Sustainability Transitions Research Network | STRN

Newsletter 26: December 2017

This is the 26th 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,

I am happy to inform you that STRN membership has almost reached 1500, which implies we've become a sizeable community. I am also very pleased to inform you that the revision process of the STRN research agenda is now completed. The initial impulse for this came from IST-2015 in Brighton, which in 2016 led to an open invitation for suggestions, which a working group then processed and elaborated. For nine sub-themes, the new agenda takes stock of research in recent years and proposes possible future research directions. The revised research agenda will be disseminated with this newsletter and is available on the STRN website. I want to thank the working group and all contributors for their work on this, and I hope you will it a useful resource, either as a quick introduction to sub-theme debates or as suggestion for future research.

Preparations for the 9th International Sustainability Transitions conference in Manchester, 11-14 June 2018, are in full swing. The 'event announcement' section provides more information, but I want to remind you that the **deadline for abstract submission is 11 January, 2018** (http://www.confercare.manchester.ac.uk/events/ist2018/.) It promises to be a very exciting conference, and hope to see many of you there.

The publications section again includes a long list of interesting papers in a wide range of journals. Additionally, it includes several PhD theses, books and four special issues on 'Policy mixes for energy transitions' (*Energy Research & Social Science*), 'Sustainability transition in developing countries' (*Environmental Science and Policy*), Experimentation for climate change solutions' (*Journal of Cleaner Production*) and 'Energy transitions' (*Nature*).

Kathy Araujo (kathleen.araujo@stonybrook.edu) has started a new book series at Routledge, called 'Routledge Studies in Energy Transitions', which focuses on the following key areas: sustainability, low-carbon development, renewables, innovation, governance, access, security, socio-technical systems. So, if you're thinking of writing/publishing a book on these topics, you can contact Kathy of follow the link to the book series: https://www.routledge.com/Routledge-Studies-in-Energy-Transitions/book-series/RSENT.

The newsletter also contains information about volume 25 in EIST, several Event announcements, Event Reviews and New research projects. So, there are lots of STRN-related activities and outputs, which may inspire you over the coming months. I hope you will enjoy this newsletter and have a good festive period.

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

Environmental Innovation and Societal Transitions

Volume 25 of *Environmental Innovation and Societal Transitions* has just been published. It contains ten articles reporting original research:

- Moral entrepreneurship: Thinking and acting at the landscape level to foster sustainability transitions by Nino Antadze and Katharine A. McGowan.
- Perspectives on Norway's supercharged electric vehicle policy by Erik Figenbaum.
- An assessment of the potential for spurring transformational change through Nationally Appropriate Mitigation Actions (NAMAs) by Mathias Fridahl and Linda Johansson.
- Analyzing sectoral niche formation: The case of net-zero energy buildings in India by Mansi Jain, Thomas Hoppe and Hans Bressers.
- Dynamic capabilities for water system transitions in Oklahoma by Preston Hartman, Travis Gliedt, Jeffrey Widener and Rebecca W. Loraamm.
- Exploring window of opportunity dynamics in infrastructure transformation by Stefan Tongur and Mats Engwall.
- Analysing the role of consumers within technological innovation systems: The case of alternative food networks by Filippo Randelli and Benedetto Rocchi.
- Designing the public sector to promote sustainability transitions: Institutional principles and a case study of ARPA-E by Brendan Haley.
- Towards a conceptualization of power in energy transitions by Helene Ahlborg.
- Lessons from a century of innovating car recycling value chains by Magnus Andersson, Maria Ljunggren Söderman and Björn A. Sandén.

As always, we look forward to receive your submissions and comments. Please 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

Update on the RSA (Regional Studies Association(Research) Network on Sustainability Transitions in the Coastal Zone

We would like to inform you that the Research Network on Sustainability Transitions in the Coastal Zone, co-organized by Dr. C. Patrick Heidkamp, Dr. John Morrissey and Dr. Catherine Chambers and supported by the Regional Studies association has published subsequent special issues in Regions—the quarterly magazine of the Regional Studies Association. The issues, Regions 307: Costal Sustainability: Challenges, Methods and Opportunities and Regions 308 Frontiers for Transition in Coastal Regions comprise a total of 12 short papers engaging with sustainability transitions in the context of the coastal zone. A common thread in all of the papers is the fact that transition dynamics need to be considered within their local and regional contexts and thus require local stakeholder engagement in coastal development scenarios and related policy formation processes. Please see the following link for Regions Magazine: http://rsa.tandfonline.com/toc/resn20/current For more information on the Research Network on Sustainability Transition in the Coastal Zone, please see: http://www.regionalstudies.org/networks/network/sustainability-transitions-in-the-coastal-zone. For additional information or questions on how to be included in the research network please contact: **Patrick Heidkamp** (heidkampc1@southernct.edu).

Event announcements

Calls for upcoming relevant events such as workshops and conferences

9th International Sustainability Transitions conference in Manchester, 11-14 June, 2018

The Sustainable Consumption Institute (SCI) and Manchester Institute of Innovation Research (MIOIR) will host the 9th International Sustainability Transitions Conference at the

University of Manchester. The conference will provide a fantastic opportunity for transition scholars and stakeholders to exchange ideas, learn about frontier research, engage in high-quality debates, socialize and generally have a very good time. The conference theme is 'Reconfiguring Consumption and Production Systems', but participants can also submit papers to ten other transition-related topics.

We chose the conference theme to re-engage with founding assumptions of sustainability transitions scholarship, which highlighted the importance of studying *systemic change across the entire chain from production to consumption*. Research over the last decade has arguably focused more on the emergence of radical innovations than on changes in 'whole systems'. IST-2018 therefore aims to re-engage with this initial agenda. This is timely, because some real-world transitions are moving beyond the diffusion of *single* innovations towards whole system change. In both electricity and mobility, for instance, the simultaneous unfolding of *multiple* technical, social and organisational innovations (e.g. renewable energy technologies, capacity markets, smart meters, decentralized community energy, 'prosumption', grid adjustments, electric cars, car sharing, cycling revolution) are interacting to change entire systems across areas of production, provision, distribution, and use. These observations suggest that transitions scholarship may be on the verge of a new phase, with new conceptual and empirical questions. The conference website provides further information about this theme and about submission procedures: http://www.confercare.manchester.ac.uk/events/ist2018/.

We now invite you to submit abstracts for papers, speed talks, posters, or dialogue sessions. The deadline for abstract submission is 11 January, 2018. This is going to be a fantastic conference with lots of fun and intellectual excitement, so we hope to see many of you in Manchester next year. **Andy McMeekin, Frank Geels, Josephine Mylan, Mike Hodson.**

Call for papers: 'Planning for transformation' (track in the frame of the 24th International Sustainable Development Research Society Conference)
The overall objective of this track is to critically review and discuss recent innovations in planning approaches, strategies and instruments regarding their potential and limits to prepare, to initiate and to sustain transformative urban change. Here you can find the complete call for papers. You may submit your abstract by visiting the Ex Ordo abstract submission system (you will be required to setup an account first): http://isdrs2018.exordo.com Deadline for abstracts: **20 December 2017.** More information: Markus Egermann (m.egermann@ioer.de)

Call for papers: 'Leading sustainability transitions', in *Sustainability*.
We invite contributions to a special issue of *Sustainability* on 'Leading Sustainability Transitions'. Both conceptual and empirical contributions are welcomed that push the frontiers of our understanding of agency in guiding and accelerating sustainability transitions. What is the role of individuals and organisations? Can we actually speak of leadership in the context of uncertain and unpredictable transitions? Can institutions and incremental policies facilitate disruptive systemic changes? For more info see: http://www.mdpi.com/journal/sustainability/special_issues/leading_sustainability_transitions

Event Reviews

Review of events interesting to the STRN community

Socio-technical transitions – a system innovation approach for practitioners. Climate-KIC workshop on energy transitions
On 5th of December Climate KIC Transitions Hub team was in Valleta, Malta, in a one-day workshop which sought to explore elements of system innovation in the context of energy transition by facilitating a system perspective through practical insights of transition

management. The workshop focused on the structural aspects of the regional context such as stakeholder network, industrial history and knowledge assets. Participants were introduced into new practices based on visual tools from Visual toolbox for System Innovation [1], designed to complement project management processes and highlight pathways for delivering change in organisations through transition management [2]. Key issues were discussed and mapped during the workshop - the importance of reducing energy consumption to lower emissions, the lack of enforcement of existing policies or the potential role of the university in policy making. Overall, the cultural aspect seemed to be the predominant challenge in Malta. The materialization of the learning process into practice-based knowledge was facilitated by the visual tools as co-created "concept maps" where concepts or elements about the energy transition topic were discussed and written down and connections were drawn between them. The codified knowledge will be shared and discussed with participants as a follow up activity to evaluate next steps in the roadmap for the Energy Transitions in Malta. Climate-KIC Team: Cristian Matti, Gianluca Avella, Eusebiu Stamate and Gian Marco Morigi. Contact: transitions.hub@climate-kic.org
[1] De Vicente Lopez, Javier and Matti, Cristian (2016). Visual toolbox for system innovation. A resource book for practitioners to map, analyse and facilitate sustainability transitions. Transitions Hub Series. Climate-KIC, Brussels 2016.
[2] https://learning.climate-kic.org/resources/transitions-hub

Update on Transformative Innovation Policy Consortium (TIPC)
Following the culmination of the pilot year at the conference 'Prospects for Transformative Innovation Policy', partners involved in the project have put their commitment to a 5 year programme. This has four key elements – research; experimentation; training and capacity building; and evaluation. Research agencies from Norway, Finland, Sweden, Colombia and South Africa will work with researchers from the Science Policy Research Unit (SPRU) at the University of Sussex. The Deep Transitions research programme, also being led by Professor Schot, will feed into the TIPC programme. Currently, the National Council of Science and Technology of Mexico (CONACYT) and CASTED, the Chinese Academy of Science and Technology for Development are embarking on exploratory years with a view to becoming permanent members. Documents that may be of interested are listed below.
TIPC Research Briefs

- The Role of Experimentation in Transformative Innovation Policy (Torrens, Schot, TIPC, 2017-02)

http://www.transformative-innovation-policy.net/publications/roles-of-experimentation-in-transformative-innovation-policy/

- Developing a Shared Understanding of Transformative Innovation Policy (Schot, Daniels, Torrens, Bloomfield, TIPC, 2017-01)

http://www.transformative-innovation-policy.net/publications/developing-a-shared-understanding/
The TIP Conference report can be viewed online - http://www.transformative-innovation-policy.net/TIPC_conference_Report.pdf
Working Position Paper
Framing innovation Policy for Transformative Change (Schot, Steinmueller 2016)
http://www.johanschot.com/publications/framing-innovation-policy/
Johan Schot (j.w.schot@sussex.ac.uk)

New research projects

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

Exploring the role of energy flexibility in transitions to low carbon futures in the UK electricity industry
Transitions to low carbon energy futures is the subject of a growing body of literature that emphasizes socio-technical change, i.e. changes in both technologies and social arrangements such as institutions and practices. Pathways to local carbon futures are

uncertain but are likely to include a mix of measures such as renewable energy technologies, carbon capture and sequestration. Often overlooked, integration of such measures in existing energy systems will require new forms of flexibility as the generation mix shifts from fossil fuels to intermittent renewable and nuclear energy resources. Sources of energy flexibility result to a large extent from the rapid start up times of modern open cycle and combined cycle gas turbines, but as the generation mix changes, interconnectors, demand side responses and energy storage solutions, such as batteries, will become more important. The government and Ofgem have started to explore the policy and regulatory issues in response to these challenges in their recent report, 'Upgrading our Energy Systems – Smart systems and flexibility plan', July 2017. However, there is not an obvious package of measures to promote energy flexibility and the implications of such measures for incumbent actors and new entrants is unclear. Thus, sponsored by The Open University and CGI, this research project explores energy flexibility in transition pathways to lower carbon futures in the UK electricity sector. Focusing on the power of discourses shaping this process, among other things it will identify and analyse emerging business model innovations. For more information please contact Matthew Cook matthew.cook@open.ac.uk.

Russian megacities in the context of new social and environmental challenges: building complex interdisciplinary model of an assessment of 'green' cities and strategies for their development in Russia

The study provides holistic insights on the post-soviet Russia's structural socio-environmental transformations in the technological, institutional, political domains and actors' everyday life. The research adopts a multi-level perspective on change including examining the interactions of different level of transitions. As a part of the project, we are planning to analyze sustainability transitions in energy efficiency and energy saving in the Russian cities, waste management, sustainable transport, application of 'green' standards in construction, public health, ecological activism, environmental consumption of the population, water resources management, management of rural and forestry, etc. The results of the project will be in the development of an integrated interdisciplinary model for assessing the degree of transition of Russian megacities (based on Moscow and Kazan examples) to the standards of a 'green' city. The complexity of the model will be achieved by comparing the opinions of different groups of citizens with objective indicators of social and environmental domains of the territory and experts' assessment. The cross-national research team (Dr. Polina Ermolaeva, Kazan Federal University; Prof. Oleg Yanitsky, Institute of Sociology, Moscow; Dr. Irina Kuznetsova, University of Birmingham and other colleagues) has adopted an interdisciplinary research approach integrating urban studies with environmental, social, political and economic sciences. The project was supported by Russian Science Foundation; project No. 17-78-2010. For more information please contact **Polina Ermolaeva**, polina.ermolaeva@gmail.com

Transition towards urban sustainability through socially integrative cities in the EU and in China (TRANS-URBAN-EU-CHINA, H2020, Jan 2018 – Dec 2020)

The project addresses a key challenge of Chinese urbanisation: how to best design and turn cities into intelligent, socially integrative and sustainable environments. The key objective of TRANS-URBAN-EU-CHINA is to help policy makers, urban authorities, real estate developers, public service providers and citizens in China to create socially integrative cities in an environmentally friendly and financially viable way. The project focuses on: (a) community building and place-making in neighbourhoods; (b) bridging the planning-implementation gap in eco and smart cities; (c) land use planning and land management in new urban expansion and urban renewal areas; and (d) transition pathways to sustainable urban planning and governance. The project will create new insights, practices and role models in sustainable urban transitions in China. It will (a) develop a systematic knowledge base on transition experiences in Europe and China; (b) advance tools and measures to support transition, and test them in 2 Living Labs in Chinese cities; and (c) elaborate related

recommendations, discuss them with representatives of 60 Reference Cities and a wider stakeholder community, and disseminate them through a variety of channels.
More information: **Markus Egermann** (m.egermann@ioer.de)

Publications

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

PhD thesis: Zhen Yu, 2017, *Sustainability transitions and leapfrogging in latecomer cities: A case of the diffusion of solar thermal energy in China*. University of Hull
Inspired by the multi-level perspective, economic geography, and leapfrogging research, the thesis proposes to understand urban sustainability transitions as consequences of power struggles between niche development and regime resistance, and latecomer cities may have a higher potential for sustainability transitions. These ideas are explored through a qualitative investigation of the diffusion of solar thermal energy in a latecomer city, Dezhou, in contrast to a more developed counterpart, Beijing. Though the global and national landscape of green development has exerted unprecedented pressures on lower governance scales, it is interpreted and responded to differently at the local level. Dezhou's transition to solar thermal energy is an interactive consequence of weak regime resistance and strong niche development with a positive feedback loop among a powerful lead industry, supportive government, networked users, and motivated estate developers. These interactions are conditioned by place-specific contexts, as well as multi-scalar interactions, through which knowledge learning, interest coordination, and empowering are realised by key local niche champions. Latecomer cities demonstrate several advantages over developed cities in transition to decentralized energy systems, as they are generally less locked-in by incumbent unsustainable regimes, and green niche actors within them could be more powerful in directing transitions if they are able to meet economic interests at the local level and environmental benefits at the higher scales. Local scalar-transcending actors are of pivotal significance for latecomer cities to pursue green transitions because they are the key mechanism whereby external knowledge, resources, and legitimacy are brought in to sustain local transitions. The thesis thus not only contributes to an in-depth understanding about why and how sustainability transitions take place in certain places, but also reveals the general potential of latecomer cities in sustainability transitions.

PhD thesis: Koirala, B.P., 2017. *Integrated Community Energy Systems*. Delft University of Technology, Comillas Pontifical University and KTH Royal Institute of Technology.
Energy systems across the globe are going through a radical transformation as a result of technological and institutional changes, depletion of fossil fuel resources, and climate change issues. Accordingly, local energy initiatives are emerging and increasing number of the business models are focusing on the end-users. In this context, Integrated community energy systems (ICESs) are emerging as a modern development to reorganize local energy systems allowing simultaneous integration of distributed energy resources (DERs) and engagement of local communities. With the emergence of ICESs new roles and responsibilities as well as interactions and dynamics are expected in the energy system. With this background, this thesis aims to understand the ways in which ICESs can contribute to enhancing the energy transition. This thesis utilizes a conceptual framework consisting of four institutional and three societal levels in order to understand the interaction and dynamics of ICESs implementation. Current energy trends and the associated technological, socio-economic, environmental and institutional issues are reviewed. The developed ICES model performs optimal planning and operation of ICESs and assesses their performance based on economic and environmental metrics. This thesis demonstrates the added value of ICESs to the individual households, local communities, and the society. As the added value of ICESs is impacted by the institutional settings internal and external to the system, a comprehensive institutional design considering techno-economic and

institutional perspectives is necessary to ensure effective contribution of ICESs in the energy transition.

PhD thesis: Johansson, P., 2017. *A Silent Revolution: The Swedish Transition towards Heat Pumps, 1970-2015*. Department of Industrial Economics and Management, KTH, Sweden; http://urn.kb.se/resolve?urn=urn:nbn:se:kth:diva-216425

Currently, more than half of all Swedish single-family houses have an installed heat pump and more heat is supplied by heat pumps in Sweden than in any other nation. Despite the enormous impact of heat pumps on the Swedish energy system, the transition towards their use has gone relatively unnoticed. This thesis provides an in-depth study of the Swedish transition towards heat pumps and how Swedish industries contributed to it. It approaches the topic from the perspective of value networks and 'coopetition', combined with the concept of complementarities. Based on this approach, the thesis explains how a durable web of relations and interdependencies between complementarities has developed within the heat pump sector and the energy system in Sweden, and between the two, during the country's transition to widespread use of heat pumps. This thesis shows how the Swedish heat pump industry has co-evolved with the market and how developments in the industry contributed towards causing the transition to heat pumps to occur so early in Sweden relative to other European markets. It also shows that coopetition dynamics in a socio-technical transition change with the emergence and characteristics of structural tensions between complementarities, which has implications for the strategic management of external relations and partnerships during socio-technical transitions. It further argues that the combination of the value network, coopetition, and complementarity concepts can be conceptualised for descriptive and exploratory studies on the role of firms and industries in socio-technical transitions, thereby offering a complement to existing dominant frameworks in the area of transition studies.

Book: Delina, L.L., 2018, *Accelerating Sustainable Energy Transition(s) in Developing Countries: The Challenges of Climate Change and Sustainable Development,* Routledge-Earthscan.

Accelerating sustainable energy transitions away from carbon-based fuel sources needs to be high on the agendas of developing countries. It is key in achieving their climate mitigation promises and sustainable energy development objectives. To bring about rapid transitions, simultaneous turns are imperative in hardware deployment, policy improvements, financing innovation, and institutional strengthening. These systematic turns, however, incur tensions when considering the multiple options available and the disruptions of entrenched power across pockets of transition innovations. These heterogeneous contradictions and their trade-offs, and uncertainties and risks have to be systematically recognized, understood, and weighed when making decisions. This book explores how the transitions occur in fourteen developing countries and broadly surveys their technological, policy, financing, and institutional capacities in response to the three key aspects of energy transitions: achieving universal energy access, harvesting energy efficiency, and deploying renewable energy. The book shows how fragmented these approaches are, how they occur across multiple levels of governance, and how policy, financing, and institutional turns could occur in these complex settings.

Book: Moore, T., de Haan, F., Horne, R., and Gleeson, B.J., (eds.), 2017, *Urban Sustainability Transitions: Australian Cases- International Perspectives*, Springer

This book contributes to current debates regarding purposive transitions to sustainable cities, providing an accessible but critical exploration of sustainability transitions in urban settings. The chapters in this volume contribute to the growing body of literature on city-scale transformative change, which seeks to address a lack of consideration for spatial and urban governance dimensions in sustainability transitions studies. Drawing on a range of perspectives and written by leading Australian and international urban researchers, the chapters explore contemporary cases from Australia and locate them within the international

context. This volume presents an extensive overview of theories, concepts, approaches and practical examples informed by sustainability transitions thinking, offering a unique resource for all urban practitioners and scholars who want to understand and transition to sustainable urban futures.

<u>Special issue</u>: 'Policy mixes for energy transitions', *Energy Research & Social Science*, 2017, Volume 33.

Rogge, K.S, Kern, F., and Howlett, M., 2017, Conceptual and empirical advances in analysing policy mixes for energy transitions, *Energy Research & Social Science*, 33, 1-10

Jacobsson, S., Bergek, A., and Sandén, B., 2017, Improving the EU Commission's analytical base for designing instrument mixes in the energy sector: Market failures versus system weaknesses, *Energy Research & Social Science*, 33, 11-20

Grubb, M., McDowall, W., and Drummond, P., 2017, On order and complexity in innovations systems: Conceptual frameworks for policy mixes in sustainability transitions, *Energy Research & Social Science*, 33, 21-34

Burke, M.J. and Stephens, J.C., 2017, Energy democracy: Goals and policy instruments for sociotechnical transition, *Energy Research & Social Science*, 33, 35-48

Del Río, P. and Cerdá, E., 2017, The missing link: The influence of instruments and design features on the interactions between climate and renewable electricity policies, *Energy Research & Social Science*, 33, 49-58

Duan, M., Tian, Z., Zhao, Y., and Li, M., 2017, Interactions and coordination between carbon emissions trading and other direct carbon mitigation policies in China, *Energy Research & Social Science*, 33, 59-69

Imbert, E., Ladu, L., Morone, P. and Quitzow, R., 2017, Comparing policy strategies for a transition to a bioeconomy in Europe: The case of Italy and Germany, *Energy Research & Social Science*, 33, 70-81

Purkus, A., Gawel, E., and Thrän, D., 2017, Addressing uncertainty in decarbonisation policy mixes - Lessons learned from German and European bioenergy policy, *Energy Research & Social Science*, 33, 82-94

Rosenow, J., Kern, F. and Rogge, K.S., 2017, The need for comprehensive and well targeted instrument mixes to stimulate energy transitions: The case of energy efficiency policy, *Energy Research & Social Science*, 33, 95-104

Falcone, P.M., Lopolito, A., and Sica, E., 2017, Policy mixes towards sustainability transition in the Italian biofuel sector: Dealing with alternative crisis scenarios, *Energy Research & Social Science*, 33, 105-114

Kivimaa, P., Kangas, H-L., Lazarevic, D., 2017, Client-oriented evaluation of 'creative destruction' in policy mixes: Finnish policies on building energy efficiency transition, *Energy Research & Social Science*, 33, 115-127

Rogge, K.S. and Johnstone, P., 2017, Exploring the role of phase-out policies for low-carbon energy transitions: The case of the German Energiewende, *Energy Research & Social Science*, 33, 128-137

David, M., 2017, Moving beyond the heuristic of creative destruction: Targeting exnovation with policy mixes for energy transitions, *Energy Research & Social Science*, 33, 138-146

Johnstone, P., Stirling, A., and Sovacool, B.K., 2017, Policy mixes for incumbency: The destructive recreation of renewable energy, shale gas 'fracking,' and nuclear power in the United Kingdom, *Energy Research & Social Science*, 33, 147-162

Bahn-Walkowiak, B. and Wilts, H., 2017, The institutional dimension of resource efficiency in a multi-level governance system - Implications for policy mix design, *Energy Research & Social Science*, 33, 163-172

Jørgensen, M.S., Jørgensen, U. and Jensen, J.S., 2017, Navigations and governance in the Danish energy transition reflecting changing Arenas of Development, controversies and policy mixes, *Energy Research & Social Science*, 33, 173-185

<u>Special issue</u> on 'Sustainability transition in developing countries', *Environmental Science and Policy*, 2018, in press

Hansen, U., Nygaard, I., Romijn, H., Wieczorek, Kamp, L., Klerkx, L., 2018. Sustainability transitions in developing countries: Stocktaking, new contributions and a research. *Environmental Science and Policy*, in press

Wieczorek, A., 2018. Sustainability transitions in developing countries: major insights and their implications for research and policy. *Environmental Science and Policy*, in press

Ramos-Mejía, M., Franco-Garcia, M., Jauregui-Becker, J., 2018. Sustainability transitions in the developing world: challenges of sociotechnical transformations unfolding in contexts of poverty. *Environmental Science and Policy*, in press

Nygaard, I., Bolwig, S., 2018. The rise and fall of foreign private investment in the jatropha biofuel value chain in Ghana. *Environmental Science and Policy*, in press

Sixt, G., Klerkx, L., Griffin, T., 2018. Transitions in water harvesting practices in Jordan's rainfed agricultural systems: systemic problems and blocking mechanisms in an emerging technological innovation system. *Environmental Science and Policy*, in press

van Welie, M., Romijn, H., 2018. NGOs fostering transitions towards sustainable urban sanitation in low-income countries: insights from transition management and development studies. *Environmental Science and Policy*, in press

<u>Special issue</u> on 'Experimentation for climate change solutions', *Journal of Cleaner Production*, volume 169, 2017

Mikael Hildén, Andrew Jordan, Dave Huitema, 2017, Special issue on experimentation for climate change solutions editorial: The search for climate change and sustainability solutions - The promise and the pitfalls of experimentation, *Journal of Cleaner Production*, 169, 1-7

Senja Laakso, Annukka Berg, Mikko Annala, 2017, Dynamics of experimental governance: A meta-study of functions and uses of climate governance experiments, *Journal of Cleaner Production*, 169, 8-16

Paula Kivimaa, Mikael Hildén, Dave Huitema, Andrew Jordan, Jens Newig, 2017, Experiments in climate governance – A systematic review of research on energy and built environment transitions, *Journal of Cleaner Production*, 169, 17-29

Sabine Weiland, Alena Bleicher, Christine Polzin, Felix Rauschmayer, Julian Rode, 2017, The nature of experiments for sustainability transformations: A search for common ground, *Journal of Cleaner Production*, 169, 30-38

Guido Caniglia, Niko Schäpke, Daniel J. Lang, David J. Abson, Christopher Luederitz, Arnim Wiek, Manfred D. Laubichler, Fabienne Gralla, Henrik von Wehrden, 2017, Experiments and evidence in sustainability science: A typology, *Journal of Cleaner Production*, 169, 39-47

Michiel A. Heldeweg, 2017, Legal regimes for experimenting with cleaner production – Especially in sustainable energy, *Journal of Cleaner Production*, 169, 48-60

Christopher Luederitz, Niko Schäpke, Arnim Wiek, Daniel J. Lang, Matthias Bergmann, Joannette J. Bos, Sarah Burch, Anna Davies, James Evans, Ariane König, Megan A. Farrelly, Nigel Forrest, Niki Frantzeskaki, Robert B. Gibson, Braden Kay, Derk Loorbach, Kes McCormick, Oliver Parodi, Felix Rauschmayer, Uwe Schneidewind, Michael Stauffacher, *et al., 2017,* Learning through evaluation – A tentative evaluative scheme for sustainability transition experiments, *Journal of Cleaner Production*, 169, 61-76

Mikko Jalas, Sampsa Hyysalo, Eva Heiskanen, Raimo Lovio, Ari Nissinen, Maija Mattinen, Jenny Rinkinen, Jouni K. Juntunen, Pasi Tainio, Heli, 2017, NissiläEveryday experimentation in energy transition: A practice-theoretical view, *Journal of Cleaner Production*, 169, 77-84

Kaisa Matschoss, Eva Heiskanen, 2017, Making it experimental in several ways: The work of intermediaries in raising the ambition level in local climate initiatives, *Journal of Cleaner Production*, 169, 85-93

Thomas Hickmann, 2017, Voluntary global business initiatives and the international climate negotiations: A case study of the Greenhouse Gas Protocol, *Journal of Cleaner Production*, 169, 94-104

Katharina Gugerell, Christian Zuidema, 2017, Gaming for the energy transition. Experimenting and learning in co-designing a serious game prototype, *Journal of Cleaner Production*, 169,, 105-116

Jasminka Young, Marleen Brans, 2017, Analysis of factors affecting a shift in a local energy system towards 100% renewable energy community *Journal of Cleaner Production*, 169, 117-124

Jan Beermann, Kerstin Tews, 2017, Decentralised laboratories in the German energy transition. Why local renewable energy initiatives must reinvent themselves, *Journal of Cleaner Production*, 169, 125-134

Senja Laakso, 2017, Giving up cars – The impact of a mobility experiment on carbon emissions and everyday routines, *Journal of Cleaner Production*, 169, 135-142

Paavo Järvensivu, 2017, A post-fossil fuel transition experiment: Exploring cultural dimensions from a practice-theoretical perspective, *Journal of Cleaner Production*, 169, 143-151

Halvor Schøyen, Kenn Steger-Jensen, 2017, Nuclear propulsion in ocean merchant shipping: The role of historical , experiments to gain insight into possible future applications, *Journal of Cleaner Production*, 169, 152-160

Edoardo Croci, Benedetta Lucchitta, Greet Janssens-Maenhout, Simone Martelli, Tania Molteni, 2017, Urban CO_2 mitigation strategies under the Covenant of Mayors: An assessment of 124 European cities, *Journal of Cleaner Production*, 169, 161-177

Jingjing Jiang, Bin Ye, Dejun Xie, Jie Tang, 2017, Provincial-level carbon emission drivers and emission reduction strategies in China: Combining multi-layer LMDI decomposition with hierarchical clustering, *Journal of Cleaner Production*, 169, 178-190

Joanna Williams, 2017, Lost in translation: Translating low carbon experiments into new spatial contexts viewed through the mobile-transitions lens, *Journal of Cleaner Production*, 169, 191-203

Harm A.R.M. van den Heiligenberg, Gaston J. Heimeriks, Marko P. Hekkert, Frank G. van Oort, 2017, A habitat for sustainability experiments: Success factors for innovations in their local and regional contexts, *Journal of Cleaner Production*, 169, 204-215

Riina Antikainen, Katriina Alhola, Tiina Jääskeläinen, 2017, Experiments as a means towards sustainable societies – Lessons learnt and future outlooks from a Finnish perspective, *Journal of Cleaner Production*, 169, 216-224

Jitske van Popering-Verkerk, Arwin van Buuren, 2017, Developing collaborative capacity in pilot projects: Lessons from three Dutch flood risk management experiments, *Journal of Cleaner Production*, 169, 225-233

<u>Special Outlook</u> on 'Energy transitions', *Nature*, Vol. 551, Issue 7682, 2017

Grayson, M., 2017, Energy transitions, *Nature*, 551(7682), S133

Pain, S., 2017, Power through the ages, *Nature*, 551(7682), S134-137

Morris, C. and Jungjohann, A., 2017, Energize the people to effect policy change, *Nature*, 551(7682), S138-140

Fouquet, R., 2017, Make low-carbon energy an integral part of the knowledge economy, *Nature*, 551 (7682), S141

Eisenstein, M., 2017, How social scientists can help to shape climate policy, *Nature*, 551(7682), S142-144

Gies, E., 2017, The real cost of energy, *Nature*, 551(7682), S145-147

Laursen, L., 2017, The next step on the energy ladder, *Nature*, 551(7682), S148-149

Fairley, P., 2017, The complex web behind the siting of power plants, *Nature*, 551(7682), S150-152

Kelsey, N. and Meckling, J., 2018, Who wins in renewable energy? Evidence from Europe and the United States, *Energy Research & Social Science*, 37, 65-73
The emerging transition to renewable energy, such as wind and solar photovoltaics, creates winners and losers in electricity markets. The political battle unfolds largely between incumbent electric utilities on the one hand and challenger firms such as independent power producers on the other. Here, we provide the first cross-national study of renewable energy ownership, based on an original dataset of fifty-nine jurisdictions in Europe and the United States. We find that independent power producers operating utility-scale generation dominate renewable energy capacity across electricity markets. Incumbent utilities and small producers of distributed generation hold substantially less capacity. Counter to expectations, this global trend is largely independent from two basic policy choices: the choice of support policy—feed-in tariffs versus renewable portfolio standards—and the choice of electricity market policy—liberalization versus regulation of power markets—only explain marginal effects on distributional outcomes. Rather, the resource potential of jurisdictions, relative technology prices, and the market effects of technological disruption likely account for the rise of medium-sized and large independent power producers as the dominant players in the transition to renewable energy. The transition to sustainable energy thus follows a substitution path, in which challenger firms prevail over incumbent utilities in renewable energy.

Reichenbach, M. and Puhe, M., 2017, Flying high in urban ropeways? A socio-technical analysis of drivers and obstacles for urban ropeway systems in Germany, *Transportation Research Part D: Transport and Environment,* in press
Urban ropeways are a novel option in public transport, using established technology known from the mountains to deliver public transport in urban areas. Generally seen as environmentally friendly with a small ecological footprint, the potential of urban ropeways has not yet been demonstrated in Germany. Applying the ‘multi-level perspective’ established in transition research, we analyse challenges in the diffusion process. Results are based on 14 interviews with transport planning experts, ropeway manufacturers and actors from cities with urban ropeway projects. The following major obstacles are identified: (1) restricted route layout and interferences with urban landscapes inherently narrowing the niche for urban ropeways, (2) frequent lack of a clear concept of how the urban ropeway will connect with the existing public transport system, (3) established actor constellations and planning routines in the public transport regime blocking off the take-up of urban ropeways, and (4) increasing public opposition against infrastructure investment projects in general. At the same time, a number of drivers stimulate the diffusion process: (1) flagship projects and events can showcase urban ropeways, (2) the public transport regime generally experiences a pressure to become more innovative, leading to (3) regime actors themselves discovering urban ropeways as an interesting option, and (4) a stimulating effect is expected from the first urban ropeways to be actually implemented in Germany. Overall, the diffusion process is still at an early stage, but our results illustrate a wide-spread expectation that urban ropeways will become part of the German public transport repertoire in the future.

Moradi, A. and Vagoni, E., 2018, A multi-level perspective analysis of urban mobility system dynamics: What are the future transition pathways?, *Technological Forecasting and Social Change*, 126, 231-243
Transport sector is one of the main contributors to air pollution, greenhouse gases and CO_2 emissions, specifically in urban areas, and is the only sector that has not yet achieved sustainability objectives. Increasing concerns about emissions from the transport sector highlight the need for urgent actions for change to more sustainable systems that consider the needs of all social groups, be more affordable and less polluted. Transition studies focus on actions and plans used to change the current system to more sustainable ones, a radical shift in incremental steps. Multi-level perspective considers the transition as a nonlinear process of change resulted from the interactions of social and technological factors at different levels. While most studies focused on historical transition reviews or future

pathways and scenarios, this paper is a study of current system as the change process is performed. The paper aimed at identifying the main mobility regimes and dynamics of low carbon mobility transitions to see what are the current pathways and most probable pathways in the scope of 2030 targets. A comprehensive review of related literature combined with stakeholder interviews in a qualitative data analysis process to see what the driving and restraining forces of transition process are and which innovations has the greater potential to get aligned in future mobility regimes. The paper contributed to transition studies through combining multi stakeholder and MLP approach for detailed investigation of passenger urban mobility transition dynamics. The results can also help urban mobility planners to know the factors that can help or challenge them in planning for more sustainable transport systems.

Berkeley, N., Bailey, D., Jones, A. and Jarvis, D., 2018, Assessing the transition towards Battery Electric Vehicles: A Multi-Level Perspective on drivers of, and barriers to, take up, *Transportation Research Part A: Policy and Practice*, 106, 320–332

The Multi-Level Perspective (MLP) framework on transitions is used to interpret European electric vehicle take up and auto mobility transition. It finds that environmental and energy security pressures have created a favourable landscape 'push' for Battery Electric Vehicles (BEVs) that in turn has encouraged and facilitated serious commitment from some manufacturers. Yet BEVs, as a niche product seeking to disrupt an entrenched and established regime, face significant multi-level forces acting as barriers against such a transition, which the paper explores. This combination of factors creates a situation where BEV market penetration remains far below the level required for mass market transition. For BEVs to 'cross the chasm' and gain an established foothold in the market and hence significantly disrupt the regime, more holistic and effective solutions are required. It is argued that, so far, this has yet to be fully taken on board by policy makers.

Geels, F.W., Sovacool, B.K., Schwanen, T., Sorrell, S., 2017, The socio-technical dynamics of low-carbon transitions, *Joule*, 1(3), 463-479.

Effective mitigation of climate change will require far-reaching transformations of electricity, heat, agricultural, transport and other systems. The energy studies and modelling research that so often dominates academic and policy debates provide valuable insights into these transitions, but remain constrained by their focus on rational decision-making and their neglect of non-linear dynamics and broader social processes. This review paper describes insights from a complementary socio-technical approach that addresses the interdependent social, political, cultural, and technical processes of transitions. Focusing on the 'Multi-Level Perspective' (MLP), the paper conceptualizes transitions as arising from the alignment of processes within and between three analytical levels: niche-innovations, socio-technical regimes and the socio-technical landscape. This analytical framework is illustrated with a case study of the German electricity transition and used to appraise low-carbon transitions in several other sectors. We end by articulating four lessons for managing low-carbon transitions.

Lin, X., Wells, P. and Sovacool, B.K., 2017, Benign mobility? Electric bicycles, sustainable transport consumption behaviour and socio-technical transitions in Nanjing, China, *Transportation Research Part A*, in press

In this paper, we ask whether electric bicycle (e-bike) use in urban China is a temporary phase or an embedded form of sustainable mobility. A survey was conducted in Nanjing in order to assess the characteristics and attitudes of electric bicycle users and other mode users (e.g. pedestrians; car drivers). Based on over 1000 responses a Logit Model was used to analyse current and future mode choice. The results show that electric bicycles are not necessarily displacing cars on a substantial scale, but are rather displacing the 'benign' modes of walking, traditional bicycling, and using the bus. We conclude that electric bicycles

are helping to enable mobility-dependent lifestyles that may in the future be supported by cars, rather than offering a true departure from carbon-centred, motorized forms of transport.

Timma, L., Blumberga, A., Bazbauers, G., and Blumberga, D., 2017, Novel tools to study socio-technical transitions in energy systems, *Energy Procedia*, 128, 418–422
As the response to the financial downturn and arising social problems, eco-innovation flagship was elaborated as one of the main building blocks for sustainable, smart and inclusive growth. Nevertheless, the experts are increasing pointing out, that we are missing one important link, while focusing mainly on technical innovations and natural environment, social aspect is mostly disregarded. This social aspect includes human, economic, policy, organisational and other interactions in the system. By bringing together these three sectors – social, technical and natural environment – studies on so called socio-technical system is created. Currently, the studies using social and technical aspects for the research on transition processes are fragmented, both in terms of studied sectors, used methods and scientific fields. Especially, in the field of energy research the majority of the works study techno-economic aspects of the systems, while only few attempts have been made to incorporate socio-technical perspective as well. There are also identified clear lack of a holistic methodology, therefore the aim of this paper is to attempt to link engineering and social science study field to create such modelling approach. Socio-technical transitions are viewed from the perspective of various sectors, such as energy use, energy production and management, innovation diffusion and other. Also the transitions are looked from the scientific lenses of various possible methods and combinations of those. And last but not least, theses transitions studies are considered from the perspective of various scientific fields, both engineering and social science.

Cherp, A, Vinichenko, V., Jewell, J., Brutschin, E., and Sovacool, B.K., 2018, Integrating techno-economic, socio-technical and political perspectives on national energy transitions: A meta-theoretical framework, *Energy Research & Social Science*, 37, 175-190
Economic development, technological innovation, and policy change are especially prominent factors shaping energy transitions. Therefore explaining energy transitions requires combining insights from disciplines investigating these factors. The existing literature is not consistent in identifying these disciplines nor proposing how they can be combined. We conceptualize national energy transitions as a co-evolution of three types of systems: energy flows and markets, energy technologies, and energy-related policies. The focus on the three types of systems gives rise to three perspectives on national energy transitions: techno-economic with its roots in energy systems analysis and various domains of economics; socio-technical with its roots in sociology of technology, STS, and evolutionary economics; and political with its roots in political science. We use the three perspectives as an organizing principle to propose a meta-theoretical framework for analyzing national energy transitions. Following Elinor Ostrom's approach, the proposed framework explains national energy transitions through a nested conceptual map of variables and theories. In comparison with the existing meta-theoretical literature, the three perspectives framework elevates the role of political science since policies are likely to be increasingly prominent in shaping 21st century energy transitions.

Dong, L. and Mori, A., 2017, Multi-level analysis of sustainable energy transition in Kenya: Role of exogenous actors, *International Journal of Energy Economics and Policy*, 7(5), 111-122
Sustainable energy transition is desirable to reduce carbon emission and to increase access to electricity from renewable energies, which hold especially true for African countries. Examining past transition pathway helps further advance the transition. Multi-level perspective has been adopted to examine technological transition and innovation in and beyond energy sector. Empirical research focused merely on energy transitions in developed countries, such as Germany, Netherlands and UK. This paper contributes by providing the

lessons from developing countries, with case of Kenya. The niche-regime-landscape dynamics in Kenya's electricity sector are depicted within three stages from 1954 to 2016, revealing the unneglectable role of exogenous actors in changing the landscape and accumulating the niche novelties. The paper holds the argument that, in comparison with developed countries, the developing world in energy transitions should pay attention to the influence of exogenous actors onto its landscape, regime and niche for a better sustainability transition.

Lepoutre, J. and Oguntoye, A., 2017, The (non-)emergence of mobile money systems in Sub-Saharan Africa: A comparative multilevel perspective of Kenya and Nigeria, *Technological Forecasting and Social Change*, in press
Mobile money systems are radically transforming the lives of a large fraction of the Sub-Saharan population. The emblematic success story of M-Pesa of Kenyan telecommunications operator Safaricom has received wide acclaim for being both the first company that launched mobile money and its mass adoption in just a few years. Despite efforts to replicate this success in other countries in Sub-Saharan Africa, many are struggling to get mobile money off the ground. This paper aims to contribute to a better understanding of the mechanisms that explain these differences by using a comparative case study analysis of Kenya and Nigeria that are comparable in many respects but are extreme opposites in their adoption of mobile money. Theoretically drawing on a combination of a multilevel perspective of sociotechnical transformation (MLP) and innovation ecosystems, we identify the idiosyncratic elements that play a role in the development of a critical mass of user and agent networks necessary for the survival of mobile money systems. We argue that while network externalities have contributed to a mass adoption of mobile money in Kenya, the different institutional and industrial conditions in Nigeria suggest that network externalities are taking much more time to be generated there and that achieving similar adoption rates as in Kenya might therefore just be a matter of time.

Boodoo, Z. and Olsen, K.H., 2017, Assessing transformational change potential: the case of the Tunisian cement Nationally Appropriate Mitigation Action (NAMA), *Climate Policy*, in press
To effectively address the root causes of carbon lock-in across developing countries, Nationally Appropriate Mitigation Actions (NAMAs) with transformational change characteristics are being supported by donors and finance mechanisms as a means to achieve ambitious nationally determined contributions (NDCs). However, there is still a scarcity of empirical studies on how transformational change policies and actions are designed and supported in practice. This article addresses such a gap in knowledge by combining theoretical insights from the multi-level perspective and transitions management literature to examine a donor-supported cement sector NAMA in Tunisia developed during 2012–2013. A narrative is constructed to analyse the adequacy of the NAMA design to promote structural shifts towards low carbon development in the cement sector. Data collection is based on semi-structured interviews and documentation gathered during field work in Tunisia 2014–2015. The study finds that the NAMA design is not likely to lead to transformational change of the cement sector, since underlying factors accounting for lock-in are not properly tackled. Although the NAMA has enabled new and promising sectoral partnerships across the cement sector, the analysis suggests that the NAMA's transformational potential is currently limited by a number of factors not being adequately addressed. Measures are proposed to reorient the NAMA towards promoting system innovation, building on further research and experimentation with the policy entrepreneurial role of donors.

Sovacool, B.K. and Hess, D.J., 2017, Ordering theories: Typologies and conceptual frameworks for sociotechnical change, *Social Studies of Science*, 47(5), 703–750
What theories or concepts are most useful at explaining socio technical change? How can – or cannot – these be integrated? To provide an answer, this study presents the results from

35 semi-structured research interviews with social science experts who also shared more than two hundred articles, reports and books on the topic of the acceptance, adoption, use, or diffusion of technology. This material led to the identification of 96 theories and conceptual approaches spanning 22 identified disciplines. The article begins by explaining its research terms and methods before honing in on a combination of fourteen theories deemed most relevant and useful by the material. These are: Sociotechnical Transitions, Social Practice Theory, Discourse Theory, Domestication Theory, Large Technical Systems, Social Construction of Technology, Sociotechnical Imaginaries, Actor-Network Theory, Social Justice Theory, Sociology of Expectations, Sustainable Development, Values Beliefs Norms Theory, Lifestyle Theory, and the Unified Theory of Acceptance and Use of Technology. It then positions these theories in terms of two distinct typologies. Theories can be placed into five general categories of being centered on agency, structure, meaning, relations or norms. They can also be classified based on their assumptions and goals rooted in functionalism, interpretivism, humanism or conflict. The article lays out tips for research methodology before concluding with insights about technology itself, analytical processes associated with technology, and the framing and communication of results. An interdisciplinary theoretical and conceptual inventory has much to offer students, analysts and scholars wanting to study technological change and society.

Ruggiero, S., Martiskainen, M. and Onkila, T., 2018, Understanding the scaling-up of community energy niches through strategic niche management theory: Insights from Finland. *Journal of Cleaner Production,* 170, 581–590.
The growing phenomenon of civil society involvement in renewable energy generation has attracted researchers' interest. However, rather little is known of how a diverse and relatively small sector such as community energy could scale up and promote a change in energy production. We examine this issue through the lens of Strategic Niche Management (SNM) and conceptualize community energy as a socio- technical niche that holds the potential to promote a transition to renewable energy. Drawing on interview data with members of community energy projects and experts in Finland, we identify different types of community energy projects and the factors that may prevent them from scaling up. The study contributes a typology of community energy projects by showing which initiatives could be more inclined to be part of a strategy aiming at scaling up the sector. It also shows the tensions of SNM in the context of non-market-driven innovation, highlighting how exogenous factors such as cultural aspects, the specific context in which community energy develops and the characteristics of community groups are also relevant in the scaling-up process.

Schaube, P., Ortiz, W. and Recalde, M., 2017, Status and future dynamics of decentralised renewable energy niche building processes in Argentina, *Energy Research & Social Science*, in press
Despite significant natural potential for renewable energy in Argentina and the political intention to generate 8% of electricity from renewable sources by 2017, by 2016 the share was only 1.95%. Although this aggregated picture appears unfavourable, several diverse initiatives promoting the development and application of decentralised renewable energy technologies are in place across the country. The aim of this study is to characterise those initiatives promoting decentralised renewable energy and to assess their potential role in inducing the wider transformation of the Argentinian energy system. To achieve this, we apply conceptualisations for the development of sociotechnical niches and use qualitative research techniques to characterise the sociotechnical dynamics of the decentralised renewable energy sector in Argentina. A niche in an advanced stage of development, in which lessons are systematically aggregated in networks, was identified and examples of generic lessons being used to frame new projects or programmes were also found. In addition to considering the internal niche development processes, we investigate how external factors affect the development of the niche. Finally, we suggest two possible development pathways by which the niche might exert stronger influence on the broader sustainability transformation of the Argentinian power system.

Raven, R.P.J.M., Sengers, F.W., Spaeth, P., Xie, L., Cheshmehzangi, A., Jong, M. de, 2017, Urban experimentation and institutional arrangements. *European Planning Studies*. Forthcoming.
Currently little is known about how institutional arrangements co-evolve with urban experimentation. This paper mobilizes neo-institutional literature and recent urban experimentation literature as a framework to explore how and why institutional arrangements differ across urban contexts. Empirically the paper focusses on smart city initiatives in Amsterdam, Hamburg and Ningbo. These three cities are frontrunners in adopting a comprehensive smart city agenda, but they do so in different ways. The paper examines regulative, normative and cognitive elements of institutional arrangements, explores how they shape experimentation, and reflects on their place-based specificities. The comparative analysis suggests that the focus of, and approach to, experimentation can be understood as resting in a (possibly unique) combination of strategic agency and dynamics at multiple spatial scales.

Loorbach, D., Frantzeskaki, N. and Avelino, F., 2017, Sustainability transition research: transforming science and practice for societal change. *Annual Review of Energy and Resources* 42(1), 599-626
The article describes the field of sustainability transitions research, which emerged in the past two decades in the context of a growing scientific and public interest in large-scale societal transformation toward sustainability. We describe how different scientific approaches and methodological positions explore diverse types of transitions and provide the basis for multiple theories and models for governance of sustainability transitions. We distinguish three perspectives in studying transitions: socio-technical, socio-institutional, and socio-ecological. Although the field as a whole is very heterogeneous, commonalities can be characterized in notions such as path dependencies, regimes, niches, experiments, and governance. These more generic concepts have been adopted within the analytical perspective of transitions, which has led three different types of approaches to dealing with agency in transitions: analytical, evaluative, and experimental. The field has by now produced a broad theoretical and empirical basis along with a variety of social transformation strategies and instruments, impacting disciplinary scientific fields as well as (policy) practice. In this article, we try to characterize the field by identifying its main perspectives, approaches and shared concepts, and its relevance to real-world sustainability problems and solutions.

Child, M., Haukkala, T. and Breyer C. 2017, The role of solar photovoltaics and energy storage solutions in a 100% renewable energy system for Finland in 2050, *Sustainability*, *9*(8), 1358
There are several barriers to achieving an energy system based entirely on renewable energy (RE) in Finland, not the least of which is doubt that high capacities of solar photovoltaics (PV) can be feasible due to long, cold and dark Finnish winters. Technologically, several energy storage options can facilitate high penetrations of solar PV and other variable forms of RE. These options include electric and thermal storage systems in addition to a robust role of Power-to-Gas technology. In an EnergyPLAN simulation of the Finnish energy system for 2050, approximately 45% of electricity produced from solar PV was used directly over the course of the year, which shows the relevance of storage. In terms of public policy, several mechanisms are available to promote various forms of RE. However, many of these are contested in Finland by actors with vested interests in maintaining the *status quo* rather than by those without confidence in RE conversion or storage technologies. These vested interests must be overcome before a zero fossil carbon future can begin. The results of this study provides insights into how higher capacities of solar PV can be effectively promoted and managed at high latitudes, both north and south.

Gliedt, T., Hoicka, C.E. and Jackson, N., 2018, Innovation intermediaries accelerating environmental sustainability transitions, *Journal of Cleaner Production*, in press
Institutions in the United States are undergoing modifications that present direct challenges for the environment and society and may result in institutional uncertainty and instability. This article explores whether innovation intermediaries can be employed as a key component of a strategy to create a window of opportunity for green job creation, infrastructure changes, and technological innovation in response to these types of institutional modifications. Based on a systematic literature review, this article outlines a framework that combines institutional modifications with technological innovation and infrastructure development as part of an economic development strategy. Important findings are that connections between innovation intermediaries, such as incubator and accelerator centers, niche actors, such as green champions, and regime actors, such as policy entrepreneurs, show potential to contribute to a green economic development strategy but require further examination for the specific roles played by policy entrepreneurs to help create the conditions for scaling niche experiments and simultaneously disrupting the regime. The key contribution is in defining the role of sustainability-oriented innovation intermediaries at linking local, state and business actions in order to scale-up and influence green economic development in a politically feasible manner during times of institutional uncertainty and instability.

Sovacool, B.K., Axsen, J., and Kempton, W., 2017, The future promise of vehicle-to-grid integration: A sociotechnical review and research agenda, *Annual Review of Environment and Resources*, 42, 377-406
Vehicle-grid-integration (VGI) describes various approaches to link the electric power system and the transportation system in ways that may provide benefits to both. VGI includes systems that treat plug-in electric vehicles (PEVs) as controllable load with a unidirectional flow of electricity, such as “smart” or “controlled” charging or time-of using pricing. Vehicle-to-grid (V2G) is a more technically advanced vision of VGI, with bidirectional flow of electricity between the vehicle and grid, in effect treating the PEV as storage device. Such VGI systems have the potential to help decarbonize transportation, support load balancing, integrate intermittent sources of renewable energy into the grid, increase revenues for electricity companies and create new revenue streams for automobile owners. This review introduces various aspects and visions of VGI based on a comprehensive, state-of-the-art review. In doing so, it identifies the possible benefits, opportunities and barriers relating to V2G, according to technical, financial, socioenvironmental, and behavioral components. After summarizing our sociotechnical approach and the various opportunities and barriers indicated by existing literature, we construct a proposed research agenda to provide insights into previously understudied and unstudied research objectives, and to provide additional rigor to continued technology-focused research. We find that the majority of VGI studies to date focus on technical aspects of VGI, notably on the potential of V2G systems to facilitate load balancing or to minimize electricity costs, in some cases including environmental goals as constraints. Only a few studies directly investigate the role of consumer acceptance and driver behavior within such systems, and almost zero studies address the need for institutional capacity and cross-sectoral policy coordination. This creates promising opportunities for future research.

Münzel, K.L., Boon, W.P.C., Frenken, K. & Vaskelainen, T. (2017). Carsharing business models in Germany: characteristics, success and future prospects. *Information Systems and e-Business Management,* in press
Carsharing provides an alternative to private car ownership by allowing car use temporarily on an on-demand basis. Operators provide carsharing services using different business models and ownership structures. We distinguish between cooperative, business-to-consumer (B2C) roundtrip and one-way, as well as peer-to-peer (P2P) carsharing. This paper characterizes these different types of business models and compares their success in terms of diffusion using a comprehensive database of all 101 German carsharing

providers in 2016. The key result holds that fleet size is significantly different across business models ranging from a few cars (cooperatives in small towns), to a few hundred (B2C roundtrip in larger cities), to over a thousand (B2C one-way in largest cities), up to multiple thousands (P2P across the country). By analyzing for each operator the number of cars *per capita* in the city they operate in, we do not find significant differences across business models indicating the viability of each separate business model type. Hence, we conclude that business models will continue to co-exist for a while, although some of the business models may well converge in the longer run due to Internet-of-Things applications and the introduction of self-driving cars.

Mahzouni, A., 2017, Urban brownfield redevelopment and energy transition pathways: A review of planning policies and practices in Freiburg, *Journal of Cleaner Production*, in press

This paper explores the role of urban brownfield redevelopment in navigating and enhancing energy transition in the built environment by conducting a case study of three city districts in Freiburg: Rieselfeld, Vauban, and Gutleutmatten, which have emerged from previously-developed lands used for sewage farm, army barracks, and inner-city allotment, respectively. It contributes to unpacking the social structure of planning system by analysing the dichotomy of structure and agency in the process of energy transition with particular focus on domestic energy use, both related to transport and in-dwelling use. The aim is to bring to light a new aspect of the complex relationship between brownfield redevelopment and energy transition by addressing the co-evolutionary interaction between structure and agency. The results show that the energy transition in the brownfield sites in Freiburg has been possible by gaining a broader agency for changing or reproducing the existing structure for planning and urban design. The broader agency was facilitated by two factors: the effective interaction and co-evolution between different elements of institutions: regulative, normative and cultural-cognitive; and the introduction and enactment of schemas (rules) across different sectors of urban design, energy, mobility, and civic participation. However, it is hard to transfer the outcomes of energy transition in the targeted sites to other places because of the unique temporal and socio-spatial context in which the transition has taken place.

Schlaile, M.P., Urmetzer, S., Blok, V., Andersen, A.D., Timmermans, J., Mueller, M., Fagerberg, J. and Pyka, A., 2017, Innovation systems for transformations towards sustainability? Taking the normative dimension seriously, *Sustainability,* 9(12), 2253

The aim of this article is to complement research on transformations towards sustainability by drawing upon the innovation systems (IS) framework. The IS framework already serves as a suitable and influential basis for research on processes of technological innovation and economic change. We argue that improving the capacity of an IS framework for dealing with wicked problems and the normative complexity of sustainability requires a fundamental paradigm shift because in the current IS paradigm innovations are considered as per se desirable and in mostly technological terms. Therefore, we call for IS dedicated to transformations towards sustainability by opening up for systemic innovations beyond the technological dimension and by acknowledging that stakeholders have conflicting visions, interests, norms, and expectations with regard to sustainability goals. Taking the normative dimension of transformations towards sustainability seriously thus requires more explicit and integrative research on directionality, legitimacy, responsibility, and their interrelation in IS. The article concludes by proposing suggestions for future research based on IS-related approaches that can serve as building blocks for an IS framework capable of incorporating legitimate goal-orientation for transformative innovation by and for society.

Berkowitz, H., 2018, Meta-organizing firms' capabilities for sustainable innovation: a conceptual framework, *Journal of Cleaner Production*, forthcoming,

Organizing practices at the collective level of firms and entrepreneurs, i.e. 'meta-organizing', is a necessity for the development and diffusion of sustainable innovations. This paper seeks

to build a meta-organization approach of sustainable innovation's governance. To do so, we conducted a three-stage literature review and analysis to 1) identify organizational capabilities that businesses need to acquire to develop sustainable innovations, 2) uncover attributes of meta-organizations as devices for governance, 3) relate these attributes to the capabilities for sustainable innovations. Our contributions are twofold: first we build a more comprehensive understanding of organizational capabilities, insisting on the overlooked importance of accountability, in addition to existing literature on anticipation, resilience, reflexivity, responsiveness and inclusion. Second, we highlight the key role of meta-organizations in facilitating the meta-governance of these capabilities. We propose a research agenda to further investigate these issues in several families of meta-organizations.

Li, F.G.N. and Pye, S., 2018, Uncertainty, politics, and technology: Expert perceptions on energy transitions in the United Kingdom, *Energy Research & Social Science*, 37, 122-132

Energy policy is beset by deep uncertainties, owing to the scale of future transitions, the long-term timescales for action, and numerous stakeholders. This paper provides insights from semi-structured interviews with 31 UK experts from government, industry, academia, and civil society. Participants were asked for their views on the major uncertainties surrounding the ability of the UK to meet its 2050 climate targets. The research reveals a range of views on the most critical uncertainties, how they can be mitigated, and how the research community can develop approaches to better support strategic decision-making. The study finds that the socio-political dimensions of uncertainty are discussed by experts almost as frequently as technological ones, but that there exist divergent perspectives on the role of government in the transition and whether or not there is a requirement for increased societal engagement. Finally, the study finds that decision-makers require a new approach to uncertainty assessment that overcomes analytical limits to existing practice, is more flexible and adaptable, and which better integrates qualitative narratives with quantitative analysis. Policy design must escape from 'caged' thinking concerning what can or cannot be included in models, and therefore what types of uncertainties can or cannot be explored.

Heyen, D.A., Hermwille, L., Wehnert, T., 2017, Out of the comfort zone! Governing the exnovation of unsustainable technologies and practices, *GAIA*, 26(4), 326-331,

Innovations are important for sustainability transformations, yet often prove insufficient for replacing established unsustainable structures. The promotion of renewable energy, for example, has been insufficient for pushing coal out of the energy market. The prevalent "innovation bias" should be overcome by complementing innovation politics and research with a stronger occupation with the purposive termination of unsustainable technologies, products and practices. This article therefore introduces the concept of "exnovation" and discusses the need of, as well as different approaches for, the governance of exnovation processes.

Upham, P., Dütschke, E., Schneider, U., Oltra, C., Sala, R., Lores, M., Klapper, R., Bögel, P., 2018, Agency and structure in a sociotechnical transition: Hydrogen fuel cells, conjunctural knowledge and structuration in Europe, *Energy Research & Social Science*, 37, 163-174

Despite each level of the multilevel perspective of sociotechnical transitions reflecting a different degree of structuration, structuration perspectives have been little used to help explain sociotechnical change and stasis. Here we show how 'strong structuration' can be used to theorise the role of agency in sociotechnical systems in a way that brings together psychological and sociological perspectives. Strong structuration gives weight not only to actors' practices, but also to their experiences. Practices and structures are viewed as mutually influencing, as in Giddens' original conception, but the role of situated, subjective experience is also explicitly acknowledged. Applying this perspective, we show how individual attitudes and beliefs in relation to a niche energy technology are influenced by

experience of national economic and innovation policy environments, with in turn implications for expectations of action by self and others. The overall aim is to illustrate a framework that connects individual psychology to practice, with implications for sociotechnical structure. For this purpose we draw on case study data of European R&D stakeholder opinion of stationary hydrogen fuel cell applications for heat and power, focusing particularly on the contrasting situations of the UK, Germany and Spain.

Kahma, N. and Matschoss, K., 2017, The rejection of innovations? Rethinking technology diffusion and the nonuse of smart energy services in Finland, *Energy Research & Social Science*, 34, 27-36

Energy markets are in a state of considerable transformation. As a result of new smart energy technologies, novel services can now be offered to customers. The adoption of innovations is often conceptualized in terms of technology diffusion, the success or failure of the new technology depending on how it is able to move across a market. It is taken as given that novel technologies diffuse from innovators to the mass market – a transfer in which non-use is thought to disappear over time. The article challenges the received approach to non-use, building on a typology by Satchell and Dourish, who suggest that non-use is more than lagging adoption: it can also manifest as active resistance, disenchantment, disenfranchisement, disinterest and displacement. The article draws on a survey carried out in Finland in 2013. We proceed from examining the non-adoption of smart energy services to analysing the attitudes linked to the many types of non-use. Thereafter, we will consider forms of non-use that are closely linked to assets and housing. We find that in the case of smart energy services the most important dimensions of non-use are disinterest and disenchantment, alongside lagging adoption. Moreover, disenfranchisement also has a role in explaining non-use.

Hanmer, C., and Abram, S., 2017, Actors, networks, and translation hubs: Gas central heating as a rapid socio-technical transition in the United Kingdom, *Energy Research & Social Science*, 34, 176-183

To achieve UK government targets to reduce carbon emissions by 80% on 1990 levels by 2050 will require a radical shift in domestic heating practices, which are currently dominated by gas central heating. Throughout this paper, the term “central heating” refers to individual home heating systems which heat the whole dwelling. Using a socio-technical systems analysis, based on Actor Network Theory, this paper examines what can be learned from previous transitions in heating, in particular the series of changes which led from the majority of UK homes being heated by open coal fires in the middle of the twentieth century, to a very high proportion of gas central heating by the end of the century. Two stages of transition are investigated: the expansion of central heating use in the 1950s and early 1960s, initiated by new technology development by the coal industry, followed by the dramatic increase in the use of gas for home heating as the supply was converted to North Sea gas in the late 1960s through to the 1970s. How did a new technology (small bore central heating systems) spread rapidly and effectively, and how was a fundamental change to a natural gas fuel infrastructure achieved? What does this tell us about the establish of strong and stable heating networks, and what are the lessons for future transitions to low carbon heating systems?

Lovell, H., Pullinger, M., Webb, J., 2017, How do meters mediate? Energy meters, boundary objects and household transitions in Australia and the United Kingdom, *Energy Research & Social Science*, 34, 252-259

This paper investigates the changing role of an integral but often overlooked technology within our energy systems: the meter. Empirical cases from the United Kingdom and Australia demonstrate the repurposing of the energy meter. No longer just an instrument of metrology, the meter is increasingly seen by utilities and governments as a key enabling technology for a raft of objectives, from tariff reform to peak load reduction. We draw on the Science and Technology Studies concept of a boundary object to explore these changes. A

boundary object is conceptualised as positioned between different social worlds – such as those of householders, government, and utilities – and as having sufficient interpretive flexibility to mediate between their distinct interests. Here we use the boundary object concept to explain the ways in which the meter is being reconfigured, and in particular to analyse the role of householders in the transition to digital meters.

Hewitt, R.J., Winder, N.P., Jiménez, V.H., Alonso, P.M., Bermejo, L.R., 2017, Innovation, pathways and barriers in Spain and beyond: An integrative research approach to the clean energy transition in Europe, *Energy Research & Social Science*, 34, 260-271

To meet the goals of the Paris Agreement, as well as earlier targets set down in the EU Low-Carbon Road Map, requires a major transformation in the way energy is generated, marketed, and distributed that we call the clean energy transition. The clean energy transition is a social process and its success will be determined by the actions of key actors such as policy makers, energy suppliers and businesses. In this paper, we apply integrative research approaches to engage stakeholders in the renewable energy (RE) sector in knowledge co-construction activities for the case of Spain. Established modes of energy production are very resilient and powerful actors are effectively blocking the energy transition on the basis that it threatens the status quo. Innovation is unlikely unless that veto can be overcome. The work has implications elsewhere, especially for other EU countries, where institutional structures and power relations are similar to those in Spain. To move forward requires a better understanding of the clean energy transition as a social process, and in particular, systematic identification of barriers to innovation and a serious effort to negotiate with the most powerful players.

Docherty, I., Marsden, G. and Anable, J., 2017, The governance of smart mobility, *Transportation Research Part A: Policy and Practice*, in press

There is an active contemporary debate about how emerging technologies such as automated vehicles, peer-to-peer sharing applications and the 'internet of things' will revolutionise individual and collective mobility. Indeed, it is argued that the so-called 'Smart Mobility' transition, in which these technologies combine to transform how the mobility system is organised and operates, has already begun. As with any socio-technical transition there are critical questions to be posed in terms of how the transition is managed, and how both the benefits and any negative externalities of change will be governed. This paper deploys the notion of ensuring and enhancing public value as a key governance aim for the transition. It sets out modes and methods of governance that could be deployed to steer the transition and, through four thematic cases explores how current mobility governance challenges will change. In particular, changing networks of actors, resources and power, new logics of consumption, and shifts in how mobility is regulated, priced and taxed – will require to be successfully negotiated if public value is to be captured from the transition. This is a critical time for such questions to be raised because technological change is clearly outpacing the capacity of systems and structures of governance to respond to the challenges already apparent. A failure to address both the short and longer-term governance issues risks locking the mobility system into transition paths which exacerbate rather than ameliorate the wider social and environmental problems that have challenged planners throughout the automobility transition.

Clausen, J., Göll, E., Tappeser, V., 2017, Sticky transformation. How path dependencies in socio-technical regimes are impeding the transformation to a Green Economy, *Journal of Innovation Management*, 5(2), 111-138.

Many works in innovation research use path dependencies to explain the fact that change is often difficult to achieve. With regard to a transition to a Green Economy, this paper identifies specific path dependencies in 15 areas of transformation in the sectors of mobility, food, housing and raw material in Germany. In total, 30 subtypes of technological, economical, organizational, user-specific and legal path dependencies were identified and

included in the analysis. One of the overarching observations is that for a successful transition to a Green Economy, the role of the state seems to be central. In many areas of transition, supposedly transformative regulation is full of loopholes and does not work, as special interest lobbying prevents the democratic implementation of effective, path-changing regulation. Furthermore, the basis of some legal as well as organizational path dependencies are false or no longer up-to-date basic assumptions regarding the appropriateness of existing arrangements, on the basis of which political decisions are made or organizations are led. Such decision-making bases, which are characterized by Schein as an "unquestioned basic assumption", can very effectively and over long-terms inhibit changes.

Gould, E., Wehrmeyer, W., and Leach, M., 2017, Transition pathways of commercial-urban fleet electrification in the UK, *Journal of Contemporary Management*, in press
Road transport accounts for 90% of UK transport emissions; by 2027 this is targeted to be reduced by 50% (OLEV, 2011). Electric vehicles offer a substantial opportunity to reduce road emissions, particularly to decarbonize the fleet market due to the sheer number of new registrations for business applications. However the diffusion of electric vehicles requires a transition across a large spectrum of societal and economic dimensions. The relationship between transition pathways and technological lock-in in the transport sector is under-researched, particularly in the field of e-mobility. This paper explores the pathway for electric vehicles, identifying the development blocks and technological lock-in of existing vehicle types, in order to understand the opportunities for technology diffusion within commercial fleet applications. This study takes a small sample of cases to achieve an in depth exploration of the motivations and barriers to this technological change. Three UK commercial-urban fleets in differing sectors are examined to understand their individual contexts and the level of correlation with the challenges experienced by the fleet market as whole, and how these have or have not been overcome. The multi-level perspective was used to determine the dynamics of change for fleets towards electric vehicles, and the roles of different stakeholder types were explored through the ‘action space’ of government, civil society and market logics. It is evident from the cases that an ‘innovator logic’ is competing to unlock EVs through technology innovation that extends beyond the transitional role of hybrids.

Martiskainen, M., Heiskanen, E. and Speciale, G., 2017, Community energy initiatives to alleviate fuel poverty: the material politics of Energy Cafés, *Local Environment*, in press.
Community action has an increasingly prominent role in the debates surrounding transitions to sustainability. Initiatives such as community energy projects, community gardens, local food networks and car sharing clubs provide new spaces for sustainable consumption, and combinations of technological and social innovations. These initiatives, which are often driven by social good rather than by pure monetary motives, have been conceptualised as grassroots innovations. Previous research in grassroots innovations has largely focused on conceptualising such initiatives and analysing their potential for replication and diffusion; there has been less research in the politics involved in these initiatives. We examine grassroots innovations as forms of political engagement that is different from the 1970s’ alternative technology movements. Through an analysis of community-run Energy Cafés in the United Kingdom, we argue that while present-day grassroots innovations appear less explicitly political than their predecessors, they can still represent a form of political participation. Through the analytical lens of material politics, we investigate how Energy Cafés engage in diverse – explicit and implicit, more or less conscious – forms of political engagement. In particular, their work to “demystify” clients’ energy bills can unravel into various forms of advocacy and engagement with energy technologies and practices in the home. Some Energy Café practices also make space for a needs-driven approach that acknowledges the embeddedness of energy in the household and wider society.

Burke, M. and Stephens, J. C., 2018, Energy democracy: Goals and policy instruments for sociotechnical transition, *Energy Research & Social Science*,
Energy democracy is an emergent social movement advancing renewable energy transitions by resisting the dominant energy agenda while reclaiming and democratically restructuring energy regimes. By integrating technological change with the potential for socioeconomic and political change, the movement links social justice and equity with energy innovation. Through a policy mix lens, this research examines the energy democracy agenda in the United States to understand how and to what extent the mix of policy instruments currently proposed among energy democracy advocates corresponds to the overarching goals of the movement. This assessment compares 22 policy instruments to 26 intended outcomes for energy democracy. The mix of policy instruments holds potential for advancing renewable energy transitions based on the combined goals of resist-reclaim-restructure, although current policies relate unevenly across the set of intended outcomes. Bolstering the energy democracy agenda will likely require developing new policies, strengthening existing policies, and integrating efforts to simultaneously resist dominant energy systems while also supporting their democratic and inclusive replacement. This research increases the visibility of the energy democracy movement and clarifies and assesses the core claims and policy instruments advanced by its advocates, contributing to policy design for renewable energy transitions and energy democracy.

Hewitt, R.J., Winder, N.P., Jiménez, V.H., Alonso, P.M., Bermejo, L.R., 2017, Innovation, pathways and barriers in Spain and beyond: An integrative research approach to the clean energy transition in Europe, *Energy Research & Social Science*, 34, 260-271
To meet the goals of the Paris Agreement, as well as earlier targets set down in the EU Low-Carbon Road Map, requires a major transformation in the way energy is generated, marketed, and distributed that we call *the clean energy transition*. The clean energy transition is a social process and its success will be determined by the actions of key actors such as policy makers, energy suppliers and businesses. In this paper, we apply integrative research approaches to engage stakeholders in the renewable energy (RE) sector in knowledge co-construction activities for the case of Spain. Established modes of energy production are very resilient and powerful actors are effectively blocking the energy transition on the basis that it threatens the status quo. Innovation is unlikely unless that veto can be overcome. The work has implications elsewhere, especially for other EU countries, where institutional structures and power relations are similar to those in Spain. To move forward requires a better understanding of the clean energy transition as a social process, and in particular, systematic identification of barriers to innovation and a serious effort to negotiate with the most powerful players.

Mok, L. and Hyysalo, S., 2017, Designing for energy transition through Value Sensitive Design, *Design Studies*, in press
Designers can do much for a more sustainable future. Sustainability transitions research and empirical assessment of its course in a specific context can be used to identify a relevant space-time for different design initiatives. We explore this reasoning in advancing solar photovoltaics in heritage, where a loss of aesthetic qualities and the heritage value of buildings may curb where solar arrays are sited. By using the Value Sensitive Design framework we illustrate how a working compromise among the seemingly conflicting values involved can be found. The value mix used and the resulting concept informs solar proponents in siting solar in culturally sensitive ways and shows the heritage constituency that solar technology does not categorically mean a misfit with cultural heritage.

Vagnoni, E. and Moradi, A., 2018, Local government's contribution to low carbon mobility transitions, *Journal of Cleaner Production*, in press
An important area of urban sustainability planning refers to the reduction of environmental impacts. Transport sector is one of the main contributors of these impacts due to its role in

air pollution, greenhouse gases and CO_2 emissions. Effective actions are needed to limit the environmental impacts of transport activities. Transition studies focus on these types of actions and plans. The role of local authorities as the closest level of government to the citizens in managing transition process is highlighted because they can better understand, inform, and guide local inhabitants, businesses and industries for achieving sustainability targets. The paper aims at assessing the efforts of local public authorities in transition toward low carbon mobility in Italy. To achieve this aim a mixed method analysis was applied. First, the analysis of qualitative data obtained from interviews with urban mobility stakeholders; used to design a framework for evaluating the role of local government in transition process. Then a quantitative analysis conducted on the data gathered through a questionnaire distributed to a sample of mobility managers (or transport responsible) in municipalities. The analyses provided a final framework showing how municipalities influence low carbon mobility transition process in Italy. In conclusion, municipalities' strategies and plans have a direct effect on the final goals. These strategies are influenced by financial support and cooperative activities, while the level of cooperation is dependent on the attitudes of deciding authorities. The paper also discusses the need to identify challenges and impediments for sustainable urban mobility transitions which was highlighted by stakeholders but less valued by local authorities.

Komendantova, N., Riegler, M. and Neumueller, S., 2018, Of transitions and models: Community engagement, democracy, and empowerment in the Austrian energy transition, *Energy Research and Social Science*, 39, 141-151

Energy transition towards a greater share of renewable energy sources and even energy independence based on local generation is ongoing in several regions of Austria. The Climate and Energy Model (CEM) regions are the major vehicles of this transition, which also assumes that investment into renewable energy sources will create socio-economic benefits for local economies. However, recent experience of such CEM regions as Güssing shows the need of holistic assessment of the transition process, including elements of participatory governance such as existing possibilities for inhabitants to engage into decision-making processes regarding energy transition in their community. The results of this paper are based on case studies of three CEMs: Freistadt, Ebreichsdorf and Baden. The data are also collected with the help of in-depth qualitative interviews with key stakeholders in the region and are analyzed based on the concept framework of the ladder of Arnstein. The results show typical level and forms of inhabitants' engagement into decision-making processes in three CEMs.

Moallemi, E.A. and Malekpour, S., 2018, A participatory exploratory modelling approach for long-term planning in energy transitions, *Energy Research & Social Science*, in press

Energy transitions are complex transformation processes, which involve different actors and unfold in a deeply uncertain future. These features make the long-term planning of energy transitions a *wicked problem*. Traditional strategic planning approaches fail to address this wickedness as they have a predictive, deterministic, and reactive standpoint to future issues. Modelling approaches that are used within conventional contexts are perceived to be inadequate too. They often simplify the qualitative characteristics of transitions and cannot cope with deeply uncertain futures. More recently, new ways of qualitative participatory planning, as well as new approaches to quantitative modelling have emerged to enable policy analysis under deep uncertainty. We argue that qualitative participatory and quantitative modelling approaches can be complementary to each other in different ways. We operationalise their coupling in the form of a practical approach to be used for long-term planning of energy transitions. The suggested approach enables energy decision makers to test various policy interventions under numerous possibilities with a computational model and in a participatory process. We explain our approach with illustrative examples mostly from transitions in electricity sectors. However, our approach is applicable to different forms

of energy transitions, and to the broader context of transition in any societal system, such as water and transportation.

Stokes, L.C. and Breetz, H.L., 2018, Politics in the U.S. energy transition: Case studies of solar, wind, biofuels and electric vehicles policy, *Energy Policy*, 113, 76-86
We examine the politics of US state and federal policy supporting wind and solar in the electricity sector and biofuels and electric vehicles in the transportation sector. For each technology, we provide two policy case studies: the federal Production Tax Credit (PTC) and state Renewable Portfolio Standards (RPS) for wind; state Net Energy Metering (NEM) and the federal investment tax credit (ITC) for solar; federal excise tax incentives and the Renewable Fuel Standard (RFS) for biofuels; and California's Zero Emission Vehicle (ZEV) mandate and federal tax incentives for electric vehicles. Each case study traces the enactment and later revision of the policy, typically over a period of twenty-five years. We use these eight longitudinal case studies to identify common patterns in the politics of US renewable energy policy. Although electricity and transportation involve different actors and technologies, we find similar patterns across these sectors: immature technology is underestimated or misunderstood; large energy bills provide windows of opportunity for enactment; once enacted, policies are extended incrementally; there is increasing politicization as mature technology threatens incumbents.

Galvin, R., 2018, 'Them and us': Regional-national power-plays in the German energy transformation: A case study in Lower Franconia, *Energy Policy*, 113, 269-277
This paper reports a regional case study of key issues for Germany's energy transformation (*Energiewende*) in and around Schweinfurt County (*Landkreis Schweinfurt*) in the geographical region of *Unterfranken* (Lower Franconia). Document research and semi-structured interviews with strategically selected local persons were conducted, supplemented by existing local knowledge. Citizen cooperatives in Lower Franconia have built numerous wind farms, were forerunners in commercial photovoltaics and provided political impetus for Germany's renewable energy subsidy law. But locals report disillusionment with recent neoliberal trends that lead to well-financed absentee investors buying up renewable energy siting rights, manoeuvring and pricing locals out of business, while government demands local access for an electricity superhighway that will serve other regions. The paper investigates local actors' perceptions of power plays between themselves and outside investors and policymakers, using Geels' schema of instrumental, material, institutional and discursive power. It finds locals outmanoeuvred and losing control, to outside interests, of what has been a significant contribution to the Energiewende, while their wider local economy and solidarity are being undermined. The paper recommends policymakers avoid framing regional groups as problems to be solved and instead act to support and harness their unique social resources for a more socially acceptable Energiewende.

Papazu, I., 2017, Storifying Samsø's renewable energy transition, *Science as Culture*, in press
Through a joint community effort Denmark's Renewable Energy Island Samsø became self-sufficient with renewable energy over a period of ten years from 1997 to 2007. Today, the story about Samsø's successful energy transition has become a global export and a widely-known model of community building, public participation and shared ownership in renewable energy technologies and transition processes. What has allowed the Samsø narrative to travel so widely has been the effective 'transition story' created about the islanders' efforts. This transition story, however, has become fixed with the years and has assumed an ideal-typical character. Meanwhile, the challenges and costs inherent in the complicated socio-material process of transition are underestimated and largely forgotten. While such transition stories are indeed inspiring, the ideal-typical narrative may stand in the way of the development of further local energy transitions, as challenging elements of the process are downplayed to strengthen the narrative power of the story. Ethnographic stories about

Samsø complicate the island's transition narrative and add nuance to the Samsø story, highlighting its discrepancies and problematizing the effects of such well-crafted transition narratives. This tendency towards the 'storification' of transition processes is not restricted to Samsø; it is employed as a tactics by environmental organizations operating globally.

Duygan, M., Stauffacher, M. and Meylan, G., 2017, Discourse coalitions in Swiss waste management: gridlock or winds of change?, *Waste Management*, in press
As a complex socio-technical system, waste management is crucially important for the sustainable management of material and energy flows. Transition to better performing waste management systems requires not only determining what needs to be changed but also finding out how this change can be realized. Without understanding the political context, insights from decision support tools such as life cycle assessment (LCA) are likely to be lost in translation to decision and policy making. This study strives to provide a first insight into the political context and address the opportunities and barriers pertinent to initiating a change in Swiss waste management. For this purpose, the discourses around a major policy process are analysed to uncover the policy beliefs and preferences of actors. Discourse coalitions are delineated by referring to the Advocacy Coalition Framework (Sabatier, 1998) and using the Discourse Network Analysis (Leifeld and Haunss, 2012) method. The results display an incoherent regime (Fuenfschilling and Truffer, 2014) with divergent belief clusters on core issues in waste management. Yet, some actors holding different beliefs appear to have overlapping interests on secondary issues such as the treatment of biogenic waste or plastics. Although the current political context hinders a system-wide disruptive change, transitions can be initiated at local or regional scale by utilizing the shared interest across different discourse coalitions.

Chapman, A.J. and Pambudi, N.A., 2018, Strategic and user-driven transition scenarios: Toward a low carbon society, encompassing the issues of sustainability and societal equity in Japan, *Journal of Cleaner Production*, 172, 1014-2024
This study investigates the sustainability and social equity impacts of the ongoing transition toward a low carbon society in Japan to assess the merits of top-down and bottom-up approaches. The research uses mixed methods, incorporating householder and energy expert surveys, scenario design utilizing the Japanese MARKAL/TIMES framework, and sustainability and social equity evaluation. Surveys identify householder energy system and participation preferences, alongside energy expert input on social equity and policy design. Scenario building is undertaken to compare energy system outcomes between the strategic Japanese policy approach and a user driven approach to energy transition, both cognizant of 2050 environmental goals. Both scenarios are comparatively assessed using a holistic sustainability evaluation process. Conclusions identify the impact of liberalization and subsequent householder participation in the energy system in Japan, when compared to a strategic, policy driven approach. Both approaches have positive ramifications on social equity and policy burden distribution outcomes. However, the household participation scenario delivers a more equitable outcome, distributing energy policy burdens in a fairer manner through the realization of an energy system which is safe, stable and affordable. The findings have practical applications in participatory policy design, and the development of energy policy which can achieve transition goals while being sensitive to householder preferences and social equity concerns.

Osunmuyiwa, O., 2017, Politics of energy transitions: A decade after Nigeria's biofuels crusade, a tale of non-commercialization and lost opportunities, *Environmental Policy and Governance*, in press
There is a growing literature on the politics of sustainability transitions and its correlation with policy changes at the national level. This paper contributes to this debate by taking stock of energy transition processes in Nigeria's biofuels sector. It explores the socio-economic externalities that influenced the biofuels policy, how this policy process was negotiated and why it failed. Based on expert interviews and document analysis, it was observed that a drop

in oil production and the need for economic diversification (GDP growth) created a favourable condition for the development of biofuels in 2005. However, the biofuels policy was insufficiently articulated when the window of opportunity opened. In the last 10 years, fluctuations in oil prices and changes in government have closed the window of opportunity for biofuels. Taken together, the results suggest that to successfully engineer transition, policy processes of this nature require a re-articulation of vision based on emerging externalities.

Falcone, P.M., Lopolito, A. and Sica, E., 2018, The networking dynamics of the Italian biofuel industry in time of crisis: Finding an effective instrument mix for fostering a sustainable energy transition, *Energy Policy*, 112, 334–348
This paper aims to design the effective instrument mixes for fostering a sustainable energy transition in times of crises. We focus on a sufficiently developed green niche – namely the Italian biofuel sector – implementing a two-step investigation: 1) a social network analysis, to study the effects of the crisis on the basic niche development mechanisms, with the aim of eliciting its development needs; 2) a fuzzy inference simulation based on a causal-effect map drawn from experts' knowledge to identify the most effective instrument mix for the development of the niche studied. The major needs emerged in the case investigated are for an increase of actors' expectations towards the further development of the sector, and a need for a tailored networking activity, devoted to attracting specific knowledgeable actors. The results indicate that, among others, effective policy instruments are, in this case, the cooperation that has the best outcome in terms of networking, and the public procurement, which remarkably increases the level of expectation. The analysis presented constitutes a model to evaluate single policy drivers and their combinations to find adequate policy actions to promote the green energy transition in times of crisis.

Ruotsalainen, J., Karjalainen, J., Child, M., Heinonen, S., 2017, Culture, values, lifestyles, and power in energy futures: A critical peer-to-peer vision for renewable energy, *Energy Research & Social Science*, 34, 231-239
Energy is not solely a techno-economic question, but has implications for the whole of society – its culture, values, lifestyles, and power structures. Changes in energy systems affect societies over decades, and long-term social and cultural processes in turn affect energy systems. Thus, energy systems should be studied from socio-cultural and futures-oriented perspectives. The purpose of this article is to describe the relationship between energy transitions and social change, and to offer one plausible socio-cultural vision of the era of renewable energy. The article addresses one of the emerging topical areas of energy research – that of rhetoric and sociotechnical imaginaries of energy transitions − surrounding emerging energy systems. Through a literature review, the article first deals with how energy transitions and societal change are related, and then maps out connections between energy and communication technology transitions. It proposes a decentralised peer-to-peer society as an emancipatory and transformative socio-cultural vision of the era of renewable energy systems. Opening up energy futures allows possible and desirable societal futures to be pursued. However, future visions need not be utopian. In order to deal with the possible contradictions of a peer-to-peer future, a critical stance is taken by using the concept of postnormality.