Sustainability Transitions Research Network | STRN

Newsletter 23: March 2017

This is the 23rd 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

The STRN steering group

Words from the Chairman

Dear transition research colleagues,

It's only 3 months until the eight International Sustainability Transitions conference, which this year will be held in Gothenburg, Sweden, from 18-21 June. It promises to be a stimulating, diverse and high-quality conference, as you can read under 'event announcements'.

The European Environment Agency (EEA) is increasingly driving sustainability transition debates at the European level, publishing several interesting reports late last year:

EEA, 2016, *Sustainability Transitions: Now for the long term*, European Environment Agency, Copenhagen

EEA, 2016, *Transforming the EU power sector: Avoiding a carbon lock-in*, European Environment Agency, Copenhagen, EEA report 22/2016

EEA, 2016, *Transitions towards a more sustainable mobility system*, European Environment Agency, Copenhagen, EEA report 34/2016

The EEA is also gearing up to make sustainability transitions a crucial part of the SOER-2020 (State of Environment Outlook), developing both in-house capabilities and inviting external organisations to interact with them in this context.

A group of STRN-members (coordinated by Jonathan Köhler) is now actively producing texts for sections of the revised STRN research manifesto. The aim is to present and discuss the new manifesto at the 2017-IST conference, and make it available to the wider STRN community.

The Belmont Forum and NORFACE have finally launched the Programme "Transformations to Sustainability" (https://belmontforum.org/transformations-sustainability-t2s), which aims to reinforce transitions/transformations research at the global scale. This call places the social science and humanities central, focusing on three themes: 1) Governance and institutional dimensions of transformations to sustainability, 2) Economy and finance of transformations to sustainability, 3) Well-being, quality of life, identity, and social and cultural values in relation to transformations to sustainability. This call provides great opportunities for STRN-members, many of whom will probably have seen the call already.

I hope you'll enjoy reading the newsletter and look forward to seeing many of you at the transitions conference in June.

Frank Geels, Chairman of STRN (frank.geels@manchester.ac.uk).

Environmental Innovation and Societal Transitions

Volume 22 of *Environmental Innovation and Societal Transitions* has just been published. It contains one commentary, six original articles and two book reviews:
The commentary is "Ten challenges for computer models in transitions research: Commentary on Holtz et al." by W. McDowall and F.W. Geels.
The original research articles are:

- Knowledge spillovers from renewable energy technologies: Lessons from patent citations by J. Noailly and V. Shestalova
- Beyond deconstruction. a reconstructive perspective on sustainability transition governance by F. Avelino and J. Grin
- Transitions in unlikely places: Exploring the conditions for renewable energy adoption in Nigeria by O. Osunmuyiwa and A. Kalfagianni
- A transition to a denser and more sustainable city: Factors and actors in Trondheim, Norway by F. Hernández-Palacio
- An agent-based model of farmer behaviour to explain the limited adaptability of Flemish agriculture by D. Maes and S.V. Passel
- The role of community leadership in the development of grassroots innovations by M. Martiskainen

The book reviews are of the publications "System Innovation: Synthesis Report, OECD (2015)" (reviewed by K.S. Rogge), and "Journey to Earthland: The Great Transition to Planetary Civilization", Paul Raskin, Boston (2016)" (reviewed by H.S. Brown).
The above makes clear that EIST continues publishing on a wide diversity of topics within the area of environmental innovations and sustainability transitions. As always, we look forward to receive your submissions and comments. Don't forget to read, and if relevant cite, EIST.
Jeroen van den Bergh, Editor-in-Chief [jeroen.bergh@uab.es]

Network News

Any news related to ongoing activities of STRN

News from Climate-KIC

New manager at Transitions Hub

Joachim Monkelbaan has recently been appointed as Hub Manager. He completed his doctorate in 2015 at the University of Geneva on 'an Integrative Framework For Steering Transitions' and has worked at the International Centre for Trade and Sustainable Development. He can be contacted at joachim.monkelbaan@climate-kic.org The Transitions Hub creates new tools and methods for system innovation through coproduction between practice-based experts, practitioners and academics addressing climate innovation. It is a laboratory for exploration and a test bed for validation. Our mission is to develop transition competences and capabilities across Europe.

Launch of Visual toolbox

The Transitions Hub has launched a Visual Toolbox to help you develop strategies for sustainable transition. Register now at https://learning.climate-kic.org/resources/transitions-hub-info to get access to a series of tools that can help you whether you are a novice to transition management or an expert. Learn how to use participatory methods like back casting and empathy mapping or find out how to map trajectories of change, using the comprehensive instructions and examples. Visualize barriers, trends, strategies and solutions, and develop clear steps to turn ambition into action. Contact our Knowledge Development Manager, Cristian Matti, for further details. He can be contacted at cristian.matti@climate-kic.org

Transitions as a contested approach in Climate-KIC

Fred Steward & Jon Bloomfield have written a recent Climate Innovation Insight paper published by Climate KIC UK (http://www.climate-kic.org/wp-

content/uploads/2017/03/Insight05_Proof4.pdf). Titled 'Broadening the innovation model' it reflects on the challenges and lessons for developing a transitions perspective which have been learned from Climate-KIC's Regional Innovation Implementation Community. It is one of 10 insight papers which address how climate innovation clusters will accelerate transition to a net zero-carbon economy.

Transition Cities

Hold the date for a one day event to be held in Brussels on Wednesday 7 June to present the results of the 3 year transition cities project. New methods for the sociotechnical network mapping of challenge led clusters will be presented along with experience of promoting transition experiments. Further details will be announced soon.

Fred Steward (F.Steward@psi.org.uk)

Event announcements

Calls for upcoming relevant events such as workshops and conferences

International Sustainability Transitions conference 2017, 18-21 June, Gothenburg

Soon it's June and time to gather for IST 2017 at Chalmers in Gothenburg. There has been great interest in participating with more than 450 abstracts submitted. After a tough and thorough review process, all acceptance notifications are out. Over the three days we are planning for more than 100 high quality sessions on a range of exciting transition topics. It's now time to register at www.ist2017.org, for speakers as well as for non-speakers. Take the lead in real world transitions and join us by the riverside in the Nordic summer light. Looking forward to see you all! **Björn Sandén (bjorn.sanden@chalmers.se) and Hans Hellsmark (hans.hellsmark@chalmers.se).**

Transition design: Everyday life, cosmopolitan localism and systems level change, 1-week course, June 12 -16th, Majorca, Spain

This 1-week short course will be held in the Santuario de Lluc retreat in the Tramuntana mountains of Majorca and is taught by the founders of Transition Design: Professor Terry Irwin and Dr. Gideon Kossoff, School of Design, Carnegie Mellon University and Professor Cameron Tonkinwise, Faculty of Art and Design, University of New South Wales, Australia. Transition Design combines many of the methods and approaches from transitions studies and research with the tools and processes of design and argues that design and designer have a key role to play in seeding and catalyzing societal transitions toward more sustainable futures. This week long course will prepare educators to introduce Transition Design into coursework and projects and equip researchers and professionals with new approaches to visualizing and framing complex problems.

For design and planning academics, researchers and professionals, design educators, sustainability consultants and researchers.. For more information about the course see: http://smart.uib.eu/activitats/projectes/PIFISD/Transition-Design-cat/

A link to the Transition Design seminar website at Carnegie Mellon provides more information: http://transitiondesignseminarcmu.net/

Call for papers for special issue on 'Real-world laboratories and transformation research' in *GAIA*

A GAIA special issue will focus on reflections and empirical insights regarding real-world laboratories. In order to bring the growing research community together and to combine empirical evidence, the guest editors hereby invite colleagues to submit papers. For more information see https://doi.org/10.14512/gaia.26.1.12 or contact Niko Schäpke (schaepke@leuphana.de).

Event Reviews

Review of events interesting to the STRN community

Sussex University's research on intermediaries in low energy housing highlighted in a joint workshop with Energy Saving Trust

A workshop on 9 February 2017 shared findings from a two-year Centre on Innovation and Energy Demand (CIED) research project, which focuses on intermediary organisations, how they can facilitate and advance low energy housing projects, and therefore aid the UK's housing sector to transition towards sustainable building concepts. The workshop, which brought together key stakeholders from government, housing industry and campaigning organisations, aimed to identify and discuss new directions for low energy housing policy in the UK. Dr Paula Kivimaa and Dr Mari Martiskainen from CIED organised the workshop, together with the UK's Energy Saving Trust. The ongoing research project has found that at a time when national policy support for the sector is minimal, dedicated intermediaries, such as architects, or annual eco home events, which bring together different groups to share ideas and plan, are vital for inspiring and driving low energy housing projects forward.
Find out more about the research project or contact Dr Paula Kivimaa directly: p.kivimaa@sussex.ac.uk.

Workshop on Policy Mixes for Sustainability Transitions

Senior SPRU researchers Dr Karoline Rogge and Dr Florian Kern, jointly with Prof Michael Howlett (Simon Fraser University and National University of Singapore), organised a workshop on '*Policy Mixes for Sustainability Transitions' (*1-3rd of February 2017). The workshop brought together an international group of researchers from the fields of innovation and policy studies to explore new avenues in research on policy mixes. The programme included 16 paper presentations on a variety of aspects (including how to delineate policy mixes, how policy mixes evolve over time, how policy mix design can be improved and how policy mixes can be evaluated). The presented papers will be submitted to *Research Policy* in April 2017 as part of a special issue on policy mixes for sustainability transitions. Please get in touch with Florian Kern (f.kern@sussex.ac.uk) if you are interested in being kept up to date with the progress of this special issue or contact Karoline Rogge (K.Rogge@sussex.ac.uk) if you want to find out more about our special issue on policy mixes for energy transitions which will be published in *Energy Research and Social Science*. This activity is part of the RCUK funded Centre on Innovation and Energy Demand's cross-cutting project on Policy Synergies and Trade-offs for low energy innovation.

New research projects

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

GONST – Where does the Green Economy Grow? The Geography of Nordic Sustainability Transitions (2017-2019). Financed by NordForsk, Nordic Innovation and Nordic Energy Research.

There is no one-size-fits-all approach to greening the growth path of an economy as this depends on place-based policy and institutional settings, level of development, resource endowments and particular environmental pressure points. This research project addresses the place-based, context-dependent nature of the shift to green growth in the Nordic countries by asking the question: where does the green economy grow? In addressing this question, we foreground the importance of innovation, new industry formation, and radical industry transformation. The project is based on a mixed methods approach. Quantitative techniques will be applied to analyse the importance of human capital and technological specialisation for the greening of the economy. Qualitative case studies of Nordic regions will focus on the role of institutions and account for the diversity in Nordic regional green pathways. Participating regions will benefit from a thorough analysis of current green growth

processes and the opportunities for further greening. The project in particular seeks to engage pioneering green growth regions in the case study analysis, and a full work package in the project will be focusing on the possibilities for policy-learning between participating regions. An important element here will be to distinguish between those successful practices that can be transferred between regions, and those which are context dependent.
Project partners: Lund University, Aalborg University, University of Tampere, NIFU, SINTEF & The Technical University of Denmark. Further information: Teis Hansen, Lund University (Teis.Hansen@keg.lu.se)

Greening the fleet – sustainability transitions in the maritime shipping sector (GREENFLEET)
The research project GREENFLEET (2017-2020) aims to analyse opportunities and challenges associated with a transition towards low- or zero-carbon technologies within the Norwegian maritime industry. With a 'technological innovation systems' (TIS) perspective at its core, strengths and weaknesses of three low- or zero-carbon energy technologies (battery-electric, biofuels, hydrogen), as well as hybrids of these will be analysed. Results will be useful for informing policy makers about framework conditions and policy tools, provide enhanced grounds for decision-making amongst investors, technology developers and service providers, and shed light on potential synergies across the maritime industry and other sectors. By also drawing on perspectives from MLP, organizational theory and strategic management, GREENFLEET aims to contribute theoretically to how TIS development is influenced by context and agency. GREENFLEET is funded by the Research Council of Norway over the ENERGIX programme with additional funding from the Norwegian Coastal Administration. Research partners include SINTEF Technology and Society (project management), Norwegian University of Science and Technology (NTNU), University of Oslo, Lund University and Chalmers University. For further information contact Tone Merethe Aasen (tone.m.aasen@sintef.no) or Markus Steen (markus.steen@sintef.no) at SINTEF Technology and Society.

Global Transitions and Innovation Systems (GLOTRAINS)
World development is at a critical turning point. Globalisation has become ever more impactful. At the same time, we see a new long term industrial development cycle (or techno-economic paradigm; TEP) coming into full swing that builds on Information and Communications Technology (ICT) while societies all over the world have to cope with sustainability challenges. These changes lead to a situation where industrial leadership may rapidly shift from one country to another. Europe 2020 reckoned these challenges under its Flagship Initiatives, in particular “An industrial policy for the globalisation era’’. Drawing on scholarship from the field of Innovation Studies, GLOTRAINS aims to make major contributions to the emerging global innovation system frameworks, combining literatures on industrial catch-up cycles and shifts in global leadership. More specifically, the project aims at further elaborating the Innovation System framework to encompass a globalised and dynamic perspective, while asking whether and how national industrial policy can still play a decisive role. Empirically, this project focuses on both long and short cycle sectors to reflect the two main propositions of the TEP hypothesis, i.e. the sustainability-driven clean-tech sector and the ICT sector. Both involve different types of catch-up mechanisms. Fieldwork cases are organised along a gradient of development stages represented by the countries of Germany, China/Taiwan and Malaysia. The selection of these countries provides an excellent base to examine global catch-up cycles and industrial leadership shifts. This project is funded by EU Horizon 2020 through the call ‘Marie Skłodowska-Curie Individual Fellowship’. It includes Utrecht University, Aalborg University and Eawag. For further information please contact Xiao-Shan Yap: xiaoshan.yap@eawag.ch

Publications

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

PhD thesis: Moshe Kinn, 2016, *An analysis of the sociotechnical transition process from the existing centralised alternating current voltage Electrical System in the UK to One Where Distributed Direct Current Voltage is used to meet the Energy Needs of the Built Environment*, The University of Salford

This study concerns the potential sociotechnical transition of the current UK centralised alternating current (AC) electricity system to one where distributed direct current (DC) systems may proliferate. The development of the new distributed DC system has the potential to address a number of global challenges including the UN's 17 Sustainability Challenges, particularly in terms of city and disaster resilience, energy security and energy independence. With the development of renewables and small-scale storage, among other technologies, this transition becomes a technical possibility. As transitions theory identifies energy systems as sociotechnical, transitions are a complex and people-centred process, an issue that has been identified that creates barriers to technical transitions. The multi-level perspective (MLP) is used as the theoretical framework and its applicability for future transitions is considered. The research proposes a "bottom-up" approach, focused on the demand side within the built environment, to avoid the transition developing into a wicked problem. Using a mixture of primary interview data, analysed using thematic analysis, supported by secondary data, from published academic and industry/governmental literature, a multi-method case study approach is used to develop a transitions model between the "as is" state and the potential future state with DC systems. Also identified were the institutions within the social and technical networks of the electricity regime, barriers and enablers to the transition, boundary points between the networks and the structurations of institutions within these networks. Key findings are a lack of interdisciplinary thinking among different academic disciplines, a lack of DC standards and home appliances, and that DC is in focus for the office rather than the home. Knowledge dissemination especially via education, government procurement and energy policy, and the importance of independence from the market are key components for a successful proliferation. A conundrum connecting renewable generation, the carbon debate and energy policy, is identified. With a deeper understanding of the regime, landscape and with a multi-systems approach, a tentative solution is provided. Contributions to knowledge are: the transitions model; the sociotechnical characterisation of the electricity system; a better understanding of how liability, living standards, disaster risk reduction and city resilience can be impacted by failure chains associated with power cuts; and a deeper understanding of the MLP model.

PhD Thesis: Normann, H.E. (2017), *Politics in energy system transformation. Conditions for the development of an offshore wind industry in Norway*, University of Oslo

A transformation of the energy system relies on a move away from burning of fossil fuels and the expansion of sustainable alternatives. This presents a challenge for fossil fuel exporting countries, but also opportunities for new industry formation. In a Norwegian context, this raises the question of how the oil and gas industry conditions the development of a Norwegian offshore wind industry. This question is explored through three articles. The first article studies the rise and decline of offshore wind in Norway between 2005 and 2012. The second article analyses how differences in network structure facilitate different levels of access to the policymaking process. The third article examines the opportunities and challenges Norwegian suppliers to an international market for offshore wind experience in the absence of a domestic market. The thesis is situated in the field of sustainability transitions and focuses on policy as important for innovation system formation. The thesis pays particular attention to the politics that underpin policy. By drawing on insights from political science, the thesis contributes to an improved understanding of politics in sustainability transitions.

<u>Book</u>: Haberl, H., M. Fischer-Kowalski, F. Krausmann, V. Winiwarter (eds.), 2016. *Social Ecology: Society-Nature Relations Across Time and Space*. Springer

This book presents the current state of the art in Social Ecology as practiced by the Vienna School of Social Ecology, globally one of the main research groups in this field. As a significant contribution to the growing literature on interdisciplinary sustainability studies, the book introduces the purpose and nature of Social Ecology and then places the "Vienna School" within the broader context of socioecological and other interdisciplinary environmental approaches. The conceptual and methodological foundations of Social Ecology are discussed in detail, allowing the reader to obtain a broad overview of current socioecological thinking. Issues covered include socio-metabolic transitions, socioecological approaches to land use, the relation between actor-centered and system approaches, a socioecological theory of labor and the importance of legacies, as conceived in Environmental History and in Long-Term Socio-Ecological Research. To underpin this overview empirically, the strengths of socioecological research are elucidated in cases of cutting-edge research, introducing a variety of themes the Vienna School has been tackling empirically over the past years.

<u>Special issue:</u> Geographical perspectives on sociotechnical transitions and emerging bio-economies

Kirby E. Calvert, Peter Kedron, Jennifer Baka and Kean Birch, 2017, Geographical perspectives on sociotechnical transitions and emerging bio-economies: introduction to a special issue, *Technology Analysis & Strategic Management*, 29(5), 477-485

Peter Kedron and Sharmistha Bagchi-Sen, 2017, Limits to policy-led innovation and industry development in US biofuels, *Technology Analysis & Strategic Management*, 29(5), 486-499

Teis Hansen and Lars Coenen, 2017, Unpacking resource mobilisation by incumbents for biorefineries: The role of micro-level factors for technological innovation system weaknesses, *Technology Analysis & Strategic Management*, 29(5), 500-513

Wilfried Ehrenfeld and Frieder Kropfhäußer, 2017, Plant-based bioeconomy in Central Germany: A mapping of actors, industries and places, *Technology Analysis & Strategic Management*, 29(5), 514-527

M. Jean Blair, Laura Cabral and Warren E. Mabee, 2017, Biorefinery strategies: Exploring approaches to developing forest-based biorefinery activities in British Columbia and Ontario, Canada, *Technology Analysis & Strategic Management*, 29(5), 528-541

Normann, H.E., 2017, Policy networks in energy transitions: The cases of carbon capture and storage and offshore wind in Norway, *Technological Forecasting and Social Change*, in press

This paper employs the concept of policy networks to study how interest groups and actors compete over the influence of energy and climate policy. It is argued that the creation of learning arenas is critical for the development of immature technologies. The paper then analyses two large efforts to secure state funding of large-scale demonstration projects for offshore wind and carbon capture and storage technology in Norway. The paper describes a range of similarities between these two technologies in terms of scale, maturity, and costs, and in the way they represent possible solutions to the problem of climate change. However, the paper also describes enormous differences in government support towards full-scale demonstration. These differences are then explained in the analysis, which shows how different network structures facilitate different levels of access to the policy making process. The paper provides insights into how the interplay between state interests, political party strategies and the interests of firms influences the potency for solutions tied to climate and energy problems. The paper therefore contributes to the discourse on the role of politics in sustainability transitions.

Berlo, K., Wagner, O. and Heenen, M., 2017, The incumbents' conservation strategies in the German energy regime as an impediment to re-municipalization—An analysis guided by the Multi-Level Perspective, *Sustainability*, 9(1), 53
After two decades of privatization and outsourcing being the dominant trends across public services, an inclination towards founding new municipal power utilities can be observed. In this article, the authors examine the preservation strategies of the German energy regime following the transition approach developed by Geels. From the multi-level perspective, it can be stated that innovations take place in niches and have to overcome the obstacles and persistence of the conventional fossil–nuclear energy regime. Through an empirical analysis, it can be concluded that the established regime significantly delays the decentralization process required for a transformation of energy structures on local electricity grids. Furthermore, it is shown that municipal utilities (Stadtwerke) are important key actors for the German Energiewende (energy transition) as they function as local energy distributors and they meet a variety of requirements to promote fundamental structural change. The trend towards re-municipalization and the re-establishment of municipal utilities reveal the desire to further strengthen the scope of local politics.

Rosenbloom, D., 2017, Pathways: An emerging concept for the theory and governance of low-carbon transitions, *Global Environmental Change*, 43, 37-50
The concept of "pathways" has increasingly come to frame the challenge of transitioning to low-carbon societies. It also shows promise as a bridging concept, encouraging constructive dialogue among the diverse perspectives and constituencies evoking its use. However, its interpretations and attributes are rarely explicit and have yet to be subject to serious scrutiny. This raises important questions for both theory and governance as the way in which a problem is framed shapes how it is understood and addressed, structuring the possibilities considered and privileging certain responses. Therefore, this study explores the concept of pathways in the context of low-carbon transitions, exposing its conceptions, maturation, and implications. Based on a survey of the relevant climate change mitigation literature, this analysis uncovers three core conceptions of pathways in the context of low-carbon transitions: (1) biophysical, (2) techno-economic, and (3) socio-technical. Constituted by diverse perspectives and approaches, each of these three core conceptions emphasize different yet interconnected dimensions of the decarbonization challenge. This analysis also points to several key attributes and functions of the concept of pathways. Yet, while the concept may possess a variety of features that recommend its use as a critical problem frame for low-carbon transitions, it also raises issues that suggest a need for further reflexivity. If the concept is cast too strongly in terms of individual core conceptions, there may be a tendency to emphasize certain dynamics while paying somewhat less attention to others, inadvertently diminishing the complexity of the decarbonization challenge. Beyond this, there are other facets of the concept that have to date received more limited attention, including the implications of choices at critical junctures and the evolving character of social practices. So, there is room for the concept of pathways to engage more fully with the range of complexities embodied by low-carbon transitions.

Ford, R., Walton, S., Stephenson, J., Rees, D., Scott, M., King, G., Williamns, J. and Wooliscroft, B., 2017, Emerging energy transitions: PV uptake beyond subsidies, *Technological Forecasting and Social Change*, in press
In the past decade there has been a substantial increase in the uptake of residential solar photovoltaic (PV) systems globally, which is starting to impact upon traditional electricity systems. An emerging energy transition is being driven by actions taken by actors at the grassroots level, and enabled by declining technology costs and new niche business models. However, to date, most work exploring change in energy systems has tended to focus on technological innovation and economic processes, leaving social aspects and daily activities under-addressed. Similarly, most theories that consider individual behaviour have tended to neglect the wider system of change. This paper presents an approach for simultaneously exploring behavioural and systemic change and demonstrates its use in a

case study of PV uptake in New Zealand. The Energy Cultures framework is used alongside the Multi-Level Perspective of socio-technical transitions to examine the broad range of factors driving, shaping, and constraining PV uptake, and the interactions between global and national landscapes, the socio-technical regime within which users are taking action, and the niche opportunities emerging. Taking an integrating approach allows these perspectives to be brought together, providing valuable insights as to how adoption might be promoted or constrained, and the implications this may have for the future management of electricity grids.

Chang, R-D., Zuo, J., Zhao, Z-Y., Soebarto, V., Zillante, G., and Gan, X-L., 2017, Approaches for transitions Towards sustainable development: Status quo and challenges, *Sustainable Development*, in press
With the aim of facilitating the long-term transformation towards a sustainable future, the research field of sustainability transition has gained growing attention. A number of approaches have been proposed to understand or even manage the complex societal transition processes towards sustainable development. There are four popular approaches for sustainability transitions, i.e. the multi-phase concept, multi-level perspective, strategic niche management and transition management. However, there is a lack of studies to systematically review and critically reflect on these various approaches in this emerging field. This paper presents a holistic review of the four most common approaches, and more importantly identifies four critical challenges for the future studies on transition approaches. Consequently, the associated future research agenda is presented.

Yliskylä-Peuralahti, J., 2016, Sustainable energy transitions in maritime transport: The case of biofuels, *The Journal of Sustainable Mobility*, 3(2), 67-93
In maritime transport, progress towards a reduction in the environmental impacts, and responses to more recent calls for corporate social responsibility (CSR) have been slow and geographically highly uneven. In this paper the multi-level perspective of transition studies is used as an analytical setting to understand the drivers and barriers for the environmental upgrading of maritime transport in the Baltic Sea region. The specific focus of the analysis is on energy questions in the shipping industry. A case study methodology is followed in gathering and analysis of the data. With a company case, a possible path to biofuel use in maritime transport is illustrated; and, in the light of the sustainability transition framework, the potential barriers that new renewable energy niches are currently facing—before they can become mainstream technologies—are discussed. The results show that at a landscape level, low fossil fuel prices reduce the economic profitability of using non-fossil energy sources in maritime transport, and inhibit the development of related infrastructure. At a regime-level, the limited demand for low-emission, non-fossil fuel-based maritime transport from the side of the cargo-owners, lack of interest, and maritime regulations that do not currently support greenhouse gas reduction or energy efficiency strongly enough, hinder the transition. The paper ends with a discussion and conclusions section, summarizing the research and highlighting policy implications.

Bush, R.E., Bale, C.S.E., Powell, M., Gouldson, A., Taylor, P.G. and Gale, W.F., 2017, The role of intermediaries in low carbon transitions — empowering innovations to unlock district heating in the UK, *Journal of Cleaner Production*, in press
The literature on socio-technical transitions considers how technological innovations can be established within the context of an incumbent regime that is often resistant or inflexible to change. Strategic niche management is an approach to catalysing a transition to a new regime using protected 'niche' spaces to enable development and experimentation with an innovation. Intermediary actors play an important role in establishing these niches as they facilitate knowledge sharing and build the wider networks and systems needed to support an innovation. The influence of intermediaries within socio-technical transitions and strategic niche management is still an under-researched area. In this paper, we use a decision theatre research process to collect empirical evidence from a range of local stakeholders involved in

establishing new district heating projects in the United Kingdom (UK). This method, carried out in a group workshop format, enables understanding of the interactions between stakeholders throughout the stages of the district heating development process. The study suggests that intermediaries can play a role in supporting niche empowering processes. The existing institutional framework surrounding intermediary actors, and the geographical scale at which they work within that framework, are shown to be influential on actors' agency to choose their approach to empowering an innovation. The work highlights the potential for intermediaries to support the restructuring of this institutional framework to enable more radical 'stretch and transform' empowering activities.

Lotten, K., Hemström, M., Gustavsson, L., Mahapatra, K., 2017, Architects' perception of the innovativeness of the Swedish construction industry, *Construction Innovation*, 17(2), in press

The aim of this paper is to enhance the understanding of architects' perceptions of the propensity to adopt innovations in building construction. Based on a theoretical underpinning of the multilevel perspective on socio-technical transitions, a web-based questionnaire (n=412) was used to empirically investigate Swedish architects' perceptions of innovativeness in the building construction industry. Specifically, the study looks at perceptions of the level of innovativeness (propensity to adopt innovations), relevant barriers to the adoption of innovations, the influence of different actors, and ways of facilitating innovativeness. Architects perceive a low level of innovativeness in the Swedish building construction industry due to a number of barriers of varying relevance. These barriers belong to interwoven regulative, normative and cognitive rules (i.e., institutions) that guide actor behaviour, which contribute to the path dependency of the industry. The site-specific nature of building construction, promotional activities from suppliers, and the level of competition in the industry is perceived as being of little relevance. The findings suggest that a multitude of interventions are necessary to facilitate innovativeness of the Swedish construction industry. To change the lock-in mechanisms of the established cognitive and normative rules, regulative rules need to change as well. According to architects, contractors and construction clients are the most influential and therefore have the most power to change the rules associated with path dependency.

Temenos, C., Nikolaeva, A., Schwanen, T., Cresswell, T., Sengers, F., Watson, M. and Sheller, M., 2017, Theorizing mobility transitions: An interdisciplinary conversation, *Transfers*, 7(1), 113-129

Despite a surge of multidisciplinary interest in transition studies on low-carbon mobilities, there has been little evaluation of the current state of the field, and the contributions of different approaches such as the multi-level perspective (MLP), theories of practice, or the new mobilities paradigm. As a step in this direction, this contribution brings together scholars representing different theoretical perspectives and disciplinary fields in order to discuss processes and uneven geographies of mobility transitions as they are currently theorized. First, we reflect upon the role of geographers and other social scientists in envisioning, enabling, and criticizing mobility transitions. Second, we discuss how different theoretical approaches can develop mobility transitions scholarship. Finally, we highlight emerging issues in mobility transitions research.

Ratinen, M. and Lund, P.D., 2017, When regime changes slow down niche development: the example of wind energy business in Finland, *International Journal of Research, Innovation and Commercialisation*, 1(1), 41, 56

This article analyses regime changes and niche development as interlinked processes as part of commercialising energy innovations. Theories about socio-technical changes are used to analyse the changes. A case study on the development of wind energy in Finland is presented to analyse the influence of the regime on niche development. In Finland, the changes in the electricity market have been rather small and the development of the wind

energy has been rather modest. Though, a recent increase in the deployment of wind power coincides with the permission to build two new nuclear reactors and with feed-in-tariffs for large scale wind mill parks that ensure the market domination of the utilities. It is concluded that if the government is included among the regime actors, and the ties between the regime actors are strong, the regime can be in a position to influence policies to serve the interests of the regime.

Audet, R., Lefèvre, S., Brisebois, E., and El-Jed , M., 2017, Structuring tensions and key relations of Montreal seasonal food markets in the sustainability transition of the agri-food sector, *Sustainability*, 9(3), 320

In cities across the world, local food networks aim to make food systems more sustainable and secure for all. As part of that effort, some of these networks also seek to introduce social innovation in the mode of selling food, namely as a way to initiate a broader transition of the sector. Based on two years of action research conducted together with promoters of Montreal's seasonal markets, this article offers an account of the co-constructed narrative of a transition of the agri-food sector. On the one hand, transition theory anticipates that the transition to sustainability of the agri-food sector would depend on the protection and empowerment of innovative 'niches' that are facing the locked-in structure of the agri-food 'sociotechnical regime'. Yet, on the other hand, the seasonal markets do not fit well in this portrait: they are shown to evolve at the intersection of the sociotechnical regime and innovative niches. For this reason, they are subject to regime rules and become difficult to protect as an entity. As such, seasonal markets face 'structuring tensions' that generate both practical dilemmas and innovative solutions in their modes of organization. These solutions, however, rely on webs of resources and supports that constitute 'key relations' for unlocking the agri-food regime rules. It is through managing these tensions and relations that the seasonal markets end up reconfiguring social and material relations and providing solutions for food security and a more sustainable food system. Therefore, we argue that the structuring tension and key relation concepts are useful for understanding the dynamics of social innovation in the transition to sustainability in food systems.

Hansen, L. and Bjørkhaug, H., 2017, Visions and expectations for the Norwegian bioeconomy, *Sustainability*, 9(3), 342

Developing a future bioeconomy has become critical for three main reasons: (1) The need for sustainability of resource use; (2) The growing demand for both food and energy; and (3) The need to decouple economic growth from environmental degradation. As Zilberman observes, a transition to bioeconomy "is a continuing evolutionary process of transition from systems of mining non-renewable resources to farming renewable ones". Hence, to meet the challenges created by a growing dependence on non-renewable resources, radical changes are needed that involve more than development of or changes within the individual bio-based sectors. In line with emerging attention to the bioeconomy in Europe and elsewhere, great expectations towards the bioeconomy have been launched in high level industry and policy fora, as well as in resource-based economies such as Norway's. Grounded in theories of transition and transition management, this paper discusses the Norwegian biosector's expectations regarding a bioeconomy. Analyses are based on empirical survey data from biosector representatives. Findings suggest that there are clear differences between sectors in motivation for a future bioeconomy. A transition into a complete bioeconomy will demand a system shift and more cross-sectoral integration between these regimes than currently exists.

Hansen, T., Klitkou, A., Borup, M, Scordato, L. and Wessberg, N., 2017, Path creation in Nordic energy and road transport systems – the role of technological characteristics. *Renewable and Sustainable Energy Reviews*, 70, 551-562

This paper reviews path-creation processes in road transport systems in the Nordic countries: e-mobility in Denmark, hydrogen and fuel-cell electrical vehicles in Norway, and advanced biofuels in Finland and Sweden. The study builds on the path creation literature,

which seeks to explain the emergence of new technological pathways. Drawing on recent insights concerning the differences between design- and manufacturing-intensive technologies, the paper analyses the influence of technological characteristics on path creation processes. The case comparison indicates that technological characteristics seem to have greater influence on the content of activities in the later phase rather than the early phase of path creation processes. The analysis also emphasises that barriers to path creation processes differ depending on technological characteristics. This highlights the importance of considering technological characteristics in energy and transport policies.

Gibbs, D. and O'Neill, K., 2017, Future green economies and regional development: A research agenda, *Regional Studies*, 51(1), 161-173.
The past thirty years have seen an explosion of interest and concern over the detrimental impacts of economic and industrial development. Despite this, the environmental agenda has not featured substantially in the regional studies literature. This paper explores a range of options for regional futures from a 'clean tech' economy and the promise of renewed accumulation, through to more radical degrowth concepts focused on altering existing modes of production and consumption, ecological sustainability and social justice. In so doing, we investigate the potential role of regions as drivers of the new green economy, drawing on research into sustainability transitions.

Kooijman, M., Hekkert, M.P., Van Meer, P.J.K., Moors, E.H.M. and Schellekens, H., 2017, How institutional logics hamper innovation: The case of animal testing, *Technological Forecasting and Social Change*, in press
For radical innovation to become successful the substitution of established practices are essential. Nevertheless, in the innovation literature novelty is often at the center and only little attention is paid to the influence of established technologies and underlying routines. This paper aims to contribute to this gap by increasing the understanding about the effect of persistence of established practices on the innovation process. We do this by using a framework that combines the Technological Innovation System approach with an analysis of the institutional logics reinforcing the established practice. The studied case concerns the innovation process to animal-free medicine development. Despite the fact that the substitution of animal tests is called for since the 1980s and animal-free methods are available, animal tests are still being used in medicine development. This study shows that adding institutional logics to the innovation systems analysis creates a much better understanding of the speed and direction of radical innovation.

Li, F.G.N., 2017, Actors behaving badly: Exploring the modelling of non-optimal behaviour in energy transitions, *Energy Strategy Reviews*, 15, 57-71
There are real political and social barriers to climate mitigation that arise from multi-actor dynamics and micro-economic decisions. Exploratory analysis that captures key uncertainties in the energy system, including behaviour, is crucial for policy design aimed at achieving ambitious greenhouse gas (GHG) mitigation targets. This paper explores the case for developing policy assessments that include non-optimal behaviour in energy systems modelling. A stochastic system dynamic model of the energy system that features multiple actors with differentiated behaviours is used to investigate energy transition pathways that deviate from strict economic rationality. The results illustrate the risks of basing GHG reduction strategies on analysis that overlooks key insights into decision making from fields such as behavioural economics and political science.

Siddiqi, A. and Collins, R.D., 2017, Sociotechnical systems and sustainability: Current and future perspectives for inclusive development, *Current Opinion in Environmental Sustainability*, 24, 7-13
Sociotechnical systems–e.g. telecommunication networks, electric grids, large-scale manufacturing systems–are interacting ensembles of engineered artifacts embedded in

society, linked with economies, and connected with ecology. Such systems have been analyzed through the lenses of sustainability (largely along the dimensions of environmental protection and affordability), carrying influence in the literatures of technology innovation, product design, infrastructure planning, and service delivery. Sustainability concerns along the environmental and financial dimensions have motivated focus on waste and emissions reduction, new technology development, and greening of industrial ecosystems. The concept of inclusive development, however, has not yet permeated the research or conceptualization of sociotechnical systems. Two streams of on-going work in inclusive innovation and in inclusive wealth analysis offer meaningful avenues for future connections. We discuss how the literature on sociotechnical systems and their constituent elements of engineered products and processes has evolved on the topic of sustainability, how the emerging concept of inclusive innovation bridges dimensions of environment and social inclusivity, and how inclusive wealth may inform system-level planning and analysis of sociotechnical systems moving forward.

Rossi, A., 2017, Beyond food provisioning: The transformative potential of grassroots innovation around food, *Agriculture*, 7(1), 6
The newly-emerged ethical foodscape includes multiple expressions of innovation around food. With reference to the Italian context, this paper focuses on the transformative potential of the experiences of social innovation, innovative grassroots initiatives, which have been significantly contributed to shaping the food culture and production-consumption practices during the last two decades. While still consolidating their fundamentals and facing the challenge of growth, the networks behind them continue to be engaged in an effort of innovation, inside and outside their niche. The paper explores these dynamics. Understanding how these networks are managing their transformative capacity and what are the opportunities and challenges arising in the relation with the mainstream system may help to better capture and value the potential of this innovation niche, drawing useful lessons for fostering its expression and for a broader transition to more equitable and sustainable food systems.

Sovacool, B.K., 2017, Contestation, contingency, and justice in the Nordic low-carbon energy transition, *Energy Policy*, 102, 568-582
The five Nordic countries have aggressive climate and energy policies in place and have already emerged to be leaders in renewable energy and energy efficiency. Denmark is renowned for its pioneering use of wind energy, Finland and Sweden bioenergy, Norway hydroelectricity and Iceland geothermal energy. All countries aim to be virtually “fossil free” by 2050. This study explores the Nordic energy transition through the lens of three interconnected research questions: How are they doing it? What challenges exist? And what broader lessons result for energy policy? The study firstly investigates the pathways necessary for these five countries to achieve their low-carbon goals. It argues that a concerted effort must be made to (1) promote decentralized and renewable forms of electricity supply; (2) shift to more sustainable forms of transport; (3) further improve the energy efficiency of residential and commercial buildings; and (4) adopt carbon capture and storage technologies for industry. However, the section that follows emphasizes some of the empirical barriers the Nordic transition must confront, namely political contestation, technological contingency, and social justice and recognition concerns. The study concludes with implications for what such historical progress, and future transition pathways, mean for both energy researchers and energy planners.

Sovacool, BK, 2017, Experts, theories, and electric mobility transitions: Toward an integrated conceptual framework for the adoption of electric vehicles, *Energy Research & Social Science*, 27, 78-95.
I expand and integrate a theory of mobility (Automobility) with one of science and technology (Actor Network Theory) and one about social acceptance and user adoption (UTAUT). I apply this integrative framework to the diffusion (and non-diffusion) of electric vehicles and

the process of electric mobility. I begin by presenting my methods, namely semi-structured qualitative research interviews with social theorists. Then, I present the three theories deemed most relevant by respondents. Automobility holds that, on a cultural or social level, automobiles exist as part of a complex, one that involves hardware and infrastructure—a hybridity between drivers and machines—along with patterns of identity and attitudes about driving pleasure. Actor Network Theory (ANT) involves the concepts of network assemblage, translation, enrollment, and actants and lieutenants. The Unified Theory of Acceptance and Use of Technology, or UTAUT, states that on an individual level, the adoption of new technologies will be predicated on interconnected factors such as performance expectancy, effort expectancy, and other facilitating conditions. Based largely on the original interview data supplemented with peer-reviewed studies, I propose a conceptual framework of user acceptance consisting of motile pleasure, sociality, sociotechnical commensurability, and habitual momentum. I conclude with implications for research and policy.

Gralla, F., Abson, D.J., Møller, A.P., Lang, D.J. and Von Wehrden, H., 2017, Energy transitions and national development indicators: A global review of nuclear energy production, *Renewable and Sustainable Energy Reviews*, in press

Energy use plays a vital role for human well-being. However, human well-being can also be affected by socio-economic and environmental impacts associated with the use of different primary energy sources. Nuclear energy production is perceived as one means of satisfying national energy demand while contributing to a potentially sustainable energy transition. The objective of this study is to further understand socio-economic, environmental and technological factors that characterize countries that choose nuclear energy production. Hence, this exploratory study reviews the socio-economic contexts of nuclear energy producing countries in comparison to countries without nuclear energy use. The study is based on world development indicators published by World Bank for 213 countries between 1960 and 2013 and follows two analytical steps. First, based on a comparison of countries average development indicator values over time, we descriptively explore which socio-economic, environmental and technological factors characterize the spectrum of countries following different 'nuclear energy strategies' (no nuclear production, phase-out, planning to produce, produce nuclear energy). Second we statistically analyze nuclear energy producing countries, exploring if there was significant change in socio-economic, environmental and technological characteristics after the start of nuclear energy production. Characteristics of our four country groups revealed nuclear countries (incl. phase-out) used more energy per capita and showed higher levels of carbon emissions as well as household consumption compared to countries planning to use nuclear energy and countries without nuclear energy use. Adoption of nuclear energy does not appear to reduce fossil fuel use or enable energy independence. Hence, our study did not provide evidence that nuclear energy production can be seen as technological answer to global challenges like climate change or unequal energy distribution. It is therefore unclear if and how nuclear energy contributes to global human well-being as part of sustainable development.

King, L.C., and J.C.J.M. van den Bergh (2017). Worktime reduction as a solution to climate change: Five scenarios compared for the UK. *Ecological Economics* 132: 124-134.

Reducing working hours in an economy has been discussed as a policy which may have benefits in achieving particular economic, social and environmental goals. This study proposes five different scenarios to reduce the working hours of full-time employees by 20%with the aim of cutting greenhouse gas emissions: a three-day weekend, a free Wednesday, reduced daily hours, increased holiday entitlement and a scenario in which the time reduction is efficiently managed by companies to minimise their office space. We conceptually analyse the effects of each scenario on time use patterns through both business and worker activities, and how these might affect energy consumption in the economy. To assess which of the scenarios may be most effective in reducing carbon emissions, this analytical framework is applied as a case study for the United Kingdom. The

results suggest that three of the five scenarios offer similar benefits, and are preferable to the other two, with a difference between the best and worst scenarios of 13.03MTCO2e. The study concludes that there is a clear preference for switching to a four-day working week over other possible work-reduction policies.

Weber, M. and Truffer, B., 2017, Moving innovation systems research to the next level: towards an integrative agenda, *Oxford Review of Economic Policy* 33(1), 101-121.
The concept of Innovation Systems has been a guiding paradigm of innovation research and strongly influenced research and innovation policy since the early 1990s. In spite of this success, criticisms have been raised in recent years whether it is still a suitable framework for addressing the innovation related challenges of the future. In the present paper we claim that systemic explanations of innovation success have still a very important role to play. In order to address the raising criticism however, we have to reconsider the conceptual core of the family of IS approaches and sketch out a path for renewal. The paper retraces the conceptual roots of IS approaches, assesses their uptake in different policy circles around the world, discusses the conceptual core and explanatory ambition and finally formulates a future oriented research agenda for a more integrative innovation systems framework.

Eggimann, S., Truffer, B., Maurer, M., 2016, The cost of hybrid waste water systems: a systematic framework for specifying minimum cost-connection rates. *Water Research*, 15, 472–484.
To determine the optimal connection rate (CR) for regional waste water treatment is a challenge that has recently gained the attention of academia and professional circles throughout the world. We contribute to this debate by proposing a framework for a total cost assessment of sanitation infrastructures in a given region for the whole range of possible CRs. The total costs comprise the treatment and transportation costs of centralised and on-site waste water management systems relative to specific CRs. We can then identify optimal CRs that either deliver waste water services at the lowest overall regional cost, or alternatively, CRs that result from households freely choosing whether they want to connect or not. We apply the framework to a Swiss region, derive a typology for regional cost curves and discuss whether and by how much the empirically observed CRs differ from the two optimal ones. Both optimal CRs may be reached by introducing specific regulatory incentive structures.

Van den Bergh, J.C.J.M. (2017). A third option for climate policy within potential limits to growth. *Nature Climate Change* 7(February): 107-112.
Climate change has revived debates around the concept of limits to growth, 45 years after it was first proposed. Many citizens, scientists and politicians fear that stringent climate policy will harm economic growth. Some are anti-growth, whereas others believe green growth is compatible with a transition to a low-carbon economy. As the window to curb warming at 2 °C closes, this debate will intensify. This article critically reflects on both positions, providing an overview of existing literature on the growth versus climate debate. Both positions are argued here to jeopardize environmental or social goals. A third position, labelled an 'agrowth' strategy, is proposed to depolarize the debate and reduce resistance to climate policies.

Safarzynska, K., and J.C.J.M. van den Bergh (2016). Integrated crisis-climate policy: Macro-evolutionary modelling of interactions between technology, finance and energy systems. *Technological Forecasting & Social Change* 114: 119-137.
Addressing four persistent problems, namely human-induced environmental change, financial instability, inequality and unemployment has now become an urgent necessity. To better grasp complex interactions between technological, financial and energy systems, we propose a formal behavioral-evolutionary macroeconomic model. It describes the coevolution of four populations, namely of heterogeneous consumers, producers, power plants and banks, interacting through interconnected networks. We examine how decisions

by all these economic agents affect financial stability, the direction of technological change and energy use. The approach generates non-trivial, even surprising insights, such as that brand loyalty, captured by a network externality on the demand side, can increase the likelihood of bankruptcies of banks. Cascades of such bankruptcies are found to be more likely under greater income inequalities and higher electricity prices. We employ the model to assess macroeconomic impacts of sustainability policies along three dimensions: environmental effectiveness, financial stability and socio-economic consequences.

Binder, C.R., Mühlemeier, S. and Wyss, R., 2017, An indicator-based approach for analyzing the resilience of transitions for energy regions. Part I: Theoretical and conceptual considerations, *Energies*, 10(1), 36
The transition of our current energy system from a fossil-based system to a system based on renewables is likely to be one of the most complex and long-term societal transitions in history. The need for a fundamental system transformation raises the question of how to measure the continuing progress and the resilience of this process over time. This paper aims at developing the conceptualization and operationalization of resilience for energy systems in transition with regard to both social and technical aspects. Based on the resilience concept in social-ecological systems literature, we propose to conceptualize resilience for energy systems building on two core attributes of resilience, namely diversity and connectivity. We present an indicator set to operationalize these key attributes in social and technical systems using: (i) definitions and measurements for three fundamental diversity properties—variety, balance and disparity—and (ii) basic connectivity properties from the social network analysis literature—path length, centrality and modularity. Finally, we reflect on possibilities for an application of these indicators in the social and technical system's spheres and discuss the added value of the approach for energy transition research.

Faber, A., P. J. M. de Goede & M.P.C. Weijnen (2016) *Long-term commitment for national climate policy in the Netherlands,* WRR-Policy Brief no. 5, The Hague: WRR.
Dutch climate policy currently lacks the clear long-term perspective that is required to provide direction, coherence and reliability to policy choices. In this policy brief the WRR proposes the establishment of an ambitious greenhouse gas emission budget in a national Climate Act. The Climate Act would also establish a Climate Authority for advice, signalling, coordination and dialogue. Important prerequisites are a public investment bank and reinforcement of the climate-related knowledge infrastructure. A future-proof regulatory framework will provide local and regional authorities with the space to develop new technologies and business concepts. At the European level it is necessary to enhance the emissions trading system. Large-scale integration of renewable energy sources requires European coordination of electricity markets and of cross-border energy infrastructure. There are no simple solutions for a complex, wicked issue such as climate change. There are many social, institutional and infrastructure-related obstacles. But with a balanced approach, offering a long-term goal that is enshrined in law and properly monitored, combined with political responsibility and social involvement, it will be possible to achieve ambitious goals.

Kivimaa, P., Hildén, M., Huitema, D., Jordan, A. and Newig, J., 2017, Experiments in climate governance – a systematic review of research on energy and built environment transitions, *Journal of Cleaner Production*, in press
Experimentation has been proposed as a key way in which governance drives sustainability transitions, notably by creating space for innovative solutions to emerge. In seeking to bring greater coherence to the literatures on climate and sustainability governance experiments, this article reports on a systematic review of articles published between 2009 and 2015. Based on these results a new definition and typology of climate governance experiments is suggested. The typology distinguishes between the various purposes experiments can have, including niche creation, market creation, spatial development, and societal problem solving. It deepens the understanding of the diversity in experimenting by highlighting the salient

features of different types of governance experiments. It can therefore guide future research to generate more cumulative research findings contributing to a better understanding of the role and outcomes of experiments in societal transitions. The findings also suggests that real transitions towards low-carbon and climate-resilient societies will require a systematic deliberate combination of different types of experiments.

Silva, A., Rosano, M., Stocker, L., and Gorissen, L., 2017, From waste to sustainable materials management: Three case studies of the transition journey. *Waste Management*, 61, 547-557

Waste policy is increasingly moving on from the 'prevention of waste' to a 'sustainable materials policy' focused agenda recognising individual wastes as a resource. In order to comparatively analyse policy developments in enhanced waste management, three case studies were selected; San Francisco's Zero Waste Program, Flanders's Sustainable Materials Management Initiative and Japan's Sound Material-Cycle Society Plan. These case studies were chosen as an opportunity to investigate the variety of leading approaches, governance structures, and enhanced waste policy outcomes, emerging globally. This paper concludes that the current transitional state of waste management across the world, is only in the first leg of the journey towards Circular Economy closed loop production models of waste as a resource material. It is suggested that further development in government policy, planning and behaviour change is required. A focus on material policy and incorporating multiple front runners across industry and knowledge institutions are offered as potential directions in the movement away from end-pipe land-fill solutions.

Silva, A., Stocker, L., Mercieca, P., Rosano, M., 2016, The role of policy labels, keywords and framing in transitioning waste policy. *Journal of Cleaner Production*, 115, 224-237.

The last decade has seen a new wave of ambitious policies in order to address the mounting ecological damage caused by high levels of consumerism and the depletion of resources to manufacture short life-cycle products. In this paper 'Zero Waste' and 'Sustainable Materials Management' are examined as prominent labels of an evolving waste policy discourse towards waste prevention and reduction and material cycles. Using discourse analysis key documents are comparatively assessed, presenting the origins of these two concepts and how they entered the waste policy domain. The different framing tactics and governance models are then presented. The findings demonstrate that the different discourse paradigms around the concept of 'waste' and 'materials', influences what policy initiatives, measurement tools and outcomes are pursued. Although Zero Waste and Sustainable Materials Management are gaining popularity as indicators of shifting waste policy towards Sustainable Production and Consumption Policy, particularly with increasing discussion and application of Circular Economy governance models in Europe and China, a distinction still exists between the conceptualisation and implementation within and across the two concepts. It is in this transition towards a Circular Economy that it is valuable to review the role of policy labels, keywords and framing context in waste policy and the ability of enhanced waste management to assist in the development of more sustainable and environmentally acceptable economic and social behaviour models.

Gorissen, L., Spira, F., Meynaerts, E., Valkering, P. and Frantzeskaki, N., 2017, Moving towards systemic change? Investigating acceleration dynamics of urban sustainability transitions in the Belgian City of Genk, *Journal of Cleaner Production*, in press

In recent years, multiple transformative initiatives have been set up in cities across the world to kick-start transitions of urban systems towards sustainability. Yet to what extent do these initiatives influence systemic change or accelerate sustainability transitions? We apply an analytical framework, conceptualizing five mechanisms representing acceleration dynamics of sustainability transitions – replicating, partnering, upscaling, instrumentalising and embedding – to examine transition dynamics in the Belgian City of Genk. The focal unit of analysis are the innovative activities and related actor-networks from the city region, defined

as ‘transition initiatives’, situated within the local governance context. We selected 10 local transition initiatives with a clear focus on environmental sustainability and set out to understand their origins and identify conditions and mechanisms for accelerating sustainable low-carbon transitions. Our findings show that all five mechanisms of acceleration are occurring in Genk at the moment and that the local governance context is favourable for accelerating transition dynamics to sustainability, mostly because it promotes diffusion, partnering and embedding processes. For instance, one initiative that proved to be a hotspot for partnering is the Heempark, a Public-Civic Partnership in which volunteers and the government collaborate in a mutually beneficial way. Our findings provide early indications of mounting changes, increasing reflexivity and coordination from governance actors and diffusion, embedding and routinisation of more sustainable ways of thinking, doing and organising in the wider public. These acceleration dynamics are most apparent in the food, nature, resource and education domain in Genk and are mostly fuelled via multi-actor collaborations. On an aggregate level, these observations suggest that socio-cultural, economic, ecological and institutional changes are accumulating. We therefore conclude that early but fragile acceleration dynamics are unfolding in Genk. Our findings are relevant to deepen the understanding of transition scholars on the acceleration dynamics of urban sustainability transitions and may be of particular interest for practitioners on the field.

Hodson, M., Geels, F.W., and McMeekin, A., 2017, Reconfiguring urban sustainability transitions, analysing multiplicity, *Sustainability*, 9(2), 299; doi:10.3390/su9020299
Cities, and the networked infrastructures that sustain urban life, are seen as crucial sites for creating more sustainable futures. Yet, although there are many plans, the realisation of sustainable urban infrastructures on the ground is uneven. To develop better ways of understanding why this is the case, the paper makes a conceptual contribution by engaging with current understanding of urban sustainability transitions, using urban sustainable mobility as a reference point. It extends these insights to argue that urban transitions are not about technological or social innovation per se, but about how multiple innovations are experimented with, combined and reconfigured in existing urban contexts and how such processes are governed. There are potentially many ways in which urban sustainable mobility can be reconfigured contextually. Innovation is in the particular *form of reconfiguration* rather than individual technologies. To make analytical sense of this multiplicity, a preliminary framework is developed that offers the potential to think about urban transitions as contextual and reconfigurational. We argue that there is a need to embrace multiplicity and to understand its relationships to forms of reconfiguration, through empirical exploration and further theoretical and conceptual development. The preliminary framework is a contribution to doing so and we set out future directions for research.

Stephan, A., Schmidt, T.S., Bening, C.R. and Hoffmann, V.H., 2017. The sectoral configuration of technological innovation systems: Patterns of knowledge development and diffusion in the lithium-ion battery technology in Japan, *Research Policy,* in press
Technological innovation systems (TISs) have found favor for analyzing a technology’s innovation dynamics. Complementary to TISs, the sectoral innovation systems approach focuses on sectoral peculiarities regarding innovation. This paper represents a first step towards integrating the sectoral dimension into TIS analysis. This seems particularly relevant for multi-component technologies, since their underlying innovation dynamics involve multiple sectors. We introduce the “sectoral configuration” of a TIS, which relates to the number and types of sectors linked via a TIS’s value chain, and elaborate how the sectoral configuration plays out for a TIS’s functional dynamics. We apply our theoretical framework to the *knowledge development and diffusion* function. Based on a quantitative analysis of patent data for lithium-ion batteries in Japan (1985–2005), we find that different sectors vary in importance for knowledge development and diffusion, especially with regard to the technology’s evolution over time. Our findings suggest that the sectoral configuration deserves more attention in future TIS analyses. This would support a better understanding of

functional mechanisms, and therefore offer the potential to derive enhanced TIS-based policy recommendations regarding the nature and balance between demand-pull, technology-push and interface improvement policies.

Treuer, G., Koebele, E., Deslatte, A., Ernst, K., Garcia, M. and Manago, K., 2017, A narrative method for analyzing transitions in urban water management: The case of the Miami-Dade water and sewer department, *Water Resources Research*, in press
Although the water management sector is often characterized as resistant to risk and change, urban areas across the United States are increasingly interested in creating opportunities to transition toward more sustainable water management practices. These transitions are complex and difficult to predict – the product of water managers acting in response to numerous biophysical, regulatory, and political factors within institutional constraints. Gaining a better understanding of how these transitions occur is crucial for continuing to improve water management. This paper presents a replicable methodology for analyzing how urban water utilities transition toward sustainability. The method combines standardized quantitative measures of variables that influence transitions with contextual qualitative information about a utility's unique decision making context to produce structured, data-driven narratives. Data-narratives document the broader context, the utility's pre-transition history, key events during an accelerated period of change, and the consequences of transition. Eventually, these narratives should be compared across cases to develop empirically-testable hypotheses about the drivers of and barriers to utility-level urban water management transition. The methodology is illustrated through the case of the Miami-Dade Water and Sewer Department (WASD) in Miami-Dade County, Florida and its transition towards more sustainable water management in the 2000s, during which per capita water use declined, conservation measures were enacted, water rates increased, and climate adaptive planning became the new norm.

Yu, Z. and David Gibbs, D., 2017, Sustainability transitions and leapfrogging in latecomer cities: the development of solar thermal energy in Dezhou, China, *Regional Studies*, in press
Sustainability transitions in cities in emerging economic contexts are rarely addressed. The paper addresses this issue by investigating the drivers and barriers in the diffusion of solar thermal energy in two Chinese cities: Dezhou and Beijing. The findings suggest that latecomer cities such as Dezhou demonstrate several advantages over developed cities in environmental transitions. In particular they can ‘leapfrog’ to environmentally friendly technologies as they are less locked in by existing technological regimes. The paper thus contributes to debates over the role of both space and the urban scale in sustainability transitions research.

Fridahl, M., 2017, Socio-political prioritization of bioenergy with carbon capture and storage, *Energy Policy*, 104, 89-99
Limiting global warming to well below 2 °C requires the transformation of the global energy system at a scale unprecedented since the industrial revolution. To meet this 2 °C goal, 87% of integrated assessment models opt for using bioenergy with carbon capture and storage (BECCS). Without BECCS, the models predict that the goal will be either unachievable or substantially more costly to meet. While the modeling literature is extensive, studies of how key climate policy actors perceive and prioritize BECCS are sparse. This article provides a unique intercontinental mapping of the prioritization of BECCS for the long term transition of the electricity supply sector. Based on survey responses from 711 UN climate change conference delegates, the article reports the low prioritization of BECCS relative to alternative technologies, indicating an urgent need for studies of the socio-political preconditions for large-scale BECCS deployment.

Bauer, F., Coenen, L., Hansen, T., McCormick, K. and Palgan, Y.V., 2017, Technological innovation systems for biorefineries: A review of the literature. *Biofuels, Bioproducts and Biorefining*, in press

The concept of a bioeconomy can be understood as an economy where the basic building blocks for materials, chemicals and energy are derived from renewable biological resources. Biorefineries are considered an integral part of the development towards a future sustainable bioeconomy. The purpose of this literature review is to synthesize current knowledge about how biorefinery technologies are being developed, deployed, and diffused, and to identify actors, networks and institutions relevant for these processes. A number of key findings can be obtained from the literature. First, investing more resources in R&D will not help to enable biorefineries to cross the 'valley of death' towards greater commercial investments. Second, while the importance and need for entrepreneurship and the engagement of small and medium-sized enterprises (SMEs) is generally acknowledged, there is no agreement how to facilitate conditions for entrepreneurs and SMEs to enter into the field of biorefineries. Third, visions for biorefinery technologies and products have focused very much on biofuels and bioenergy with legislation and regulation playing an instrumental role in creating a market for these products. But there is a clear need to incentivize non-energy products to encourage investments in biorefineries. Finally, policy support for biorefinery developments and products is heavily intertwined with wider discussions around legitimacy and social acceptance. The paper concludes by outlining current knowledge gaps, which future research ought to target.

Feola, G., Butt, A. 2017. The diffusion of grassroots innovations for sustainability in Italy and Great Britain: an exploratory spatial data analysis. *Geographical Journal*, 183(1), 16-33.

Little research so far has been devoted to understanding the diffusion of grassroots innovation for sustainability across space. This paper explores and compares the spatial diffusion of two networks of grassroots innovations, the Transition Towns Network (TTN) and Gruppi di Acquisto Solidale (Solidarity Purchasing Groups – GAS), in Great Britain and Italy. Spatio-temporal diffusion data were mined from available datasets, and patterns of diffusion were uncovered through an exploratory data analysis. The analysis shows that GAS and TTN diffusion in Italy and Great Britain is spatially structured, and that the spatial structure has changed over time. TTN has diffused differently in Great Britain and Italy, while GAS and TTN have diffused similarly in central Italy. The uneven diffusion of these grassroots networks on the one hand challenges current narratives on the momentum of grassroots innovations, but on the other highlights important issues in the geography of grassroots innovations for sustainability, such as cross-movement transfers and collaborations, institutional thickness, and interplay of different proximities in grassroots innovation diffusion.

Papachristos, G., 2017. Diversity in technology competition. The link between platforms and sociotechnical transitions. *Renewable and Sustainable Energy Reviews*, 73, 291-306.

There is an urgent need for a fast transition to a low-carbon economy, which will involve behavioural change and new technologies. This paper focuses on the technological dimension of the transition. Low-carbon technologies usually have a modular architecture that utilize standards to enable interfacing of components. These standards contribute to transition inertia. An important question addressed in this article is whether maintaining technological diversity can help overcome inertia. This requires keeping options open and foregoing returns to scale. It is a trade-off which has technological as well as spatial dimensions which are important because different geographical areas may provide institutional or other advantages to the emergence of distinct technologies. In order to explore this, the platform competition and transitions literature are reviewed, links between them are established, and a system dynamics model is developed where multiple new technologies compete with an incumbent. It is used to answer two questions: Will a larger portfolio accelerate or delay a transition to a new technology, and under which conditions will

such an acceleration occur? does spatial differentiation matter to the outcome? The model results show that technological diversity and spatial differentiation matter for the speed of transitions. The challenge is to create a level competitive field for all technologies accounting for the distinct institutional advantages their spatial differentiation may provide. This opens a range of future research directions.

Huguenin, A. and Jeannerat, J., 2017, Creating change through pilot and demonstration projects: Towards a valuation policy approach, *Research Policy*, in press

Beyond R&D and competitiveness theories of innovation, various conceptual broadenings have recently been proposed to tackle the complex, multidimensional and multi-level dynamics of innovation at stake in the transformation of the economy and society towards new sustainable development regimes. This paper proposes a reading of these conceptual broadenings as a matter of 'valuation'. In line with pragmatic theories of socio-economic value and market construction, it is argued that value creation is not the result or byproduct of innovation. In contrast to traditional regulation and R&D policies, which confine themselves to framing innovation, valuation policies are endogenous triggers of the transformation of a value regime. Value creation is about inquiring into new values in society, translating them into social and technological solutions and making them valuable in markets. In this perspective, pilot and demonstration (P&D) projects in current transition policies can be interpreted as fundamental inceptions of new values that are not predetermined by innovation but actuated through complex processes of value co-creation in society and markets, and which engage policies as agents of change. By focusing on the purpose behind the sustainability transition rather than the factors that contribute to it, a valuation policy approach offers new insights for future research and policy.

Schäpke, N., Stelzer, F., Bergmann, M., Lang, D.J., 2016, Tentative theses on transformative research in real-world laboratories: First insights from the accompanying research for real. *Technikfolgenabschätzung: Theorie und Praxis*, 25(3), 45-51

Real-world laboratories are growing in popularity promising a contribution to both: the understanding and facilitation of societal transformation towards sustainability. Baden-Württemberg substantially funds real-world labs as part of the initiative "science for sustainability". To facilitate learning with and from these so-called BaWü-Labs, they are supported by accompanying research conducted by two teams. This article presents first insights and theses on real-world labs as a research format, based in particular on the work of the accompanying research team ForReal. The team supports the labs in their realization and in providing general insights, e.g. by learning from related international research approaches and dialog with international experts, and analyzes suitable quality features and methods (the latter together with the University of Basel team). The theses presented here put up for discussion first insights on real-world labs as a transformative research approach and reflect on them from a theoretical perspective. They illustrate the relevance of a goal-oriented use of methods and present learning processes as core characteristics of real-world labs. The theses were formulated based on discussions with the BaWü-Labs, exchange in international contexts as well as a thematic literature review.

Kishna, M., Negro, S., Alkemade, F. & Hekkert, M., 2017, Innovation at the end of the life cycle: discontinuous innovation strategies by incumbents, *Industry and Innovation*, 24(3), 263-279

This paper focuses on the strategies of incumbents that seek to develop discontinuous innovations within the boundaries of a mature innovation system. Mature innovation systems do not provide support for these discontinuous innovations. This article focuses on exploring why incumbents in these setting engage in discontinuous innovation and what strategies they deploy to become successful. We analyse 10 cases of incumbents developing

discontinuous innovations in the mature Dutch greenhouse horticulture sector. The results of our analysis show that the incumbents are primarily triggered by dissatisfaction with the current way of doing business and that the existing institutions are the main barrier to discontinuous innovation. In response, the incumbents try to circumvent the existing innovation system in their innovation process, but when successful also engage in changing the existing innovation system. This paper contributes to the understanding of the role of incumbents as source of discontinuous innovation in mature innovation systems.

Mikko Jalas, Sampsa Hyysalo, Eva Heiskanen, Raimo Lovio, Ari Nissinen, Maija Mattinen, Jenny Rinkinen, Jouni K. Juntunen, Pasi Tainio, Heli Nissilä, 2017, Everyday experimentation in energy transition: A practice-theoretical view, *Journal of Cleaner Production*, in press
Research on sustainable practices has attracted increasing interest as a way to understand energy demand and transitions towards sustainability. In this paper we elaborate on how practice theories can inform the discussion of experimentation. Practice theory suggests that the everyday life of people appears recalcitrant. Practices are robust, resilient and have multiple, historically formed constituents and are thereby difficult to destabilize and change quickly. The making and breaking of links inside and between practices is highlighted, as is the need for enduring, multi-sited change efforts. Practice theory further helps us to better understand the constitution of new, levelled forms of expertise, the distributed nature of experimentation and the enrolment of citizens as active participants in sustainability transitions. We have operationalized and examined these suggestions in a Finnish research project related to climate change mitigation and energy use in detached houses. We report specific modes of experimentation and innovation, including user innovations, and the shared resources of situated expertise, the collective and shared processes of empowerment and the ways in which normality is challenged by ruptures in everyday life. Based on the results, we derive suggestions for effective policy interventions. We also bring forward a set of generic suggestions for more sensitive, appreciative and effective public policies on sustainability transitions and cast experimentation in a particular and partial role in such policies.

Matschoss, K. and Heiskanen, E., 2017, Making it experimental in several ways: The work of intermediaries in raising the ambition level in local climate initiatives, *Journal of Cleaner Production*, in press
Local climate experimentation is a topical issue as cities and rural municipalities are increasingly engaging in various local energy experiments in order to act against climate change. There are high expectations toward experimentation among the policy makers, funders and local actors. Intermediary organisations have an important role as facilitators, brokers, instigators and network builders in low-energy and low-carbon experiments. However, there is still limited understanding of exactly what is the work of an innovation intermediary in contributing to local experiments. Our paper focuses on how intermediaries aggregate lessons and transfer knowledge across experiments. We study how the intermediary activities also help in going beyond existing practice and make a difference beyond the experimental context. Our analysis is based on three empirical case studies in Finland: Smart Kalasatama in Helsinki, Skaftkärr in Porvoo and HINKU with a focus on joint purchase of solar panels. Our research shows how intermediaries balance diverse demands, such as immediate benefits vs. radical change or societal learning, in order to render local climate initiatives more experimental.

Johansson, N., Krook, J. and Eklund, M., 2017, The institutional capacity for a resource transition—A critical review of Swedish governmental commissions on landfill mining, *Environmental Science & Policy*, 70, 46–53
Recycling of minerals from waste deposits could potentially double the recycling flows while offering an opportunity to address the many problematic landfills. However, this type of activity, i.e., landfill mining, brings many advantages, risks and uncertainties and lacks

economic feasibility. Therefore, we investigate the capacity of the Swedish authorities to navigate the environmental, resource, and economic conditions of landfill mining and their attitude to support such radical recycling alternatives towards a resource transition. By analyzing three governmental commissions on landfill mining, we show how the authorities seem unable to embrace the complexity of the concept. When landfill mining is framed as a remediation activity the authorities are positive in support, but when it is framed as a mining activity the authorities are negative. Landfill mining is evaluated based on how conventional practices work, with one and only one purpose: to extract resources or remediation. That traditional mining was a starting point in the evaluation becomes particularly obvious when the resource potential shall be evaluated. The resource potential of landfills is assessed based on metals with a high occurrence in the bedrock. If the potential instead had been based on metals with low incidence in the Swedish bedrock, the potential would have been found in the human built environment. Secondary resources in landfills seem to lack an institutional affiliation, since the institutional arrangements that are responsible for landfills primarily perceive them as pollution, while the institutions responsible for resources, on the other hand, assume them to be found in the bedrock. Finally, we suggest how the institutional capacity for a resource transition can increase by the introduction of a broader approach when evaluating emerging alternatives and a new institutional order.

Larsson, J. and Holmberg, J., 2017, Learning while creating value for sustainability transitions: the case of Challenge Lab at Chalmers University of Technology. *Journal of Cleaner Production*, in press.
To achieve a sustainable future, a variety of societal systems need to be transformed and new ways of social collaboration created. Higher education institutions play an important role in guiding these changes, through education, research, and outreach. In this paper, we study a lab-based learning environment, the Challenge Lab, where master's degree students engage in, and create value in support of, the transition to a sustainable society. Three student cases are analyzed in-depth to understand how the Lab functions as an expansive learning process and provides space for transformative and integrative value creation. The Lab's guiding methodology is based on backcasting from principles, combined with clarifying the students' core values and drivers. The role of the teacher in such a learning environment is to provide the basis for the process by facilitating and guiding. Provided with the right conditions, these students have the ability to challenge underlying assumptions about how systems work and to build trust by facilitating dialogue among actors in society. The students perceived the opportunity to engage in real-world challenges as meaningful, drew valuable lessons for their future, and got to know themselves better. In this transitional period of achieving ambitious sustainability goals and targets, students' ability to be a source of change – maybe the most important source inside higher education institutions – deserves much more attention.

Kemp, R. and Never, B., 2017, Green transition, industrial policy, and economic development, *Oxford Review of Economic Policy*, 33(1), 66-84
This paper outlines possibilities for a green industrial policy with particular emphasis on developing countries. The question of green industrial policy is investigated by examining experiences and barriers to phasing-in green technologies, focusing on solar PV and energy efficiency as areas for a green industrial policy. The paper outlines a green transition approach to sustain a shift to cleaner and more energy-efficient production processes through clever policy mixes involving elements of push and pull. Rent management and policy adaptation by competent authorities are also part of the model. The paper offers concrete guidance to the question of what governments in developing countries can usefully and realistically do to phase in green technologies given the priorities for development, imperfect institutions for policy-making and implementation, weakly developed innovation systems, and problems of lock-in.

Koirala B, Chaves Ávila J P, Gómez T, Hakvoort R, Herder P., 2016, Local alternative for energy supply: Performance assessment of integrated community energy Systems. *Energies*, 9, 981
Integrated community energy systems (ICESs) are emerging as a modern development to re-organize local energy systems allowing simultaneous integration of distributed energy resources (DERs) and engagement of local communities. Although local energy initiatives, such as ICESs are rapidly emerging due to community objectives, such as cost and emission reductions as well as resiliency, assessment and evaluation are still lacking on the value that these systems can provide both to the local communities as well as to the whole energy system. In this paper, we present a model-based framework to assess the value of ICESs for the local communities. The distributed energy resources-consumer adoption model (DER-CAM) based ICES model is used to assess the value of an ICES in the Netherlands. For the considered community size and local conditions, grid-connected ICESs are already beneficial to the alternative of solely being supplied from the grid both in terms of total energy costs and CO2 emissions, whereas grid-defected systems, although performing very well in terms of CO2 emission reduction, are still rather expensive.

Eid C, Bollinger LA, Koirala B, Scholten D, Facchinetti E, Lilliestam J., 2016, Market integration of local energy systems: Is local energy management compatible with European regulation for retail competition?, *Energy*, 114:913–22.
The growing penetration of distributed energy resources is opening up opportunities for local energy management (LEM) – the coordination of decentralized energy supply, storage, transport, conversion and consumption within a given geographical area. Because European electricity market liberalization concentrates competition at the wholesale level, local energy management at the distribution level is likely to impose new roles and responsibilities on existing and/or new actors. This paper provides insights into the appropriateness of organizational models for flexibility management to guarantee retail competition and feasibility for upscaling. By means of a new analytical framework three projects in the Netherlands and one in Germany have been analysed. Both the local aggregator and dynamic pricing projects present potentials for retail competition and feasibility of upscaling in Europe.

Schroeder, P. and Anantharaman, M., 2017, "Lifestyle leapfrogging" in emerging economies: Enabling systemic shifts to sustainable consumption, *Journal of Consumer Policy*, in press
This paper combines the concept of leapfrogging with systems-thinking approaches to outline the potentials for and barriers to enabling systemic shifts to strong sustainable consumption in the emerging economies of China and India. New urban consumers in China and India have the potential to "lifestyle leapfrog" the high impact lifestyle models of the industrialized countries while simultaneously improving their quality of life. This paper argues that by implementing systemic approaches in the consumption domains of mobility and housing, the historical trajectory of high environmental footprints of mobility and housing can be avoided. The analysis based on systems-thinking principles identifies existing barriers and possible solutions. The importance of policies for strong sustainable consumption is highlighted to induce positive feedbacks in the areas of markets and society facilitating both efficient technology uptake and behavioural changes.

Michalena, E. and Hills, J., 2017, Renewable energy issues and implementation of European energy policy: The missing generation?, *Energy Policy*, in press
The European Commission has set renewable energy (RE) targets at the Member State (MS) level, however, at the local scale there are many issues related to renewable energy implementation. In this work, a meta-analysis of European RE generation issues from international scientific literature was carried out. Fifty-four local RE implementation issues were identified. Five main clusters of issues were determined, some were aligned along sectoral lines (e.g. governance and technology) but others were inherently multi-sectoral

(e.g. complexity and multiplicity of factors), challenging the traditional sectorial view. Results show that RE issues are not just a finite list of independent issues but are hierarchical, multi-scale and cross-linked. As a further step, these issues clusters were linked to the European RE policy and subsidiarity through the National Renewable Energy Action Plans (NREAP) in selected MS. EU policy and NREAP subsidiarity proved limited in their scope in dealing with local RE issues. With this scope, the way that EU policy partially fails to facilitate delivery of RE targets, follows a traditional sectoral approach, promotes weak subsidiarity through NREAPs and does not address EU-wide, but local issues of RE, is discussed.

Canzler, W., Engels, F., Rogge, J-C, Simon, D. and Wentland, A., 2017, From "living lab" to strategic action field: Bringing together energy, mobility, and ICT in Germany, *Energy Research and Social Science*, 27, 25-35
Against the backdrop of the transformation of the German energy system, a new dynamic is emerging between the previously separate economic fields of renewable energy systems, transportation, and information and communication technologies (ICT). The trend towards digitalization and interconnectivity is prompting the formation of new corporate alliances and business ideas. We argue that the increasing interactions between actors in these sectors are evidence of the emergence of a new intersectoral field. Building on concepts from neoinstitutionalism, particularly, the framework of strategic action fields (SAF), we examine the overlaps and dynamics that are arising in an exemplar of what policy makers and planners often refer to as "living labs." With help of this case study we observe the cross-field innovation activities taking place at a particular local site. Our empirical examination draws upon a four-year-long ethnography of an innovation campus in Berlin, the German capital. This case reveals the development of interdependent interests and collaborations between both different industries and between companies and academic institutions. These interconnections are built, in part, by socially skilled actors, who act as border crossers between established fields.

Apajalahti, E-L., Temmes, A. and Lempiälä, T., 2017, Incumbent organisations shaping emerging technological fields: Cases of solar photovoltaic and electric vehicle charging, *Technology Analysis and Strategic Management*, in press
We explore how large incumbent organisations shape emerging technological fields while establishing a position and business opportunities for themselves during technological shifts. We draw from innovation studies that increasingly emphasise the ability of incumbent organisations to survive technological transformations and studies on emerging technological fields to identify ways in which incumbent organisations shape novel fields during their emergence. Through longitudinal case studies of two emerging fields, we examine how incumbents shape the emerging technological fields of solar energy and electric vehicles. We discuss the interlinked and cumulative business and discursive activities utilized by the incumbents as well as the mechanism through which they influence the legitimacy, expectations and field boundaries of the emerging technological fields. Our study draws attention to the fact that incumbents enter emerging fields at an earlier stage and in more diverse ways than has previously been noted.

Skeete, J-P., 2017, Examining the role of policy design and policy interaction in EU automotive emissions performance gaps, *Energy Policy*, 104, 373-381
In the wake of the 2015 'Dieselgate' scandal, the US and European governments publicly confronted automakers about their behaviour, which raised concerns about the integrity of the current emissions legislation regimes. In this article, I argue that 'flexibilities' within the EU's emissions legislative framework afforded automakers the opportunity to legally sidestep strict performance standards laid out in the law and resulted in a significant performance gap in real world driving emissions. This article provides a timely examination of EU emission legislation policy design and policy interaction within the European Union with the aim of explaining why the EU policy framework failed to regulate the regional automotive industry. Current research is mostly concerned with the typology and effectiveness of individual

environmental policy instruments, be it regulatory or economic incentives, that aim to influence industry behaviour. This article approaches the current EU policy regime in a more holistic manner and focuses on the exploitation of weaknesses in the regulatory framework by private firms, which has received little academic attention in the innovation and transition literature. A major contribution of this article therefore is a body of primary qualitative interview data from industry elites concerning relevant emissions policies.

Pearson, P.J.G. and Arapostathis, S., 2017, Two centuries of innovation, transformation and transition in the UK gas industry: Where next?, *Proceedings of the Institution of Mechanical Engineers, Part A: Journal of Power and Energy*, in press
Britain's gas system developed in the early 1800s. Over the past two centuries the system and its local, national and international networks have experienced much socio-technical innovation, governance changes and six key transitions. Since the Climate Change Act of 2008, it faces a seventh challenging transition as the UK moves uncertainly towards a low-carbon energy system, including decarbonising electricity, heat and transport. The paper explores: the origins of the system by Murdoch, Boulton and Watt; the early 19th century development of local gas networks; innovative responses to, inter alia, the challenge of incandescent electric light from the 1880s, including the expansion of the customer base and the development and active promotion of cooking and heat services – the growth, fragmentation and incoherence of the industry between the two World Wars; the post-war period that saw the industry nationalised in 1948, as the multi-fuel economy developed; the institutional, technical and social challenges associated with the conversion to North Sea natural gas in the 1960s; and innovation and change in response to the challenges that flowed from the privatisation of British Gas in 1987. The paper shows how examining past processes of innovation, transition and transformation through the lens of institutional 'governance logics' helps appreciate the challenges faced by system actors, technologies, institutions and regulators in the past and offers insights into the issues posed by the low-carbon transition. The paper begins by outlining some analytical concepts used in the analysis. We then examine the regime's six past transitions. The paper concludes by considering what insights these past experiences suggest for a seventh transition towards a low-carbon economy, for the future governance of the UK gas system and its networks and particularly for natural gas.

Bouzarovski, S., Herrero, S.T., Petrova, S., Frankowski, J, Matousek, R. and Maltby, T., Multiple transformations: Theorizing energy vulnerability as a socio-spatial phenomenon, *Geografiska Annaler: Series B, Human Geography*, in press
The on-going transition towards low-carbon forms of energy provision (frequently termed 'energy transitions') has triggered far-reaching material, economic and institutional reconfigurations at the global scale. There is evidence to suggest that energy transitions increase the social vulnerability of actors involved in and affected by them, including entities operating at different scales, from individual households to entire states. However, the link between energy vulnerability and energy transitions remains poorly understood. We aim to formulate an explicitly geographical perspective on this relationship. The paper is based on an analysis of documentary evidence and 170 expert interviews undertaken between April 2013 and March 2015. This research took place in the post-communist states of Central and Eastern Europe where systemic change has fundamentally altered the institutional landscape of the energy sector since the early 1990s. Our findings point to the need for understanding energy vulnerability as an evolving socio-spatial phenomenon embedded in multiple layers of institutional change and organizational practice. We identify urban landscapes as the primary site for the geographic expression and articulation of domestic energy deprivation.

Brown, K. 2016. In the pocket: energy regulation, industry capture, and campaign spending. *Sustainability: Science, Practice, & Policy* 12(2).
The transition to clean energy can be compromised when electrical utilities hold significant sway over the political bodies that regulate them. While much empirical evidence in the United States supports the direct election of state utility commissioners as a means to prevent regulatory capture this article argues that less attention has been paid to an important mechanism of capture: political campaign contributions. Using a qualitative comparative study of public utility commissions (PUCs) in four states, this study shows that the direct election of commissioners without a concomitant legal restriction on campaign spending by the regulated utilities insufficiently insulates regulators from industry capture. This finding is particularly important in the contemporary legal climate following the Supreme Court ruling in *Citizens United v. Federal Election Commission (FEC)*, which opened the door to unlimited corporate campaign spending, and in the face of industry resistance to climate-change mitigation in the energy sector.

Scordato, L., Bugge, L.M. and Fevolden, A.M., 2017, Directionality across diversity: Governing contending policy rationales in the transition towards the bioeconomy, *Sustainability*, 9(2), 206
Although the bioeconomy has been embraced by many governments around the world as a way of responding to the grand challenge of climate change, it remains unclear what the bioeconomy is and how it can contribute to achieving these broad policy objectives. The aim of this paper is to improve our understanding of whether, and how, the bioeconomy includes contending rationales for governance and policy-making. In order to do this, we apply a typology of three bioeconomy visions onto the policy discourse on the bioeconomy. These visions are (1) a bio-technology vision; (2) a bio-resource vision; and (3) a bio-ecology vision. Based on a discourse analysis of 41 submissions to a public hearing on the development of a bioeconomy strategy in Norway, the paper explores the actors involved in shaping the new bioeconomy and analyses their positions on this emerging field. The paper finds that it is possible to categorise the consultative inputs into these three visions, and also that the bio-resource vision is predominant, which reflects the structure of the national economy. Moreover, the paper reflects upon how the contending visions observed imply negotiations and power struggles, which may hamper directionality in the current socio-technical transition.

Muinzer, T.L., and Ellis, G., 2017, Subnational governance for the low carbon energy transition: Mapping the UK's 'Energy Constitution', *Environment and Planning C*,
The UK has a 'national' strategy to decarbonise its energy sector, yet the transfer of key responsibilities to its Devolved Administrations has meant that they control many of the powers that determine the rate and extent of the decarbonisation process. This reflects an asymmetrical distribution of legal responsibilities that has cast a complex range of powers 'downward' from the national sphere to subnational scales and which plays a crucial role in shaping the agency at different levels of the UK's energy governance. This paper provides a detailed exploration of the UK's 'Energy Constitution' as a means of examining the way in which the complex legal framework of devolution shapes the spatial organisation of the UK's low carbon transition. Previous research on the low carbon transition has remained largely 'lawless' and as such has tended to overlook how the legal regimes governing energy both produce space and are shaped by its geographic context. The paper therefore develops a more nuanced understanding of the spatiality, territorialisation and scaling of UK energy governance to highlight a nexus of ambiguity and partial power allocation distributed across a plurality of overlapping 'legal' jurisdictions. This raises fundamental questions over how UK constitutional arrangements reify the territoriality of energy governance and structure the relationships between national and subnational multi-level decarbonisation processes.

Broto, V.C., 20167, Energy landscapes and urban trajectories towards sustainability, *Energy Policy*, in press

An urban energy transition is needed to address the two global environmental challenges of urbanisation and increasing carbon emissions. Urban energy landscapes represent the spatial patterns of urban energy systems which are visible in the built environment. Spatial regularities in the way systems of energy provision and use are organised are manifest in urban energy landscapes. Energy uses may vary in relation to the structures of the built environment, and the perceptions that coevolve with technologies. This paper presents evidence from three case studies of urban energy landscapes in Hong Kong (PRC), Bengaluru (India) and Maputo (Mozambique). The cases suggest a variety of patterns (uniform, fragmented, scattered) in terms of how different fuels and electricity are provided and who has access to them. Qualitative research among policy makers reveals different trajectories towards sustainability. The paper concludes with the suggestion that the spatial organisation of urban energy systems shapes potential trajectories of change for an urban energy transition. This would call for forms of spatial planning that promote flexibility as a means to foster sustainability innovations. However, further evidence will be required to evaluate whether this exploratory analysis can be generalised beyond the three cities studied.