *Environmental Science & Policy*, 6, 33-41**

Three decades of economy growth and urbanization has brought China into the rim of water crisis. Transition to sustainability has gained consensus and put into practice at all administrative levels. However, due to locking mechanisms such as sunken investments, vested interests, and economic structure, such transition would not prove to be easy. Here we adopt the Multi-Level Perspective framework to analyze a county level water regime shift in Yiwu of Zhejiang province, which is representative for its economic success and severity of water problem in China. The transition is described as the interactions between water regime subsystems including society, economy, administration, infrastructure, and natural water cycling process, as well as the influence from the landscape level such as politics. Figures show that the water system is making a turnaround to the better side, while the government plays a key role in pushing and managing the transition. This study allows us to have a glimpse of the whole water regime transition currently happening in China, as well as being used for reference in other parts of the developing world, for the promoting of sustainable water resource management.

**Birtchnell, T., Böhme, T. and Gorkin, R., 2016, 3D printing and the third mission: The university in the materialization of intellectual capital, *Technological Forecasting and Social Change*, in press**

The production, diffusion and preservation of knowledge are the main goals of universities, which are critical nodes for mediating intellectual capital. In recent years, 3D printing (additive manufacturing) technologies are emerging as a possible disruptive or transformative force in the knowledge economy and by extension the material economy as consumers are given the affordance of materializing information into real-world objects. To understand the role universities will play in this potential convergence of the material and

knowledge economies, this paper surveys current levels of involvement of tertiary institutions in 3D printing. The paper projects how the materialization of data will affect a range of social dynamics for creators-cum-consumers at different scales: community, region and nation-state and applies case studies to the multilevel perspective (MLP) framework. Studies are considered in three empirical cases: Berlin in Germany, Lancashire in the United Kingdom, and the United States. The research indicates that the National Additive Manufacturing Innovation Institute (NAMII) 'America Makes' Program is a top-down knowledge dissemination program for 3D printing. In contrast, the UK Lancaster University Product Development Unit (LPDU) is a 3D-printing value-network, which has developed organically over a decade of operation. Fablab Berlin is a local initiative loosely coupled with industry and tertiary education providers. The paper proposes a future-oriented conceptual framework to capture a variety of present-day university engagements with additive manufacturing in terms of intellectual capital.

**Nilsson, M. and Nykvist, B., 2016, Governing the electric vehicle transition – Near term interventions to support a green energy economy, *Applied Energy*, in press**

This paper seeks to better understand how one plausible development in a green energy economy transition of the transport sector can be governed: a breakthrough of battery-electric vehicles (BEV). Drawing on recent results and lessons from BEV studies at local, national and regional scales, the paper presents two alternative scenarios of BEV uptake until 2030 – one incremental growth scenario and one breakthrough scenario. It then draws on the multilevel perspective (MLP) on socio-technical systems as an approach to identify the governance implications of the breakthrough scenario. Based on a characterisation of barriers and drivers at landscape, regime and niche levels, it identifies governance interventions to enable a BEV breakthrough. The results point towards a multidimensional governance approach that includes conventional policy instruments such as durable incentive policies, with a predictable mechanism for adjustment and phase-out, and mechanisms for mobilising investment finance for fast and super-fast charging and home charging along public roads. In addition, more innovation-systems oriented governance is required, such as familiarisation and experience building to ease cognitive barriers and build knowledge for both consumers and businesses, and supporting structural and technological change within automotive industries.

**Ramankutty, N. and Coomes, O.T., 2016, Land-use regime shifts: an analytical framework and agenda for future land-use research, *Ecology and Society* 21(2):1**

A key research frontier in global change research lies in understanding processes of land change to inform predictive models of future land states. We believe that significant advances in the field are hampered by limited attention being paid to critical points of change termed land-use regime shifts. We present an analytical framework for understanding land-use regime shifts. We survey historical events of land change and perform in-depth case studies of soy and shrimp development in Latin America to demonstrate the role of preconditions, triggers, and self-reinforcing processes in driving land-use regime shifts. Whereas the land-use literature demonstrates a good understanding of within-regime dynamics, our understanding of the drivers of land-use regime shifts is limited to ex post facto explications. Theoretical and empirical advances are needed to better understand the dynamics and implications of land-use regime shifts. We draw insights from the regime-shifts literature to propose a research agenda for studying land change.

**Foran, T., Fleming, D., Spandonide, B., Williams, R. and Race, D., 2016, Understanding energy-related regimes: A participatory approach from central Australia, *Energy Policy*, 91, 315–324**

For a particular community, what energy-related innovations constitute no-regrets strategies? We present a methodology to understand how alternative energy consuming activities and policy regimes impact on current and future liveability of socio-culturally diverse communities facing climate change. Our methodology augments the energy policy

literature by harnessing three concepts (collaborative governance, innovation and political economic regime of provisioning) to support dialogue around changing energy-related activities. We convened workshops in Alice Springs, Australia to build capability to identify no-regrets energy-related housing or transport activities and strategies. In preparation, we interviewed policy actors and constructed three new housing-related future scenarios. After discussing the scenarios, policy and research actors prioritised five socio-technical activities or strategies. Evaluations indicate participants enjoyed opportunities given by the methodology to have focussed discussions about activities and innovation, while requesting more socially nuanced scenario storylines. We discuss implications for theory and technique development.

**Levy, D., Reinecke, J. and Manning, S., 2016, The political dynamics of sustainable coffee: Contested value regimes and the transformation of sustainability, *Journal of Management Studies*, 53(3), 364-401**

The global coffee sector has seen a transformation towards more 'sustainable' forms of production, and, simultaneously, the continued dominance of mainstream coffee firms and practices. We examine this paradox by conceptualizing the underlying process of political corporate social responsibility (PCSR) as a series of long-term, multi-dimensional interactions between civil society and corporate actors, drawing from the neo-Gramscian concepts of hegemony and passive revolution. A longitudinal study of the evolution of coffee sustainability standards suggests that PCSR can be understood as a process of challenging and defending value regimes, within which viable configurations of economic models, normative-cultural values, and governance structures are aligned and stabilized. Specifically, we show how dynamics of moves and accommodations between challengers and corporate actors shape the practice and meaning of 'sustainable' coffee. The results contribute to understanding the political dynamics of CSR as a dialectic process of 'revolution/restoration', or passive revolution, whereby value regimes assimilate and adapt to potentially disruptive challenges, transforming sustainability practices and discourse.

**Kiparsky, M., Thompson, B. H. Jr, Binz, C., Sedlak, D. L., Tummers, L. Truffer, B. 2016. Barriers to innovation in urban wastewater utilities: Attitudes of managers in California. *Environmental Management*, 57(6), 1204-1216.**

In many regions of the world, urban water systems will need to transition into fundamentally different forms to address current stressors and meet impending challenges—faster innovation will need to be part of these transitions. To assess the innovation deficit in urban water organizations and to identify means for supporting innovation, we surveyed wastewater utility managers in California. Our results reveal insights about the attitudes towards innovation among decision makers, and how perceptions at the level of individual managers might create disincentives for experimentation. Although managers reported feeling relatively unhindered organizationally, they also spend less time on innovation than they feel they should. The most frequently reported barriers to innovation included cost and financing; risk and risk aversion; and regulatory compliance. Considering these results in the context of prior research on innovation systems, we conclude that collective action may be required to address underinvestment in innovation.

**Binz, C., Truffer, B., Coenen, L. 2016. Systemic anchoring of global innovation processes and new industry formation – The emergence of on-site water recycling in China. *Economic Geography*, 92(2), 172-200.**

Where and how new industrial paths emerge are much debated questions in economic geography, especially in light of the recent evolutionary turn. This article contributes to the ongoing debate on path creation with a new analytical framework that specifies the formation of generic resources in embryonic industries. It suggests that path creation processes are not only conditioned by preexisting regional capabilities and technological relatedness but also by the way firm and nonfirm actors mobilize and anchor key resources for industry formation. Our framework elaborates on the early industry development phase, extending

the focus on regional knowledge spillovers in evolutionary economic geography (EEG) literature with recent insights on industry formation dynamics from innovation studies. It understands early path creation as conditioned by four systemic resource formation processes—knowledge creation, investment mobilization, market formation, and technology legitimation— that can be mobilized both from inside or anchored from outside the region. The use and value of the analytical framework is illustrated by a case study on on-site water recycling technology (OST), based on interviews with 40 experts in three Chinese city regions. The findings suggest that, despite possessing the least favorable initial conditions, a sizable OST industry developed only in Beijing. This is explained based on the specific anchoring process of the four key resources in the early development stage of the industry. Our results imply that EEG would profit from incorporating a broader set of variables than knowledge-based relatedness in explanations of regional industrial path creation.

**Fischer, L-B. and Newig, J., 2016, Importance of actors and agency in sustainability transitions: A systematic exploration of the literature, *Sustainability*, 8(5), 476**

This article explores the role of actors and agency in the literature on sustainability transitions. We reviewed 386 journal articles on transition management and sustainability transitions listed in Scopus from 1995 to 2014. We investigate the thesis that actors have been neglected in this literature in favor of more abstract system concepts. Results show that this thesis cannot be confirmed on a general level. Rather, we find a variety of different approaches, depending on the systemic level, for clustering actors and agency as niche, regime, and landscape actors; the societal realm; different levels of governance; and intermediaries. We also differentiate between supporting and opposing actors. We find that actor roles in transitions are erratic, since their roles can change over the course of time, and that actors can belong to different categories. We conclude by providing recommendations for a comprehensive typology of actors in sustainability transitions.

**Van Doren, D., Driessen, P.P.J., Runhaar, H. and Giezen, M., 2016, Scaling-up low-carbon urban initiatives: Towards a better understanding, *Urban Studies*, in press**

In cities worldwide, low-carbon urban initiatives (LCUIs) are realised by pioneers that prove that climate mitigation strategies can be integrated in urban development trajectories. Practitioners and scholars reflect on the need to scale-up such initiatives in order to accelerate the transition to low-carbon cities. Yet, limited conceptual clarity exists regarding the meaning of the concept of 'scaling-up' and the factors driving this process. This article aims to contribute to practice and theory on low-carbon urban development by presenting a taxonomy on the concept of scaling-up. Moreover, an explanatory framework is presented consisting of factors expected to contribute to the impact and scaling-up of LCUIs. Two case studies were conducted to illustrate the explanatory framework. The studies are illustrative but suggest that the explanatory framework allows for a systematic understanding of how the impact of former initiatives can be explained, and how their scaling-up can be promoted.

**Sengers, F. 2016. Cycling the city, re-imagining the city: Envisioning urban sustainability transitions in Thailand. *Urban Studies*, 1-17**

Urban sustainability transitions are journeys of transformative socio-technical change to set course for an envisioned future city. These journeys start out in the minds of change agents as vague conceptual images inspired by far-flung ideals, which are then further substantiated and articulated as 'urban imaginaries' – shared understandings of what constitutes a desirable future city. The conceptual contribution of this paper lies in demonstrating the power of the urban imaginaries notion to studying the process of envisioning in the context of sustainability transitions. By following a number of prolific Thai cycling campaigners through the streets of several cities in Thailand – focusing on the urban imaginaries they articulate – this paper shows how urban sustainability transitions are envisioned from the bike saddle, how these imaginaries are mobilized to empower cycling and how a seemingly disparate set of urban development pathways converge around technological artefacts and material infrastructure.

**Planko, J., Cramer, J.M., Chappin, M.M.H. and Hekkert, M.P., 2016, Strategic collective system building to commercialize sustainability innovations, *Journal of Cleaner Production*, in press**

The implementation of innovative sustainability technologies often requires far-reaching changes of the macro environment in which the innovating firms operate. Strategic management literature demonstrates that the chances of a successful diffusion and adoption of an innovative technology in society are increased if the firms wanting to commercialize this technology collaborate in networks or industry clusters to build a favourable environment for their technology. However, the strategic management literature does not offer advice on how to strategically create this supportive external environment. We fill this gap with complementary insights from the technological innovation systems literature. We introduce the concept of strategic collective system building; this concept describes processes and activities that networks of actors can strategically engage in to collectively build a favourable environment for their innovative sustainability technology. Furthermore, we develop a strategy framework for collective system building. To underpin our theoretical analysis empirically, we have conducted a case study in the Dutch smart grid field. The resulting strategy framework consists of four key areas: technology development and optimization, market creation, socio-cultural changes and coordination. Each of these key strategic areas is composed of a set of system-building activities.

**Chilvers, J. and Longhurst, N., 2016, Participation in transition(s): Reconceiving public engagements in energy transitions as co-produced, emergent and diverse, *Journal of Environmental Policy & Planning*, in press**

This paper brings the transitions literature into conversation with constructivist Science and Technology Studies (STS) perspectives on participation for the first time. In doing so we put forward a conception of public and civil society engagement in sustainability transitions as co-produced, relational, and emergent. Through paying close attention to the ways in which the subjects, objects, and procedural formats of public engagement are constructed through the performance of participatory collectives, our approach offers a framework to open up to and symmetrically compare diverse and interconnected forms of participation that make up wider socio-technical systems. We apply this framework in a comparative analysis of four diverse cases of civil society involvement in UK low carbon energy transitions. This highlights similarities and differences in how these distinct participatory collectives are orchestrated, mediated, and subject to exclusions, as well as their effects in producing particular visions of the issue at stake and implicit models of participation and 'the public'. In conclusion we reflect on the value of this approach for opening up the politics of societal engagement in transitions, building systemic perspectives of interconnected 'ecologies of participation', and better accounting for the emergence, inherent uncertainties, and indeterminacies of all forms of participation in transitions.

**Viola, S., 2016, Green roofs for built environment recovery: technological transitions, *Journal of Cleaner Production*, in press**

In 2012, the Laboratory of Recovery and Maintenance at the University of Naples Federico II starts an applied research with the Institute for Composite and Biomedical Materials - IMCB - CNR, of Naples. The aim is to explore the potential of a patented hybrid foam, Hypucem, as a green technology for the recovery of flat roofs in reinforced concrete buildings.

Two green extensive prototypes are developed and tested to provide an adequate response to the problem of residential buildings. The difference between them is in the mode of greening: sowing before or after the on-site assembly, with overlapping layers of green, in the first case, and their integration into special pockets formed inside the panel, in the second. Laboratory tests verify the germination and growth dynamics for a closed-cell polyurethane-concrete foam and for open-cell polyurethane-soil specimens.

Trials are carried out in a residential neighborhood realised after Second World War. During six months, the benefits to buildings' performances, in both solutions, are monitored, highlighting the importance of roofs dimensions and accessibility. With a greater ease of

installation and inspection, the open-cell polyurethane foam solution, accommodating transplanted vegetation, results more suitable for a direct involvement of users in ordinary maintenance. This attitude is fundamental in order to prevent any decrease in roofs thermal resistance due to the lowering of the green layers performances.

**Fuchs, G. and Hinderer, N., 2016, One or many transitions: local electricity experiments in Germany, *Innovation: The European Journal of Social Science Research*,**

A characterizing feature of the German electricity transition is that it started as a movement arising from the civil society. Initially the movement was directed against nuclear energy and later on turned into a movement favouring decentralized forms of energy production and distribution as well as local control over energy issues. Once these demands found official recognition and regulatory support, a dynamic development ensued in which a host of new actors with new ideas and strategies became involved in the field of electricity generation. Regions, cities and villages experimenting with socio-technical innovations and aiming to implement new concepts developed governance structures under high uncertainty. These governance structures mirror space-specific social, political, technological and economic constellations. Once the old incumbent actors in the field began to falter, both government and electricity providers started to stem the tide of decentralized initiatives, whose dynamic in fact has recently been seriously weakened. In order to help us better understand these developments in a more generic context, the political-cultural theory of strategic action fields as developed by Neil Fligstein and Doug McAdam will be applied.

**Fuchs, G. and Hinderer, N., 2016, Towards a low carbon future: a phenomenology of local electricity experiments in Germany, *Journal of Cleaner Production*, in press**

A characterizing feature of the German electricity transition is that it started as a movement arising from the civil society. Initially the movement was directed against nuclear energy and later on turned into a movement favoring decentralized forms of energy production and distribution as well as local control over energy questions. Once these demands found official recognition and regulatory support, a dynamic development ensued in which a host of new actors with new ideas and strategies became involved in the field of electricity generation. Regions, cities and villages experimenting with socio-technical innovations and aiming to implement new concepts developed governance structures under high uncertainty. These governance structures mirror space-specific social, political, technological and economic constellations. Once the old incumbent actors in the field began to falter, both government and electricity providers started to stem the tide of decentralized initiatives, whose dynamic in fact has recently been seriously weakened. In order to help us better understand these developments in a more generic context, the theory of strategic action fields will be applied.

**Huijben J.C.C.M., Podoyntsyna, K.S., Van Rijn, M.L.B., Verbong, G.P.J., 2016, A review of governmental support instruments channeling PV market growth in the Flanders region of Belgium (2006-2013), *Renewable and Sustainable Energy Reviews* (62), 1282 – 1290.**

How did a country in the middle of Western Europe, starting almost from scratch, reach the European top 3 in terms of solar PV capacity in five years? And what were the costs? We provide a systematic chronological review of the different governmental support instruments that drove the exponential growth of the solar energy market in the Flanders region of Belgium and calculate their relative contributions. The results of the economic calculations show that green electricity certificates had by far the greatest effect on both the rise and stagnation of the market, costing about 1.5 billion euro only for 2006–2013. The long-term societal costs of such growth proved to be even higher (6.7 billion for 2014–2031) and unevenly distributed, with residents paying the highest price via their energy bills. Companies continuously adapted their organizations to enact the available support instruments. Counter-intuitively, the substantial support shifted the attention of companies to

the larger systems, even though the incentive for investment in PV was lower than for the smaller systems

**Korsnes, M., 2016, Ambition and ambiguity: Expectations and imaginaries developing offshore wind in China, *Technological Forecasting and Social Change*, in press**

This paper investigates how future-orientation generates action in China's offshore wind industry. We might expect that, with an authoritarian government, China would be able to push through policies with ease. Using the sociology of expectations and sociotechnical imaginaries, this paper shows how the future is an important resource for not only coordinating government and industry actors but also calibrating and negotiating expectations of what can be achieved. On the one hand, sociotechnical imaginaries – as exemplified by government development targets – appear to spur action; on the other hand, local expectations modify the intended development targets. The paper describes a strategic waiting game in which the government is obscure about intentions and in which the industry, wanting a piece of a promising cake, is eager to get a head start. This paper finds that ambitiousness about the future, but ambiguity in implementation, is a strategy successfully employed by the government to ensure change. The paper shows how state intervention is productively managed so that it neither stifles nor exclusively drives offshore wind industry development in China.

**Lilliestam, J. and Hanger, S., 2016, Shades of green: Centralisation, decentralisation and controversy among European renewable electricity visions, *Energy Research & Social Science*, 17, 20–29**

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.

**Rocholl, N. and Bolton, R., 2016, Berlin's electricity distribution grid: an urban energy transition in a national regulatory context, *Technology Analysis & Strategic Management*, in press**

Germany has set ambitious targets to transform its energy system from being based on fossil fuels and nuclear to renewable energies, requiring electricity grids to be upgraded. As a result there is significant public pressure in some German cities to exert greater local control over electricity distribution infrastructure. A case study approach was used to investigate contestations around ownership and governance of Berlin's electricity distribution grid. Actors at the local level perceive the national institutional framework supporting liberalised energy markets as not designed to adapt electricity distribution grids to the challenges of the *Energiewende* (energy turn) and to be instead hampering investment, innovation and the involvement of local actors. By analysing politics of grid ownership and governance, and emerging tensions between a national regulatory framework and more

locally bounded energy system visions, our study contributes to the emerging academic debate on urban energy transitions.

**Papachristos, G. and Adamides, E., 2016, A retroductive systems-based methodology for socio-technical transitions research, *Technological Forecasting and Social Change*, 108, 1-14**

Socio-technical system transitions research describes and categorizes transitions and explains and identifies their driving causes. In the literature, transition research frameworks have received some critique on whether they can facilitate the search for transition causes. As a response, and in order to cater for the complexity and contextuality of multi system transitions, this paper proposes a retroductive systems-based methodology. The methodology relies on qualitative case study development and quantitative simulation modelling. Retroduction along with modelling and simulation can contribute to the shift from researching single system/technology transitions to multi system/technology transitions. Thus the paper offers a step towards coping methodologically with sustainability transitions that often concern multi system interactions. We demonstrate the use of the methodology by adopting the Multi-Level Perspective on transitions to explain the emergence of the functional foods as a niche in the food/nutrition socio-technical system.

**Avelino, F. and Wittmayer, J.M., 2016, Shifting power relations in sustainability transitions: A multi-actor perspective, *Journal of Environmental Policy & Planning*, in press**

This paper contributes to understanding transition politics by conceptualizing (shifting) power relations between actors in sustainability transitions. The authors introduce a Multi-actor Perspective as a heuristic framework for specifying (shifting) power relations between different categories of actors at different levels of aggregation. First, an overview is provided of how power and empowerment have been treated in transition research, and remaining questions are identified on *who* exercises power and *who* is empowered by and with whom. It is argued that theoretical frameworks and empirical analyses in transition studies lack precision when it comes to distinguishing between different types and levels of actors. In response, a Multi-actor Perspective (MaP) is developed, which distinguishes among four sectors (state, market, community, third sector), and between actors at different levels of aggregation: (1) sectors, (2) organizational actors, and (3) individual actors. The paper moves on to specify how the MaP contributes to understanding transition politics specifically in conceptualizing shifting power relations. Throughout the paper, empirical illustrations are used regarding public debates on welfare state reform, civil society and 'Big Society', as well as more specific empirical examples of community energy initiatives.

**Szarka, J., 2016, Towards an evolutionary or a transformational energy transition? Transition concepts and roadmaps in European Union policy discourse, *Innovation: The European Journal of Social Science Research*, in press**

To develop a new typology of energy transitions, the article firstly clarifies the ambiguities in the transition debate and establishes fault lines that divide rival conceptualizations of energy transitions. The main fault lines relate to a product versus a process emphasis, a deterministic versus an open-ended perspective, and near-term versus long-term orientations. Two "ideal type" positionings towards energy transition(s) are developed. An evolutionary variety is based on incremental energy transitions over the long term which combine "old" and "new" energy sources and providers, whereas a transformational variety recommends a "grand transition" based on a near-term switch to 100% renewables. In its second section, the article uses this twofold typology to investigate transition thinking in the energy policy discourse of the European Commission. A key finding is that the Commission's policy documents indicate a leaning towards evolutionary transitions, with reliance on conventional energy sources set to continue for some time. Several explanations for this leaning are identified: a shortage of political will, finite available means, limits to knowledge, as well as institutional incapacity. An additional finding is that tensions in energy policy

formulation emerging from the EU's multilevel system of governance are leading to a clash between pioneer member states aiming for an ambitious energy transition and the Commission's more modest orientations. In consequence, an analytical typology exploring conflict between rival conceptualizations of energy transitions will be relevant for the future.

**Van Lancker, J., Wauters, E. and Van Huylenbroeck, G., 2016, Managing innovation in the bioeconomy: An open innovation perspective, *Biomass and Bioenergy*, 90, 60–69**

The transition towards a bioeconomy is increasingly viewed by both policy makers and scholars as one of the primary ways to reduce our dependency on fossil resources. However, socio-economic research on the transition towards the bioeconomy at the firm-level remains scarce. Specifically, studies approaching the bioeconomy from the technology and innovation management (TIM) concepts are particularly uncommon, although the importance of knowledge generation and innovation is considered crucial to make the transition towards a greener economy. In this study, we take a first step in addressing this issue by developing a set of guiding principles for the management of innovation processes in the bioeconomy comprised in three key issues: the relevant stakeholder groups and their importance in innovation development within the bioeconomy, the innovation network strategy and management, and organizational features considered prerequisites for collaborative innovation. This called for an identification of influencing factors specific to the bioeconomy context and the establishment of basic characteristics of innovation processes in the bioeconomy. The five identified influencing factors, the basic innovation process characteristics, and the guidelines and recommendations presented in this paper are based on insights derived from a four-staged literature research of the bioeconomy and TIM literature. In particular, we focused on the Open Innovation approach because of the evident fit between this approach and the requirements for innovation in the bioeconomy.

**Pel, B., Wallenborn, G. & Bauler, T. (2016), Emergent transformation games: exploring social innovation agency and activation through the case of the Belgian electricity blackout threat, *Ecology and Society*, 21(2):17**

The persistence of current societal problems has given rise to a quest for transformative social innovations. As social innovation actors seek to become change makers, it has been suggested that they need to play into impactful macrodevelopments or “game-changers”. Here, we aim to deepen the understanding of the social innovation agency in these transformation games. We analyze assumptions about the game metaphor, invoking insights from actor-network theory. The very emergence of transformation games is identified as a crucial but easily overlooked issue. As explored through the recent electricity blackout threat in Belgium, some current transformation games are populated with largely passive players. This illustrative case demonstrates that socially innovative agency cannot be presupposed. In some transformation games, the crucial game-changing effect is to start the game by activating the players.

**Power, M., Newell, P., Baker, L., Bulkeley, H., Kirshner, J. and Smith, A., 2016, The political economy of energy transitions in Mozambique and South Africa: The role of the Rising Powers, *Energy Research & Social Science*, 17, 10-19**

In a world in which rising powers are reconfiguring global development trajectories with significant implications for their sustainability, it becomes increasingly important to understand *whether* and *how* low carbon energy transitions might be enabled or frustrated by this new global geography of power. Towards this end, this paper makes the case for bringing together insights from three broad sets of literature on: (1) socio-technical transitions; (2) the rising powers as (re)emerging development donors and; (3) energy geographies. In building bridges between these three bodies of scholarship we seek to develop an alternative analytical framework that attends more effectively to the global and domestic political economy of transitions and whose value is illustrated empirically in relation to the growing involvement of Brazil, India and China in the energy systems of Mozambique and South Africa. We argue that this alternative framework provides a better understanding

of how the rising powers are influencing the changing relationships between low carbon and fossil-fuel based energy pathways and of the multiple roles they are playing in the development and transformation of energy systems, through the development of 'niches' where innovation can emerge, or in reinforcing or challenging existing 'regimes' or dominant ways of providing energy services.

**Edomah, N., Jones, A., and Foulds, C. 2016. Energy transitions in Nigeria: The evolution of energy infrastructure provision (1800–2015). *Energies*, in press,**

The provision of energy infrastructure is essential for economic growth, social cohesion, and environmental sustainability. Understanding the multiple functions and services it provides us requires firstly a deeper understanding of the factors that influence energy infrastructure itself. This paper focusses on the factors that influence the evolution of energy infrastructure in Nigeria. By studying different eras of energy use according to the technologies that were being implemented, resources that were available, and the political practice of the time, it is possible to better frame the drivers of energy infrastructure. The paper explores the transitions of how Nigerians managed to obtain the vast majority of energy from food calories and traditional biomass, to the broad portfolio of energy sources that is in use today.

**Newell, P. and Bulkeley, H., 2016, Landscape for change? International climate policy and energy transitions: evidence from sub-Saharan Africa, *Climate Policy*, in press**

A deep and rapid de-carbonisation of the world's energy systems is essential to meeting international goals for addressing climate change. But what is the role of the climate regime in facilitating such transitions? How do assumptions built into existing climate policy about how, when, why and for whom energy transitions are unfolding relate to practice on the ground? How far do they help or hinder the critical task of supporting and orchestrating society-wide efforts to reduce fossil fuel use? In this paper, we examine how core assumptions concerning the role of the nation state, of carbon markets and finance, and of technology built into international climate policy are being challenged by the realities of how transitions in the energy systems are unfolding. Drawing on the critical region of Sub-Saharan Africa and empirical research in Mozambique and South Africa, we examine the challenges facing energy transitions and the potential for international climate policy to foster new trajectories towards decarbonisation.

**Newell, P. and Phillips, J., 2016, Neoliberal energy transitions in the South: Kenyan experiences, *GeoForum*, 74, 39-48**

What is the relationship between the direction and form of an energy transition and the political economy within which it is embedded? This paper explores how the nature of (low carbon) energy transitions is strongly influenced by the process of neoliberalisation that shape energy policy in the South. We seek to understand emergent energy transitions and to advance their theorisation through an account of the political economy of energy transition in Kenya. In contrast to the often techno-managerial orientation of literatures on socio-technical transitions, we explore the political terrain upon which competing visions of energy futures and material interests collide and seek to accommodate one another. We develop a political economy account that emphasises the structural and disciplinary power of capital and global institutions to set the terms of transition. This expresses itself in both delimiting the autonomy of state actors and by reconfiguring domestic institutional and social power in ways that shape the distributional politics of transitions.

**Marshall, J.P., 2016, Disordering fantasies of coal and technology: Carbon capture and storage in Australia, *Energy Policy*, in press**

One of the main ways that continued use of coal is justified, and compensated for, is through fantasies of technology. This paper explores the politics of 'Carbon Capture and Storage' (CCS) technologies in Australia. These technologies involve capturing CO<sub>2</sub> emissions, usually to store them 'safely' underground in a process called 'geo-sequestration'. In Australia the idea of 'clean coal' has been heavily promoted, and is a major part of CO<sub>2</sub>

emissions reduction plans, despite the technological difficulties, the lack of large scale working prototypes, the lack of coal company investment in such research, and the current difficulties in detecting leaks. This paper investigates the ways that the politics of 'clean coal' have functioned as psycho-social defence mechanisms, to prolong coal usage, assuage political discomfort and anxiety, and increase the systemic disturbance produced by coal power.

**Ryghaug, M. and Toftaker, M., 2016, Creating transitions to electric road transport in Norway: The role of user imaginaries, *Energy Research & Social Science*, 17, 119-126**

The aim of this paper is to study the role of user imaginaries in relation to electric cars and the role these imaginaries play in the ongoing transition towards electrification of the transport sector. We conducted interviews with a diverse group of stakeholders to explore how imaginaries of the public are constructed and how the shared expectations of a user trajectory shaped by user groups with different concerns and different expected technology developments influence policy. We identified a range of implications and influences of this shared imagination for different aspects of the development of strategies and policies related to electrification of the transport sector in Norway. Finally, we discuss how these user imaginaries, that we call imagined publics, appear to have become part of the process of sociotechnical changes and what the consequences may be for a transformation to sustainable mobility.

**Rogge, K.S. and Reichardt, K., 2016, Policy mixes for sustainability transitions: An extended concept and framework for analysis, *Research Policy*, in press**

Reaching a better understanding of the policies and politics of transitions presents a main agenda item in the emerging field of sustainability transitions. One important requirement for these transitions, such as the move towards a decarbonized energy system, is the redirection and acceleration of technological change, for which policies play a key role. In this regard, several studies have argued for the need to combine different policy instruments in so-called policy mixes. However, existing policy mix studies often fall short of reflecting the complexity and dynamics of actual policy mixes, the underlying politics and the evaluation of their impacts. In this paper we take a first step towards an extended, interdisciplinary policy mix concept based on a review of the bodies of literature on innovation studies, environmental economics and policy analysis. The concept introduces a clear terminology and consists of the three building blocks elements, policy processes and characteristics, which can be delineated by several dimensions. Based on this, we discuss its application as analytical framework for empirical studies analyzing the impact of the policy mix on technological change. Throughout the paper we illustrate the proposed concept by using the example of the policy mix for fostering the transition of the German energy system to renewable power generation technologies. Finally, we derive policy implications and suggest avenues for future research.

**Schaltegger, S., Lüdeke-Freund, F., and Hansen, E.G., 2016, Business models for sustainability: A co-evolutionary analysis of sustainable entrepreneurship, innovation, and transformation, *Organization & Environment*, in press**

The relevance of business models for corporate performance in general and corporate sustainability in particular has been widely acknowledged in the literature while sustainable entrepreneurship research has started to explore contributions to the sustainability transformation of markets and society. Particularities of the business models of sustainable niche market pioneers have been identified in earlier research, but little is known about the dynamic role of business models for sustainable entrepreneurship processes aiming at upscaling ecologically and socially beneficial niche models or sustainability upgrading of conventional mass market players. Informed by evolutionary economics, we develop a theoretical framework to analyze co-evolutionary business model development for sustainable niche pioneers and conventional mass market players aiming at the sustainability transformation of markets. Core evolutionary processes of business model

variation, selection and retention, and evolutionary pathways are identified to support structured analyses of the dynamics between business model innovation and sustainability transformation of markets.

**Boyer, R., 2016, Achieving one-planet living through transitions in social practice: A case study of Dancing Rabbit Ecovillage, *Sustainability: Science, Practice, & Policy*, 12(1).**

The per capita resource consumption for inhabitants of Dancing Rabbit Ecovillage (DR) is less than ten percent of the average American in most major categories, approximating “one planet” living in a nation that contributes disproportionately to global resource consumption. This article examines DR’s extraordinary energy and resource savings through the lens of social practice theory, which focuses on the meanings, competencies, and materials that individuals combine to form everyday practices. Participant observation and interviews with DR community members reveals how this rural ecovillage achieves remarkable energy and resource savings by transitioning away from the exclusive ownership of capital goods, investing in skills that facilitate the collective management of resources, and eliminating waste by taking advantage of locally available resources. Results suggest that local governments interested in sustainability and climate mitigation should encourage systems of collective resource management rather than maintaining a traditional focus on influencing changes in individual consumption choices.

**Hoppe, T., Kuokkanen, A., Mikkilä, M., Kahiluoto, H., Kuisma, M., Arentsen, M., & Linnanen, L. (2016). System merits or failures? Policies for transition to sustainable P and N systems in the Netherlands and Finland. *Sustainability*, 8(5), 463.**

Nitrogen (N) and phosphorus (P) cycles are absolutely vital in maintaining sustainable food systems. Human activities disturb the natural balance of these cycles by creating enormous additional nutrient fluxes, causing eutrophication of waterways and pollution in land systems. To tackle this problem, sustainable nutrient management is required. This paper addresses sustainable nutrient management in two countries: The Netherlands and Finland. We adopt a critical perspective on resource politics, especially towards opportunistic policy strategies for the pollutant management of N and P. Two research questions are considered. First, what are the key systemic and policy failures that occurred in the N and P systems in the Netherlands and Finland between 1970 and 2015? And second, which lessons can be drawn when addressing the policy responses in the two countries to cope with these failures? The cases are analyzed within Weber and Rohrer’s framework that addresses “failures” preventing sustainable transitions. The results show that a number of failures occurred, besides market failures (over-exploitation of the commons, externalization of costs): lack of directionality, policy coordination, institutions, capabilities, infrastructure, demand articulation, and reflexivity. Policy responses in both countries resulted in ponderous policy frameworks that were adequate to tackle nutrient problems from the industrial sector and municipalities. However, both countries provided only a moderate response in terms of system-wide integrated policy frameworks to cope with sectoral-transcending issues. The agricultural use of N and P, in contrast to detergents, has not been subjected to strong regulatory measures.

**Van den Bergh, J.C.J.M. (2016). Disagreement on sustainability policy within the social sciences? *European Review* 24(1): 83-88.**

One can find many proposals for policy responses to global environmental problems. Different disciplines – notably economics, geography, innovation studies, policy and political sciences, psychology and sociology – offer partly inconsistent advice. This undermines the social-political acceptance of policies as voters and politicians are likely to be left confused. To decide about an adequate sustainability policy mix we need to concur on the core problems such a mix has to tackle. I address four of these hereafter. Each one involves important issues of disagreement as well as unresolved questions.

**Shemelev, S., and J. van den Bergh (2016). Optimal diversity of renewable energy alternatives under multiple criteria: An application to the UK. *Renewable and Sustainable Energy Reviews* 60: 679-691.**

We propose a multi-criteria analysis of alternative combinations of renewable energy technologies to meet a sustainable energy supply. It takes into account a range of criteria to reflect relevant environmental, social and economic considerations, capture the value of diversity, and reflect innovative potential and learning capacity. The combination of these factors allows for solutions in which there is more balance between economic, environmental and social dimensions, unlike in previous studies. Scenarios that might have been preferred on the basis of, for example, minimal costs or low CO<sub>2</sub> emissions, will have to be reconsidered because of negative effects in terms of land use or unemployment. The decision making philosophy in this case changes from that of optimization to multi-criteria satisficing. This article argues for consideration of the following dimensions of the energy system: costs, emissions, water use, land use and employment. Consideration of such dimensions will shift energy system into the direction of overall sustainability while making it more resilient in the long-term. The approach is applied to the case of the United Kingdom by making use of a MARKAL model, complementing its goal of cost-minimization with additional, social and environmental criteria. This gives rise to a number of suggestions for UK energy mix and policy.

**Drews, S., J.C.J.M. van den Bergh (2016). Public views on economic growth, the environment and prosperity: Results of a questionnaire survey. *Global Environmental Change* 39: 1-14.**

The long-standing academic and public debate on economic growth, prosperity and Environmental sustainability has recently gained new momentum. It lacks, however, a broad perspective on public opinion. Prior opinion surveys typically offered a simple dichotomous choice between growth and environmental protection. This study examines public beliefs and attitudes about a wider range of aspects of the growth debate. To this end, we conducted an online questionnaire survey including a country-wide, representative sample of 1008 Spanish citizens. Using factor analysis, we identify six distinct dimensions of public attitudes, referred to as: prosperity with growth; environmental limits to growth; general optimism; wrong priority; overrated GDP; and governmental control. We further analyze several specific questions associated with the growth debate, such as those concerning the desired GDP growth rate, the preferred growth-environment position, and beliefs about, as well as reasons for, a possible end or continuation of growth. We find that most respondents favor GDP growth rates of more than 3%. A majority views growth and environmental sustainability as compatible (green growth), while about one-third prefers either ignoring growth as a policy aim (agrowth), or stopping it altogether (degrowth). Only very few people want growth unconditionally (growth-at-all-costs). About one-third of the respondents believe that growth may be never-ending. We examine how support for or disagreement with different statements on growth are related to each other, as well as how they are influenced by socio-demographic, knowledge and ideology/values variables. Overall, our findings can inform public debates about the growth paradigm and its potential alternatives by providing a more nuanced understanding of public opinion. We make suggestions for future research, including modifying poll questions on growth and environment through offering a more diverse set of response options.

**Subtil Lacerda, J., and J. van den Bergh (2016). Mismatch of wind power capacity and generation: Causing factors, GHG emissions and potential policy responses. *Journal of Cleaner Production* 128: 178-189.**

Policies to assure combatting climate change and realising energy security have stimulated a rapid growth in global installed capacity of renewable energy generation. The expansion of power generation from renewables, though, has so far lagged behind the growth in generation capacity. This indicates missed and relatively cheap opportunities to reduce GHG emissions. This paper sheds light on the mismatch between installed capacity and power

generation for the case of wind power. It analyses and compares wind power developments in the four countries that contributed most to the increase in wind power capacity during the last decade: namely, China, the United States, Germany and Spain. We estimate the dynamics of capacity utilisation of wind power installations and identify its drivers. Finally, we identify potential policies to reduce the gap between power capacity and generation, which will contribute to cost-effective reduction of GHG emissions.

**Van der Voorn, T, Quist, J., Pahl-Wostl, C., Haasnoot, M., 2016, Envisioning robust climate change adaptation futures for coastal regions: a comparative evaluation of cases in three continents, *Mitigation and Adaptation Strategies for Global Change*, in press**

The paper reports on a comparative study of three different cases on vision and strategy development for climate change adaptation planning in (i) The South African Breede–Overberg Catchment, (ii) The Mississippi Estuary-New Orleans region and (iii) The Dutch Rhine-Meuse Estuary. The objective of the paper is twofold: to develop a better understanding of such processes and to further develop the Backcasting-Adaptive Management (BCAM) methodology. A framework for case evaluation is developed using six dimensions: (i) inputs and resources, (ii) future vision, (iii) stakeholder engagement, (iv) methodological aspects, (v) pathway development and (vi) impact. Major conclusions based on a cross-case comparison and testing propositions are (i) participatory vision development is a strong tool for climate change adaptation planning in different governance contexts and shows considerable diversity in its application in these contexts; (ii) a single, shared future vision is not a prerequisite for vision and pathway development and endorsement; (iii) broad stakeholder engagement enriches strategy development, but the involvement of marginal groups requires additional efforts and capacity building; (iv) multiple pathways and robust elements are useful but require novel expertise; and (v) more institutional embeddedness and support for participatory processes lead to better implementation of the outcomes of these processes.

**Hermwille, L., Obergassel, W. and Arens, C., 2015, The transformative potential of emissions trading, *Carbon Management*, 6(5-6), 261-272**

Limiting global warming to below 2 °C or even 1.5 °C requires a fundamental transformation of global socio-economic systems. This need for transformation has been taken up by international climate policy. This article synthesizes criteria of transformational change from transition research and climate finance agencies. On this basis, the article conducts a multi-criteria evaluation of the transformative potential of the European Union Emissions Trading Scheme (EU ETS), currently the world's largest market-based climate policy. From this case it can be inferred that emissions trading can “destabilize” incumbent high-emission practices, but its effectiveness in fostering innovation is limited. Furthermore, the analysis shows that details in the arrangements of the scheme such as allocation rules can have a strong detrimental impact on its outcome. If a global carbon market with a uniform price were introduced, this could lead to developing countries “buying in” with large amounts of freely allocated allowances. This, however, has been shown to thwart transformational effects and instead contribute to further carbon lock-in.

**Chang, R-D., Zuo, J., Soebarto, V., Zhao, Z-Y., Zillante, G. and Gan, X-L., 2016, Sustainability transition of the Chinese construction industry: Practices and behaviors of the leading construction firms, *Journal of Management in Engineering*, in press**

Because of various economic, social, and environmental challenges, the Chinese construction industry is under tremendous pressure to transition to a sustainability orientation. Existing studies have extensively explored the technological innovations of environmental sustainability within the Chinese construction industry. In contrast, very little attention has been paid to a holistic exploration of the economic and social dimensions

related to sustainability, or to the sustainability strategies and behaviors of construction firms in China. From the perspective of sustainability transition, this paper analyzes the sustainability practices and strategic sustainability behaviors of three leading construction firms in China based on three case study firms. Twenty-nine aspects of sustainability practice implemented by the studied firms are identified. The evolution of the strategic sustainability behaviors exhibited by the three firms and the strengths and weaknesses of their sustainability practices are also critically analyzed. The results reveal that the studied firms present different strategic sustainability behaviors, and that practices toward environmental sustainability are weak compared with practices toward economic and social sustainability. Potential measures to facilitate sustainability transition of the Chinese construction industry are also discussed. This study helps industry practitioners to gain a better understanding of sustainability practices and behaviors of leading construction firms in China.

**Trutnevyte, E., 2016, Does cost optimization approximate the real-world energy transition?, *Energy*, 106, 182-193**

Bottom-up energy system models rely on cost optimization to produce energy scenarios that inform policy analyses, debates and decisions. This paper reviews the rationale for the use of cost optimization and questions whether cost-optimal scenarios are adequate proxies of the real-world energy transition. Evidence from ex-post modeling shows that cost optimization does not approximate the real-world UK electricity system transition in 1990-2014. The deviation in cumulative total system costs from the cost-optimal scenario in 1990-2014 is equal to 9-23% under various technology, cost, demand, and discount rate assumptions. In fact, cost-optimal scenarios are shown to gloss over a large share of uncertainty that arises due to deviations from cost optimality. Exploration of large numbers of near-optimal scenarios under parametric uncertainty can give indication of the bounds or envelope of predictability of the real-world transition. Concrete suggestions are then made how to improve bottom-up energy system models to better deal with the vast uncertainty around the future energy transition. The paper closes with a reflective discussion on the tension between predictive and exploratory use of energy system models.

**Amars, L., Fridah, M., Hagemann, M., Röser, F. and Linnér, B-O., 2016, The transformational potential of Nationally Appropriate Mitigation Actions in Tanzania: assessing the concept's cultural legitimacy among stakeholders in the solar energy sector, *Local Environment*, in press**

While energy-sector emissions remain the biggest source of climate change, many least-developed countries still invest in fossil-fuel development paths. These countries generally have high levels of fossil-fuel technology lock-in and low capacities to change, making the shift to sustainable energy difficult. Tanzania, a telling example, is projected to triple fossil-fuel power production in the next decade. This article assesses the potential to use internationally supported Nationally Appropriate Mitigation Actions (NAMAs) to develop solar energy in Tanzania and contribute to transformational change of the electricity supply system. By assessing the cultural legitimacy of NAMAs among key stakeholders in the solar energy sector, we analyse the conditions for successful uptake of the concept in (1) national political thought and institutional frameworks and (2) the solar energy niche. Interview data are analysed from a multi-level perspective on transition, focusing on its cultural dimension. Several framings undermining legitimacy are articulated, such as attaching low-actor credibility to responsible agencies and the concept's poor fit with political priorities. Actors that discern opportunities for NAMAs could, however, draw on a framing of high commensurability between experienced social needs and opportunities to use NAMAs to address them through climate-compatible development. This legitimises NAMAs and could challenge opposing framings.

**Canzler, W. and Knie, A., 2016, Mobility in the age of digital modernity: why the private car is losing its significance, intermodal transport is winning and why digitalisation is the key, *Applied Mobilities*, in press**

The private automobile is a central enabler for modern societies and is thus a culturally charged symbol. Can this societal promise of private car ownership and automotive mobility in the face of climate change and permanent congestion imply the continued guarantee of social participation? The digital options for transportation allow for a general safeguarding of mobility without the direct need for private vehicles, but the current market structures do not allow for that. It is obvious, that new business models triggered by digitalisation are struggling to find support in the current legal frameworks, although they increase the capacity and efficiency of transport and energy systems, reinforcing decarbonisation initiatives and eventually also address the citizens needs and interest in a more effective way. The dynamics of digitalisation are speeding up, eroding current patterns of mobility behaviour; the current legal framework, however, preserves the status quo and even contradicts the promise of social participation. Considerable restrictions on the private car need and will be implemented as urban and environmental pressures can no longer be mitigated. Electrification of the entire transportation sector is thus not only necessitated due to climate change mitigation, but is in line with the increased interlinking of different modes of transport into integrated mobility services. This shift will involve a fundamental transformation of the transport sector. It is driven not only by economic and technological factors, but importantly also by important societal developments and considerations. The use of digital technologies in order to economise the mobility sector, making it more efficient and intermodal, cannot be stopped. The automobile with its combustion engine was only the first generation appliance. Its broad success, however, has forced us to consider alternatives and reinterpret the product with the help of digital technologies.

**Randelli, F., 2015, The role of consumers in the transition towards a sustainable food supply: The case of Gruppi do Acquisito Solidale (Solidarity Purchasing Groups) in Italy, *International Journal of Food and Agricultural Economics*, 3(4), 15-26**

This paper addresses the role of ethical consumers in the transition process towards a sustainable food supply. The questions that immediately come to mind are: can the consumers put changes in motion in the established food supply regime? Which are the mechanisms hindering a transition driven by consumers? In order to answer to these questions we analyse the case of Gruppi di Acquisito Solidale (Solidarity Purchasing Groups) in Italy, as a support for a broader reflection to the topic. The growing dissatisfaction with the established food supply, dominated by the duopoly supermarket-global food supplier, has driven a few pioneers to search for new solutions. In the case of Italy, consumers have organized themselves into informal networks, in order to purchase quality food together from local farmers. They are motivated by the meeting of social, ethical and environmental needs (providing sustainable food and support local farmers) which were not served in the beginning by incumbent firms and they operate in the social economy as community groups.

**Joint special issue in *Nature Climate Change* and *Nature Energy* (on the role of social science in energy and climate change research)**

**Stern, P.C., Sovacool, B.K., Dietz, T., 2016, Towards a science of climate and energy choices, *Nature Climate Change*, 6(6), 547-555**

The linked problems of energy sustainability and climate change are among the most complex and daunting facing humanity at the start of the twenty-first century. This joint *Nature Energy* and *Nature Climate Change* Collection illustrates how understanding and addressing these problems will require an integrated science of coupled human and natural systems; including technological systems, but also extending well beyond the domain of engineering or even economics. It demonstrates the value of replacing the stylized assumptions about human behaviour that are common in policy analysis, with ones based

on data-driven science. We draw from and engage articles in the Collection to identify key contributions to understanding non-technological factors connecting economic activity and greenhouse gas emissions, describe a multi-dimensional space of human action on climate and energy issues, and illustrate key themes, dimensions and contributions towards fundamental understanding and informed decision making.

**Geels, F.W., Berkhout, F. and Van Vuuren, D., 2016, Bridging analytical approaches for low-carbon transitions, *Nature Climate Change*, 6(6), 576-583**

Low-carbon transitions are long-term multi-faceted processes. While integrated assessment models (IAMs) have many strengths for analysing such transitions, their mathematical representation requires a simplification of the causes, dynamics and scope of such societal transformations. We suggest that IAM-based analysis should be complemented with insights from socio-technical transition analysis and practice-based action research. We discuss the underlying assumptions, strengths and weaknesses of three analytical approaches. We argue that full integration of these approaches is not feasible, because of foundational differences in philosophies of science and ontological assumptions. Instead, we suggest that bridging, based on sequential and interactive articulation of different approaches, may generate a more comprehensive and useful chain of assessments to support policy formation and action. We also show how these approaches address knowledge needs of different policymakers (international, national, local), relate to different dimensions of policy processes, and speak to different policy-relevant criteria such as cost-effectiveness, socio-political feasibility, social acceptance and legitimacy, and flexibility. A more differentiated set of analytical approaches thus enables a more differentiated approach to climate policy-making.

**Schot, J., Kanger, L., and Verbong, G.P.J., 2016, The roles of users in shaping transitions to new energy systems, *Nature Energy*, 16054**

Current government information policies and market-based instruments aimed at influencing the energy choices of consumers often ignore the fact that consumer behaviour is not fully reducible to individuals making rational conscious decisions all the time. The decisions of consumers are largely configured by shared routines embedded in socio-technical systems. To achieve a transition towards a decarbonized and energy-efficient system, an approach that goes beyond individual consumer choice and puts shared routines and system change at its centre is needed. Here, adopting a transitions perspective, we argue that consumers should be reconceptualized as users who are important stakeholders in the innovation process shaping new routines and enacting system change. We review the role of users in shifts to new decarbonized and energy-efficient systems and provide a typology of user roles.

**Sovacool, B.K., Heffron, R.J., McCauley, D., and Goldthau, A., 2016, Energy decisions reframed as justice and ethical concerns, *Nature Energy*, 16024**

All too often, energy policy and technology discussions are limited to the domains of engineering and economics. Many energy consumers, and even analysts and policymakers, confront and frame energy and climate risks in a moral vacuum, rarely incorporating broader social justice concerns. Here, to remedy this gap, we investigate how concepts from justice and ethics can inform energy decision-making by reframing five energy problems — nuclear waste, involuntary resettlement, energy pollution, energy poverty and climate change — as pressing justice concerns. We conclude by proposing an energy justice framework centred on availability, affordability, due process, transparency and accountability, sustainability, equity and responsibility, which highlights the futurity, fairness and equity dimensions of energy production and use.