

Newsletter 29: September 2018

This is the 29th 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,

Sustainability transitions have gained increasing attention in recent years. The French government introduced an Energy Transition Law in 2015. The German government embarked on energy transitions in 2011. At the global level, there is an *Energy Transition Commission* (<http://www.energy-transitions.org/>), consisting of high-level leaders from public, private and social sectors (e.g. UN, BP, Shell, Rocky Mountains Institute, Tata, HSBC, World Resources Institute). There is a *Transitions Research Network*, which is a self-organising peer group of academics and community activists which aims to help advance understanding and practice in transition (<http://www.transitionresearchnetwork.org/>). *Global Transitions* (<http://www.keaipublishing.com/en/journals/global-transitions>) and *Energy Transitions* (<https://www.springer.com/energy/policy,+economics,+management+&+transport/journal/41825>) are two new journals, which were recently launched. And transitions thinking is entering the European Commission's discussions about the next framework programme for research and innovation (see under 'network news' in this newsletter).

Sustainability transitions are thus becoming an increasingly 'crowded space', which has both positive (increasing political attention, research funding, publication outlets) and negative consequences (e.g. terminological confusion, interest from 'mainstream' academic communities which increases competition and may lead to particular reframings of transition issues). On the whole, however, I think this is a positive development, which also raises new research questions about performativity (if/how our research actively contributes to real-world transitions) and reflexivity (e.g. about our roles as researchers).

Another indication of increasing interest and activity is that new national/regional sustainability transition networks are being created. A Brazilian transitions network has been created (see 'network news' below) and a Canadian/North American network is in the making (more about this soon...). There is already an Australia-based Sustainability Transitions Researchers Alliance. STRN welcomes these bottom-up activities and hopes that the newsletter and annual conference provide a useful platform for coordination and exchange. We're also discussing options to make these national/regional activities visible on the STRN website.

The website for the 10th International Sustainability Transitions conference is now live (<https://carleton.ca/istconference/>), and will be filled with more content soon. The conference will be on 23-26 June 2019 in Ottawa, Canada. The conference theme is 'Accelerating

sustainability transitions: Building visions, unlocking pathways, navigating conflicts', but participants can, of course, also discuss findings on other research themes. A conference call will be disseminated soon, and I hope that many of you will submit abstracts and session proposals for this anniversary conference.

This newsletter informs you about further activities such as new projects, events, publications and the most recent EIST-journal. I hope you enjoy reading the newsletter, and want to thank everyone for their contributions.

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

Environmental Innovation and Societal Transitions

Volume 28 (September 2018) of *Environmental Innovation and Societal Transitions* has just been published. It contains 10 articles reporting original research and 2 book reviews:

- A just transition for coal miners? Community identity and support from local policy actors, by Adam Mayer
- Unrelated diversification in latecomer contexts: Emergence of the Chinese solar photovoltaics industry, by Christian Binz and Laura Diaz Anadon
- Interdependence between Urban Processes and Energy Transitions: The Urban Energy Transitions (DUET) Framework, by Ping Huang and Vanesa Castán Broto
- Eco-innovation to reduce biodiversity impacts of wind energy: Key examples and drivers in the UK, by Philippa Roddis
- Incumbent energy companies navigating energy transitions: strategic action or bricolage?, by Eva Heiskanen, Eeva-Lotta Apajalahti, Kaisa Matschoss and Raimo Lovio
- Articulations of mundane transition work among consulting engineers, by Knut H. Sørensen, Vivian Anette Lagesen and Thea Sofie Melhuus Hojem
- Experimenting with a circular business model: Lessons from eight cases, by N.M.P. Bocken, C.S.C. Schuit and C. Kraaijenhagen
- Narratives of biorefinery innovation for the bioeconomy: Conflict, consensus or confusion? by Fredric Bauer
- Niche aggregation through cumulative learning: A study of multiple electric bus projects, by Benny B. Borghei, Thomas Magnusson
- Role of psychology in sociotechnical transitions studies: Review in relation to consumption and technology acceptance, by Paula Maria Bögel and Paul Upham
- Book review: The Palgrave Handbook of the International Political Economy of Energy, by Matthew Lockwood
- Hopkins, Debbie, Higham, James, (Eds.) 2016. Low Carbon Mobility Transitions. Goodfellow Publishers Ltd, Oxford, by Bert van Wee

We had some discussion among the editors about the difficulty to find reviewers. Our expectation was that authors benefitting from the services offered by EIST would be generous in accepting requests for review tasks. While many are, we have experienced that not everyone sees it like that. Hence, we ask via this newsletter all those who have (co)authored articles in EIST if we can please count on you to serve as a reviewer in the future, especially in view of the recent rise in submissions that the journal is experiencing given its favourable impact factor (5.265). A rigorous and constructive review process is the backbone of EIST's success and for this we depend on expert contributions of you all. In addition, we very much appreciate any suggestions for improving the review process.

As always, we look forward to receiving 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

Foresight and transitions thinking underpinning Horizon Europe: The BOHEMIA project

Transitions thinking has entered the preparations of the next European framework program for research and innovation (“Horizon Europe”) through a foresight project called BOHEMIA – Beyond the Horizon: Foresight in Support of the Preparation of the European Union’s Future Policy in Research and Innovation. This project was commissioned by DG RTD in 2016 and implemented by a consortium consisting of AIT Austrian Institute of Technology (lead), Fraunhofer Institute for Systems and Innovation Research, ISINNOVA and Institutul de Prospectiva. Their research work already delivered inputs to the Lamy report, published in June 2017 to define major cornerstones of a future framework program, and further informed the Commission’s ‘Horizon Europe’ proposal presented before summer. The results of BOHEMIA will also be used to inform the still ongoing debates about thematic priorities and possible missions to be supported by Horizon Europe. The exploration of context scenarios defines possible environments and requirements for the future role of R&I in society at a time horizon around 2040, and it informed an in-depth exchange with Commission officials from different DGs and external stakeholder on the purposes of a future framework program. Both the achievement of Sustainable Development Goals and the global political and economic positioning of Europe are regarded as the key ambitions to which a future framework program shall contribute. The study argues that these overarching ambitions can only be achieved jointly if Europe in cooperation with other world regions works on the realization of four major transitions in the areas of i) social needs and inequality, ii) preservation of the biosphere, iii) harnessing the forces of innovation, and iv) global governance. Against this backdrop, the study argues that future R&I activities funded by Horizon Europe should be geared towards realizing these four transitions. The further specification of possible agendas is framed in terms of 19 so-called targeted scenarios, which draw on an extensive analysis and online-Delphi consultation process on emerging developments in science, technology and society. The targeted scenarios not only provide a vision and assessment of the 19 key areas of future change and the social and technological R&I agendas underpinning them, but also of the needs for complementary action in sectoral policy areas, which define the demand-side conditions for new solutions and transformative change processes to happen. In terms of implementation, the targeted scenarios are candidate areas for future missions to be addressed by the European Commission, but to make this happen, major governance challenges will need to be addressed, such as the alignment of R&I policies with sectoral policies around common agendas, or the coherence with demand-side policies, which often shaped at national level. Further information on the study is available on the Commission’s foresight website: https://ec.europa.eu/info/research-and-innovation/strategy/support-policy-making/support-eu-research-and-innovation-policy-making/foresight/activities/current/bohemia_en. For more information, please contact: **Matthias Weber** (matthias.weber@ait.ac.at).

New Sustainability Transitions Brazil Research Network

On August 23, an energetic and engaged group of Brazilian sustainability transitions researchers met each other at Universidade Positivo, in the city of Curitiba, where they decided to set up the Transitions Sustainability Brazil: a new research network which is now part of the Global South thematic group of STRN. This important decision was encouraged and supported by Anna Wieczorek, who in the same event delivered an inspiring research seminar entitled “Studying transitions in non-developed contexts”. On September 16, Transitions Sustainability Brazil was officially inaugurated as an emailing list with more than 60 members. This newly created network initially aims to connect local researchers who up until very recently were conducting their studies on transitions, but with very little collaborations with colleagues from other parts of Brazil. From now on this young community

has a virtual space for sharing news, publications and invitations for events related to the sustainability transitions approach in the Brazilian context. For more information on the Sustainability Transitions Brazil send an email to Marcelo Tete at sustaintransitionsbrazil@gmail.com



Event announcements

Calls for upcoming relevant events such as workshops and conferences

Panel discussion on “Urban energy transitions and intermediaries”, 9 Nov 2018, Delft
Gilles Debizet (Grenoble Alpes University), Melike Yalçın-Riollet (Grenoble Alpes University) and Antoine Tabourdeau (EIFER) organize a panel discussion within the TU Delft Sustainable Urban Energy Systems Conference (8-9 November 2018) on: “Urban energy transitions: emergent intermediaries and the need to connect energy flows”. Recent studies on the transformation of urban socio-technical systems have been focusing on the role of intermediaries, which work across different scales and realms of action connecting other actors (eg. providers, users and regulators). The goal of this panel is to explore an understudied aspect of the intermediary function, that of connecting energy chains. How do intermediaries hinge on urban energy planning? To energy management? For how long are they getting involved into those processes? Which relational and physical (i.e. infrastructure) perimeter do they get engaged into? What additional concepts can be used to theorize intermediation processes? Empirical contributions by Gordon Walker, Mette Kragh-Furbo (Lancaster University), Grégoire Wallenborn (Université Libre de Bruxelles) and Pia Laborgne (EIFER) on case studies in the UK, Belgium and Germany, as well as following discussions will provide insight for better understanding energy transition processes and intermediaries by considering together their relational and material aspects. We invite researchers interested in energy intermediaries to join us by registering at <https://www.aanmelder.nl/urbanenergyconference/subscribe>. For more information contact: **Melike Yalcin-Riollet (melike.yalcin-riollet@umrpacte.fr)**.

Transition towards a circular economy in Switzerland, October 25, 2018, the Empa Academy, Dübendorf

German speaking transition colleagues are invited to participate in the second Resource Forum Switzerland (rf-ch 2018), which will discuss "Science, Economy and Cities Together

for More Resource Efficiency". As with the energy transition, cities and pioneers of the industry, are often referred to as initiators of a commodity shift. Among others, the following questions arise: Where are the hotspots of raw material consumption? Have cities and industry already found solutions? Decision-makers and experts from business and industry, politics and administration as well as science and civil society will meet at the second Resource Forum Switzerland in order to get to the bottom of these questions and deepen the topic. The conference is organized in collaboration with national partners such as a +, FOEN, ecos, Empa, engageability, esm, NEROS, NFP 73, öbu, Reffnet.ch, SQS and SATW. More information can be found at: <https://www.wrforum.org/rf-ch-2018/programm-2018/>
Daniel Kliem (daniel.kliem@fhsg.ch)

New research projects

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

CONSORT – CONsumers providing cost effective grid support

This project is a socio-technical pilot of smart household [residential] batteries, being rolled-out on Bruny Island, Australia. The incumbent network utility *TasNetworks* instigated the pilot through collaborating with a number of organisations and with funding from the Australian Renewable Energy Agency (ARENA). CONSORT aims to solve a network problem; a constrained under-sea cable. The project can be represented using the MLP frameworks as a niche development within the electricity regime. The project is multi-disciplinary, and involves three universities including Sydney University and the University of Tasmania. The project is led by the Australian National University with a research team of computer scientists, engineers, economists and social scientists. The project has a dedicated social science team that are investigating householder perceptions, trust, technology use and understanding, as well as wider policy questions, and higher level issues of governance during structural change and innovation. The CONSORT project team also comprises a new entrant to the energy market, an ICT start-up that manages the battery software, *Reposit Power*. The project peers 'over the curve' at a possible future electricity grid where electricity storage, finance and governance become more decentralized. The smart-batteries trade energy, as a service procured by the network. It aims to be for financial benefit to the consumer, and simultaneously for technical benefit to the network. A near-future transition towards internet-enabled batteries is a change of high complexity, for the consumer, network and installers alike. Learnings from this pilot indicate that utilities that wish to remain relevant will need to offer higher levels of engagement, information or *choice* to the consumers (or prosumers) into the future. However, this pilot has revealed that a range of possibilities in terms of agency and information will be required by consumers. It is argued that consumers will trade agency for reduced system complexity, because a key finding for the pilot was the diversity of household needs and desires on Bruny Island, and diversity of experiences with the battery-PV system. For more info contact sylvie.thieboux@anu.edu.au heather.lovell@utas.edu.au or veryan.hann@utas.edu.au.

Urban Green Religions: Religion in Low Carbon Transitions in two Western European Cities

This research project explores the role of religion in urban low carbon transitions. As Western European countries struggle to implement more sustainable forms of living, vast research is being conducted to study and inform these transitions processes. Sustainability transitions research has highlighted the role of actors from a variety of social spheres in promoting low carbon transitions. However, it has thus far ignored religion as a potentially important factor, despite the growing number of academic contributions in religious studies that underscore its role in promoting low carbon transitions. In particular, religion's impact on current low carbon transitions in cities remains largely unexplored. This research project addresses this research gap by studying how religion manifests itself in urban low carbon transition processes. The research project combines insights from (a) sustainability transition

studies, (b) sociological theory, and (c) contributions to the debate on religion and ecology, to evolve a framework for the study of religion in low carbon transitions. This framework identifies two ways in which religion may become manifest in urban low carbon transitions: (a) religious actors (e.g. Christian churches) acting as “service providers” for low carbon transitions, contributing to these processes with specific functions (i.e. public lobbying, materialization of transitions, environmental value dissemination); and (b) “non-religious” actors involved in low carbon transitions employing religion in their communication (e.g. politicians referring to the sacredness of nature). Accordingly, the research focuses on two potential manifestations of religion in urban low carbon transitions: (a) contributions from religious actors to these transitions, (b) religion manifesting itself in the environmental engagement of “non-religious” actors. Focusing on these two types of actors, the project undertakes research in two benchmark cities with multiple research methods, including qualitative interviews, analysis of document material, and participative observation. A comparative analysis of the results from the cities will provide first empirical insights into the roles of religion in urban low carbon transitions and thereby contribute to the debate on religion and sustainability. Emphasizing a, to date, neglected factor, the project endeavors to promote a more encompassing and inclusive understanding of sustainable transitions, which may reveal new possibilities for advancing these transformation processes. For more information, please contact Jens Koehrsen, jens.koehrsen@unibas.ch, or see the project homepage: <https://ugr.theologie.unibas.ch/de/home/>

Publications

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

PhD thesis: Schapke, Niko (2018), *Linking Transitions to Sustainability: Individual Agency, Normativity and Transdisciplinary Collaborations in Transition Management*, Leuphana University of Luneburg, Institute for Ethics and Transdisciplinary Sustainability Research (published as IETSR Discussion Paper No. 2/2018).

Sustainability transitions research proposes fundamental changes of societal systems’ organization to overcome persistent societal challenges, such as climate change or biodiversity loss, and allowing systems to become more sustainable. This thesis addresses an underlying tension in sustainability transitions research: between transitions as an open-ended process of fundamental change and the normative direction of this change: sustainability. In doing so, three themes so far underexplored in sustainability transitions scholarship are in the focus of the research: individual agency, normativity and transdisciplinary collaboration. Thereby, the thesis aims to strengthen process-oriented and potentially transformative approaches to sustainability transition research, in contrast to primarily descriptive-analytical approaches. Transition management as a recent and salient example of transdisciplinary transition research is chosen to provide both, research framework and application context. Based on conceptual-theoretic, empirical case study and reflexive work, three main results are contributed: First, a psychologically enriched understanding of individual and sustainability related agency in understandings of transition management is developed. Secondly, normative considerations, namely sustainability, are included into transition management combining substantive, procedural and intentional aspects. Thirdly, the transdisciplinary collaboration in transition management of creating an arena as an interactive learning space is conceptualized and explored, as well as the roles of the researchers therein. Implications of results for sustainability transitions research more broadly, including the Multi-level Perspective, are discussed. As overall synthesis of results, ten principles of sustainability transition management are proposed.

PhD thesis: Benny B. Borghei, 2018, *Incumbent Actors in Sectoral Transformations Towards Sustainability: A sociotechnical study of the European commercial heavy-vehicles sector*, Linköping University.

Industry incumbents are widely black-boxed as a homogenous group of actors to the extent that they are conceived as a single entity whose predefined role is to act as the guardian of the existing structures and the defender of the status-quo. While there are legitimate concerns about the power of incumbent firms, such one-sided views do not offer an inclusive approach in formulating multi-actor processes for sustainability transitions. Therefore, the purpose of this thesis is to contribute to a more comprehensive theorization on the role of incumbents in sustainability transitions literature. The thesis offers an alternative perspective and challenges the prevailing assumptions about incumbent actors by providing empirical evidence from the heavy commercial vehicles sector in Europe. The findings show that incumbents are able to adopt various technological strategies ranging from incremental innovations with highly coordinated actions for reducing emission levels based on established technologies, to the adoption of radical technological choices for introducing alternative propulsion in the existing markets. In fact, the strong position of incumbents often enables them to introduce radical innovations in established markets. The research findings also indicate that incumbents can act as learning agents or knowledge repositories to overcome the problem of isolation for niche technological innovations by transferring learning experiences over the boundaries of time and space. Incumbents can ramp up the adoption of new technologies through standardization at the industry level. Moreover, incumbents from a range of different sectors have been recognized as the integrators for the development of new technological solutions that span over traditional boundaries (such as electromobility in public transportation). Hence, new industrial sectors can emerge through the integration of knowledge and technologies from various established sectors, and incumbents are at the heart of the integration processes due to their knowledge and familiarity of the established sectors. Theoretical implications invite transition scholars to re-consider the role of incumbent actors in sustainability transitions, while practical implications suggest that policy-makers need to pay more attention to the diversities that exist among different actors and the need for subsequent policy alignments.

PhD thesis: Kyungsun Lee, 2018. *Exploring Eco-Industrial Parks via a Technological Innovation Systems Lens: Sustainability Transitions in South Korea and Japan*, The State University of New York College of Environmental Science and Forestry, USA.

How have the structure and functioning of Technological Innovation Systems contributed to the successful sustainability transitions toward Eco-Industrial Parks in South Korea and Japan? This study seeks to advance industrial symbiosis scholarship based on a field-based, empirical analysis of the origins and implementation of Eco-Industrial Parks in South Korea and Japan. The establishment of Eco-Industrial Parks in Japan and South Korea beginning in the 1990s, has drawn attention around the world because of the mutual benefit of these facilities to both economic development and environmental protection. Yet there have been important implementation gaps: successful implementation of Eco-Industrial Parks in these two countries has been less than fully realized. This research analyzes the establishment of Eco-Industrial Parks in South Korea and Japan through a Technological Innovation System framework, a systematic approach to development and diffusion of novel technologies in sociotechnical transition for sustainable future. By focusing on the dynamic process, the role of actors and networks, and institutional factors, the Technological Innovation System framework reveals factors that foster or hamper societal sustainability transitions. Prior studies have identified critical success factors and barriers to the implementation of Eco-Industrial Parks. However, the process of implementing Eco-Industrial Parks remains unclear, especially in terms of the roles of various actors and their activities related to success factors and barriers. The dissertation draws on 16 months of field research in Japan and South Korea in 2014-15, including in-depth interviews of key stakeholders, analysis of available data, and field observations of Eco-Industrial Parks. The study finds that the factors fostering and hampering implementation of Eco-Industrial Parks in the policy process across the national and local level and the stakeholders should overcome the challenges based on the local context to achieve the successful implementation of Eco-Industrial Parks.

Book: Büscher, C., Schippl, J. and Sumpf, P. (eds.), 2019, *Energy as a Sociotechnical Problem: An Interdisciplinary Perspective on Control, Change, and Action in Energy Transitions*, Routledge

Energy as a Sociotechnical Problem offers an innovative approach to equip interdisciplinary research on sociotechnical transitions with coherence and focus. The book emphasizes sociotechnical problems in three analytical dimensions. In the control dimension, contributing authors examine how control can be maintained despite increasing complexity and uncertainty, e.g., in power grid operations or on energy markets. In the change dimension, the authors explore if and how change is possible despite the need for stable orientation, e.g., regarding discourses, real-world labs and learning. Finally, in the action dimension, the authors analyze how the ability to act on a permanent basis is sustained despite opaqueness and ignorance, exemplified by the work on trust, capabilities or individual motives. Drawing on contributions from engineering, economics, philosophy, political science, psychology and sociology, the book assembles a range of classic and current themes including innovation, resilience, institutional economics, design or education. *Energy as a Sociotechnical Problem* presents the ongoing transformation of the energy complex as a multidimensional process, in which the analytical dimensions interact with each other in shaping the energy future. As such, this book will be of great interest to students and scholars of energy transitions, energy science and environmental social science more generally, as well as to practitioners working within the field of energy policy.

Book: Mohamed, N. (ed.), 2018, *Sustainability Transitions in South Africa*, Routledge

South Africa's transition to a greener economy features prominently in the long-term development vision of the country, and is an integral part of the country's national climate change response strategy. Despite significant gains in socio-economic development since its transition to democracy, the country continues to face the triple challenges of rising unemployment, income inequality and poverty – amid a slowdown in economic growth. Sustainability transitions offer new ways of shifting the trajectory of South Africa's resource-intensive economy towards low-carbon pathways linked to the country's transformative development agenda. Calls for inclusive approaches to greening the South African economy, which addresses the most vulnerable in society and ensures that the benefits of sustainability innovations reach all South Africans, are becoming more pronounced as sustainable development policy reforms are being implemented. The question that should be placed centre stage in South Africa's sustainability discourse is whether notions of justice and inclusivity are being sufficiently addressed in the design and implementation of policy and programme interventions. This book explores South Africa's sustainability transition through reflections on critical policy, economic, technological, social and environmental drivers. It provides a synthesis of theoretical insights, including new models and concepts, and praxis through illustrations from South Africa's growing landscape of sustainable development policies and programmes. Finally, it assesses whether these transition pathways are beginning to reconfigure the system-level structures hindering the country's goal of 'ensuring environmental sustainability and an equitable transition to a low-carbon economy'.

Book: Bartels, K.P.R. and Wittmayer J.M. (eds.), 2018, *Action Research in Policy Analysis: Critical and Relational Approaches to Sustainability Transitions*, London: Routledge.

Action research is rapidly taking hold in policy analysis and sustainability transitions research. It offers a valuable methodology for co-producing knowledge and action in the face of today's pressing societal, political, economic and environmental crises. This book explicates the ambitions, challenges, and practices involved with fostering policy changes and sustainability transitions. Each of the chapters shares action research experiences, heuristics, and approaches in a variety of policy settings and is accompanied by a 'co-inquirer reflection'. A key contribution of the book is its distinct and novel framework for engaging in the critical-relational dynamics of action research. This framework facilitates

action researchers and their co-inquirers in reflecting on how they (could) negotiate the starting point of their collaboration, enact multiple roles and relationships, challenge and reproduce hegemonic structures, cultures, and practices, and evaluate reflexivity, impact, and change. In this way, the book aims to encourage and guide future action research in policy analysis and sustainability transitions research. It features contribution by Westling & Sharp, Balazs & Pataki, Jhagroe, Henderson & Bynner, Paredis & Block, Arrona & Larrea, Gardner, Kuitenbrouwer, Clement and van der Arend and their co-inquirers, see for more information: <https://www.routledge.com/Action-Research-in-Policy-Analysis-Critical-and-Relational-Approaches/Bartels-Wittmayer/p/book/9781138553828>

Book: Delina, L., 2018, *Climate Actions: Transformative Mechanisms for Effective Social Mobilisations*, Palgrave Macmillan.

Climate change remains a challenge that needs to be addressed at its core, particularly the rapid reduction of anthropogenic greenhouse gas emissions. This book discusses strategies for climate actions by synthesizing insights from a set of international 'contemporary social action group's' surveys. Based on these Delina introduces a synthesis of mechanisms for generating change, designed around 5 main themes: relationships (relating); value-based messages (messaging); alternatives (visioning); diversity (webbing); and communication (interacting). This book will be of great value to all academics and practitioners interested in the future development of our climate.

Book: Monkelbaan, J., 2019, *Governance for the Sustainable Development Goals: Exploring an Integrative Framework of Theories, Tools, and Competencies*, Springer

This book provides a detailed overview of governance for the Sustainable Development Goals (SDGs). Adopting a unique integrative approach, it examines the fragmentation of governance that is a critical barrier to achieving the SDGs. The main question addressed is: What are the crucial elements and the organizing logic of an integrative framework that is suitable for analysing governance for the SDGs and for implementing the transitions that we need towards a more sustainable world? This transdisciplinary book first proposes a combination of innovative governance theories that can improve the analysis and practice of sustainability governance. One of the main theories that is explored and compared with the other theories (metagovernance, experimentalist governance, polycentricity) is transition theory/transition management. Secondly, it explores the interests of core actors in a number of case examples. And thirdly, it offers recommendations for improving the study and practice of sustainability governance. The findings presented form the basis for a new approach to governance towards objectives such as the SDGs: Integrative Sustainability Governance (ISG). The ensuing ISG framework includes indicator frames within the pillars of power, knowledge and norms. The book concludes that the transformation of crisis into sustainability transitions requires a deeper consideration of risk management that strengthens resilience; systems deliberation that complements democracy; and behavioral insights that elevate human awareness and collaboration. This handbook is a comprehensive and valuable companion for students, experts and practitioners with an interest in the SDGs.

Book: Heidkamp, C.P. and Morrissey, J. (eds.), 2018, *Towards Coastal Resilience and Sustainability*, Routledge

Coastal zones represent a frontline in the battle for sustainability, as coastal communities face unprecedented economic challenges. Coastal ecosystems are subject to overuse, loss of resilience and increased vulnerability. This book aims to interrogate the multi- scalar complexities in creating a more sustainable coastal zone. Sustainability transitions are geographical processes, which happen in situated, particular places. However, much contemporary discussion of transition is either aspatial or based on implicit assumptions about spatial homogeneity. This book addresses these limitations through an examination of socio- technological transitions with an explicitly spatial focus in the context of the coastal

zone. The book begins by focusing on theoretical understandings of transition processes specific to the coastal zone and includes detailed empirical case studies. The second half of the book appraises governance initiatives in coastal zones and their efficacy. The authors conclude with an implicit theme of social and environmental justice in coastal sustainability transitions. Research will be of interest to practitioners, academics and decision-makers active in the sphere of coastal sustainability. The multi-disciplinary nature encourages accessibility for individuals working in the fields of Economic Geography, Regional Development, Public Policy and Planning, Environmental Studies, Social Geography and Sociology.

Special issue on ‘Sustainability transition towards a bio-based economy: New technologies, new products, new policies’, *Sustainability*

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- Schot, J.W. and Steinmueller, E., 2018, New directions for innovation studies: Missions and transformations, *Research Policy*, 47, 1583-1584

Capellán-Pérez, I., Celador, A.C. and Teres-Zubiaga, J., 2018, Renewable energy cooperatives as an instrument towards the energy transition in Spain, *Energy Policy*, 123, 215-229

Renewable Energy Sources (RES) offer a key transformative potential from a social point of view due to their modularity and capacity to generate energy at local level, allowing for the development of democratic and participative bottom-up initiatives. Spanish RES cooperatives, unlike other European countries, are few in number. Here, we review their development by applying the Multi-Level Perspective approach. Spanish RES cooperatives have recently come up against a hostile regulatory and economic context, which has induced specific organizational and operating structures such as the application of innovative participation methods and investment tools. Spanish RES cooperatives regularly collaborate in sharing learning processes and experiences, having also demonstrated their capacity to spread new ideas at both social and political levels. However, despite their growth and territorial spread over the last few years, RES cooperatives still have a minor presence in the Spanish energy system. Although some internal factors may limit their potential as an active instrument towards the transition to RES in the country, the regime's resistance is found to be the main barrier. This paper concludes with some recommendations for policy makers and RES cooperatives to enhance its potential role in the forthcoming energy transition process.

Geels, F.W., 2018, Low-carbon transition via system reconfiguration? A socio-technical whole system analysis of passenger mobility in Great Britain (1990-2016), *Energy Research & Social Science*, 46, 86-102

Low-carbon transitions in whole systems (in energy, mobility, agro-food) are an important, yet understudied topic in socio-technical transition research. To address this topic, the paper builds on the Multi-Level Perspective, but stretches it to address developments in multiple regimes and multiple niche-innovations. This 'zooming out' strategy changes the conceptualisation of transition dynamics from *bottom-up disruption* (driven by singular niche-innovations) to *gradual system reconfiguration*, which represents a more distributed, multi-source view of change that includes cumulative incremental regime change, shifts in relative sizes of regimes, regime alignments, component substitution, and symbiotic adoption. To illustrate the reconfiguration approach and empirically explore the topic of whole system change, the paper investigates unfolding trajectories in UK passenger mobility. This analysis, which addresses developments in auto-mobility, train, bus and cycling regimes and five niche-innovations (biofuels, electric vehicles, smart cards, compact cities, home working), aims to assess if and how the mobility system is reconfiguring in low-carbon directions. It also aims to provide an interpretive assessment of the 12.7% decrease in domestic transport-related CO₂-emissions between 2007 and 2013. This decrease is attributed to reduced auto-mobility (due to the financial-economic crisis), incremental engine efficiency improvements in new cars, some modal shift from cars to trains, and biofuels. Radical niche-innovations (smart cards, compact cities, electric vehicles) did not (yet) greatly contribute to emission reductions. CO₂-emissions increased again since 2014, which suggests that further low-carbon transitions require deeper system reconfiguration.

Belmin, R., Meynard, J-M., Julhia, L., and Casabianca, F., 2018, Sociotechnical controversies as warning signs for niche governance, *Agronomy for Sustainable Development*, 38:44

In agriculture, not all sociotechnical niches seek to plant the seeds of further regime transition: Some niches are designed to last as stable subnetworks harboring alternative agri-food systems. However, such niches often interact with sociotechnical regimes, leading to controversies, conflicts, and threats to niches sustainability. This situation calls for proactive governance of niche-regime interactions. We studied the innovation process in the "Corsican clementine" niche, using semi-structured interviews and participant observation. We wondered how local actors have been dealing with three controversial innovations: a clementine variety, a biological pest control method, and a pruning

technique. Cross-analysis of the three innovations shows that (i) the niche's innovation pathway can be diverted by regime-driven innovations; (ii) to protect their niche, local actors set collective rules, both formal and informal; and (iii) controversies over technical innovations make niche-regime tensions more visible, leading local actors to make collective decisions for governing the innovation pathway. This study is the first to highlight the key role of sociotechnical controversies in niche governance.

Markard, J., 2018, The life cycle of technological innovation systems, *Technological Forecasting and Social Change*, in press

The technological innovation systems (TIS) framework is one of the key approaches in sustainability transition studies. However, scholars have so far mostly concentrated on the early stages of technology development and we know rather little about mature, or even declining TIS. Building on earlier insights from the industry and technology life cycle literatures, this paper introduces the key elements of a TIS life cycle framework and distinguishes between four key stages of TIS development: formation, growth, maturity and decline. An ideal TIS life cycle representation is suggested and three empirical examples of long-term TIS development and decline are discussed. It is argued that adopting a TIS life cycle perspective opens up important new issues for sustainability transition studies. One such issue is directing attention to technology decline and the role of public policies therein.

Pekkarinen, S. and Melkas, H., 2018, Welfare state transition in the making: Focus on the niche-regime interaction in Finnish elderly care services, *Technological Forecasting and Social Change*, in press

The study tackles the socio-technical transition in Finland's elderly care within the framework of the multi-level perspective of transitions, with a specific focus on the confrontation between niche and regime levels. Despite the recognised societal importance of rethinking the welfare state and elderly care in it, the direction of change is not straightforward. Even though the regime is experiencing destabilisation, remarkable inertia, deriving from old trajectories, exists, in both technological development and socio-institutional adaptation. Our analysis is based on four case studies that represent different development processes aiming at changes in the elderly care system. In the analysis, we have identified several lock-ins that act as barriers to the niche breakthrough and transition in elderly care according to whether they are related to confrontation either between technologies, between practices or between practices and technologies. Barriers were identified in the form of technical incompatibilities and usability problems, professional roles and responsibilities and a lack of training and systemic thinking, for instance. Overcoming these confrontations can be facilitated through learning different professional and work cultures, smoothing organisational and sectoral borders as well as facilitating users' adoption of technologies. The study contributes to the research on transition dynamics and responds to the need to analyse the complex process between niches and regimes.

Arentshorst, M.E. and Peine, A., 2018, From niche level innovations to age-friendly homes and neighbourhoods: A multi-level analysis of challenges, barriers and solutions, *Technology Analysis & Strategic Management*, 30(11), 1325-1337

Age-friendly housing is an envisioned solution to enable people to live longer independently at home, thereby reducing costs of long-term care and responding to the needs and demands of older persons. Although different age-friendly innovations exist, they fail to realise scale beyond the niche level. Based on workshops with stakeholders from different European countries we show that challenges and barriers for scaling-up relate to the unknowns and uncertainties of the culture (age-friendly housing vision), practice (approaches to realise age-friendly housing) and structure (organising and structuring elements) of the age-friendly housing system. Solutions are merely informed by the perspective of the own professional practice and might fail due to their mismatch with other practices and by not considering the resilience of incumbent regimes. Establishing a multi-

actor process to start defining the culture, structure and practice might result in a cooperative and distributive effort to realise age-friendly homes and neighbourhoods.

Geels, F.W., 2018, Socio-technical transitions to sustainability, *Oxford Research Encyclopedia of Environmental Science*, June 2018, DOI: 10.1093/acrefore/9780199389414.013.587

Addressing persistent environmental problems such as climate change or biodiversity loss requires shifts to new kinds of energy, mobility, housing, and agro-food systems. These shifts are called socio-technical transitions because they involve not just changes in technology but also changes in consumer practices, policies, cultural meanings, infrastructures, and business models. Socio-technical transitions to sustainability are challenging for mainstream social sciences because they are multiactor, long-term, goal-oriented, disruptive, contested, and nonlinear processes. Sustainability transitions are being investigated by a new research community, which uses a socio-technical Multi-Level Perspective (MLP) as one of its orienting frameworks. Focusing on multidimensional struggles between “green” innovations and entrenched systems, the MLP suggests that transitions involve alignments of processes within and between three analytical levels: niche innovations, socio-technical regimes, and an exogenous socio-technical landscape. To understand more specific change mechanisms, the MLP mobilizes ideas from evolutionary economics, sociology of innovation, and institutional theory. Different phases, actors, and struggles are distinguished to understand the complexities of sustainability transitions, while still providing analytical traction and policy advice. The MLP draws attention to socio-technical systems as a new unit of analysis, which is more comprehensive than a micro-focus on individuals and more concrete than a macro-focus on a green economy. It also forms a new analytical framework that spans several stale dichotomies in environmental social science debates related to agency or structure and behavioral or technical change. The MLP accommodates stability and change and offers an integrative view on transitions, ranging from local projects to niche innovations to sector-level regimes and broader societal contexts. This new interdisciplinary research is attracting increasing attention from the European Environment Agency, International Panel on Climate Change (IPCC), and Organization for Economic Cooperation and Development (OECD).

Rut, M. and Davies, A.R., Transitioning without confrontation? Shared food growing niches and sustainable food transitions in Singapore, *Geoforum*, 96, 278-288

Following a series of global food crises and an increasing dependence on food imports, the Singaporean government has begun to support local food production as a means to improve the sustainability of its food regime. This extends to the development of state-led ventures which support shared food growing in the city. In parallel, informal citizens' groups are experimenting with collaborative forms of food provisioning. Both types of initiatives utilise Information and Communication Technologies (ICT) to facilitate their practices of shared growing and seek to reorient the current food regime onto a more sustainable pathway. Drawing on ethnographic research conducted with two initiatives representative of both organisational positions, this paper critically examines the efficacy of using a transitions thinking approach to assess their actual and potential contribution to the disruption of the food regime in Singapore. The paper first reviews existing approaches to transitions thinking in order to distil insights for examining shared food growing initiatives in Singapore as niche projects. The broader socio-cultural and political context of Singapore's food system and the food growing niche projects which are emerging within it are then delineated, followed by a strategic niche management (SNM) analysis of the two initiatives. Ultimately, the paper makes two linked contributions: firstly, it diversifies the empirical foundations and the sectoral and geographical reach of sustainability transitions research. Secondly, it provides space for critical reflection on transitions thinking when applied beyond the Western liberal democratic settings from which it emerged.

Broto, V.C., Trencher, G., Iwaszuk, E., and Westman, L., 2018, Transformative capacity and local action for urban sustainability, *AMBIO*, in press

There is a consensus about the strategic importance of cities and urban areas for achieving a global transformation towards sustainability. While there is mounting interest in the types of qualities that increase the capacity of urban systems to attain deep transformations, empirical evidence about the extent to which existing institutional and material systems exhibit transformative capacity is lacking. This paper thereby seeks to determine the extent to which sustainability initiatives led by local governments and their partners reflect the various components that the literature claims can influence the emergence of transformative capacity as a systemic property of urban settings. Using an evaluative framework consisting of ten components of transformative capacity and associated indicators, the specific objective is to identify patterns in these initiatives regarding the presence of individual components of transformative capacity and their interrelations with other components. The analysis of 400 sustainability initiatives reveals thin evidence of transformative capacity. When detected, evidence of transformative capacity tended to emerge in relation to wider processes of institutional- and social-learning and initiatives that linked outcomes to a city-wide vision of planning and development. However, instances of such initiatives were rare. This widespread lack of evidence for transformative capacity raises concerns that this set of attributes normalised in the literature is in fact rarely found in sustainability action on the ground.

Falcone, P.M., Morone, P. and Sica, E., 2018, Greening of the financial system and fuelling a sustainability transition: A discursive approach to assess landscape pressures on the Italian financial system, *Technological Forecasting and Social Change*, 127, 23-37

By examining the use of language and depicting the emerging storylines surrounding the green finance (GF) niche, this study aims to identify actors pushing the Italian financial sector to become increasingly greener. Then, it scrutinizes the narratives used by landscape actors to assess the channels through which such pressure is exerted, as well as its effectiveness. Our findings reveal a high/unbalanced narrative pressure coming from global actors by means of both institutional and informal channels, and from national actors mainly by means of informal channels. If no apposite policy interventions are undertaken, such inadequacy could jeopardize the development of green innovations. More specifically, this study could support decision makers in developing specific strategies to unlock the huge potential of GF in the transition process towards a greener economy by: (i) supporting a deeper strategic collaboration among informal and institutional actors operating at the national level; (ii) acting as catalysts of green-oriented financial initiatives and related dissemination, and (iii) re-addressing the national-institutional actors towards a more proactive role in fostering finance for green innovation.

Osti, G., 2018, The uncertain games of energy transition in the island of Sardinia (Italy), *Journal of Cleaner Production*, in press

Energy is a basic issue for cleaner production and more sustainable consumption. A transition to renewable sources and massive energy savings face several problems: technological lock-ins, energy companies' oligopoly, unsteadily governments' policies. These problems are especially severe in small island developing states or regions. For these territories, however, energy transition can be a chance to improve their situation, especially if they are rich of renewable sources and they can mobilise important cultural and organisational resources, such as claims for identity and autonomy. An exemplary case study is Sardinia, the second biggest island in the Mediterranean Sea. It has problems of energy supply, strained political relationships with the mainland, and low economic development. The framework for this case study is rooted in multilevel perspective and political economy, complemented by games playing metaphor. The research hypothesis is that sustainable energy practices emerge if a variety of 'games' are visible, if they stimulate lay people participation, and if they are consistent with key goals for islanders, including

independence, development and identity. In Sardinia, three games are identified: fossil fuels vs. renewables, competition on smart grid and storage system technologies, energy sovereignty vs. energy interdependency. There is not a single result of these games. Variable situations emerge, which allow forecasting a very slow progress of the energy transition.

Vögele, S., Kunz, P., Rübhelke, D., and Stahlke, T., 2018, Transformation pathways of phasing out coal-fired power plants in Germany, *Energy, Sustainability and Society*, 8, 25

While there are plenty of studies investigating the market penetration of new technologies, phase-out processes of a predominant technology are rarely analyzed. The present study explores the case of a declining technology, employing the example of coal-fired power plants in Germany. These plants were promoted by governmental decision-makers as well as by the industry for a long time, but meanwhile, the phase-out or at least a cutback of coal-fired power plants is—not only in Germany—considered to be a key strategy for the transformation towards a sustainable society. We investigate potential pathways of the future development of the coal-fired power plant sector in an extended multi-level perspective (MLP) framework that integrates. Taking into account the fact that coal is losing its support from several important stakeholders (e.g., governmental decision-makers, utilities) due to, e.g., changes in the prioritization of political goals, changes in the economic framework, in actor constellations, and in public attitudes, coal-fired power plants tend to be pushed into niches or to disappear completely. A reasonable management of the niche technology “coal-fired power plants” could include a protection of space for ensuring a smooth removal of the links between the regime and the technology with respect to, e.g., social and environmental aspects. The phase-out pathways for the coal-fired power plants elaborated on in this paper help to better inform policy-makers to design transformation processes not only for coal-fired power but also for other declining technologies.

Hörisch, J., 2018, How business actors can contribute to sustainability transitions: A case study on the ongoing animal welfare transition in the German egg industry, *Journal of Cleaner Production*, in press

This research analyses how different business actors can contribute to sustainability transitions. It draws on the case of the ongoing transition towards higher levels of animal welfare in the German egg industry. For this industry the share of organic sales is higher than for any other German industry. The analysis uses the theoretical framework of the multi-level perspective and draws on documentary information, interviews and direct observation. The results reveal that sustainable entrepreneurs at the niche level support the transition of the German egg industry by continuously creating transformative innovations, but do not aim at changing the mass market. Incumbent corporations have been fast in reacting to these changes and adopted selected niche-level innovations in a way which stabilised the regime. The paper finds that relatively comprehensive changes are possible via reconfigurational pathways of transitions.

Kooij, H-J., Lagendijk, A., and Oteman, M., 2018, Who beats the Dutch tax department? Tracing 20 years of niche–regime interactions on collective solar PV production in the Netherlands, *Sustainability*, 10(8):2807

In the past years, Dutch citizens have experimented with various kinds of innovations to organize the collective production of renewable energy, including shared wind power and solar PV installations. Most of these attempts failed mainly due to legal issues and tax rules. Yet, one model for solar PV on collective roofs was implemented more widely, namely the postcode rose (PCR, postcoderoos): a form of cooperative solar PV production within a set of adjacent postcode areas. Set within a broader transition perspective, this article studies the emergence and evolution of the PCR as an example of a successful social innovation in the energy transition, through an innovation biography and mapping of the evolution of the social and institutional network around the innovation. The various attempts for collective

solar PV, with different degrees of success and uptake into the regime, present a key aspect of niche development, namely associational work (circulation and mobilization) focused on regime change. In conclusion, the innovation path of the PCR emphasizes the importance of the political and associational in the energy transition and in transition thinking.

Tronchin, L., Manfren, M. and Nastasi, B., 2018, Energy efficiency, demand side management and energy storage technologies – A critical analysis of possible paths of integration in the built environment, *Renewable and Sustainable Energy Reviews*, in press

The transition towards energy systems characterized by high share of weather dependent renewable energy sources poses the problem of balancing the mismatch between inflexible production and inelastic demand with appropriate solutions, which should be feasible from the techno-economic as well as from the environmental point of view. Temporal and spatial decoupling of supply and demand is an important element to be considered for the evolution of built environment, especially when creating sectorial level planning strategies and policies. Energy efficiency measures, on-site generation technologies, demand side management and storage systems are reshaping energy infrastructures and energy market, together with innovative business models. Optimal design and operational choices in buildings are systemic, but buildings are also nodes in infrastructural systems and model-based approaches are generally used to guide decision-making processes, at multiple scale. Built environment could represent a suitable intermediate scale of analysis in Multi-Level Perspective planning, collocated among infrastructures and users. Therefore, the spatial and temporal scalability of modelling techniques is analysed, together with the possibility of accommodating multiple stakeholders' perspectives in decision-making, thereby finding synergies across multiple sectors of energy demand. For this reason, the paper investigates first the cross-sectorial role of models in the energy sector, because the use of common principles and techniques could stimulate a rapid development of multi-disciplinary research, aimed at sustainable energy transitions. Further, relevant issues for the integration of energy storage in built environment are described, considering their relationship with energy efficiency measures, on-site generation and demand side management.

Becker, S.L. and Von der Wall, G., 2018, Tracing regime influence on urban community gardening: How resource dependence causes barriers to garden longer term sustainability, *Urban Forestry & Urban Greening*, 35, 82-90

This article explores how resource dependence leads to barriers to urban community gardening. Nine barriers to urban gardening were identified: finance, space, organizational structure, water, external damage, soil, communication, interpersonal issues, and participation issues. Using process tracing and grounded theory, we found that these barriers could be divided into three groups: primary, secondary, and participation barriers. Primary barriers are caused and directly influenced by the regime, whereas secondary barriers are the result of decisions and actions taken while addressing the primary barriers. All of these barriers cause frustration and affects the ability of the gardens to retain and acquire new members. This affects the longer term sustainability of the gardens and their potential to contribute to an urban governance transition.

Forssell, S. and Lankoski, L., 2018, Shaping norms. A convention theoretical examination of alternative food retailers as food sustainability transition actors, *Journal of Rural Studies*, 63, 46-56

Changing the shared rules and norms underpinning dominant regimes is seen as one driver of sustainability transitions, yet relatively little attention has been paid to exactly how actors seek to change these. In this study, we focus on the norm-shaping work performed by alternative food retailers, a potentially influential alternative food network actor, as a potential element of food system sustainability transitions. We use convention theory as a novel framework for examining this. Convention theory focuses on shared rules and norms in economic coordination and offers a framework for examining how actors negotiate what is

right and desirable. By this theory, actors are considered to engage with a plurality of universally accepted notions of worth, organised into different worlds of justification, and to use specific strategies of justification or negotiation to propose and justify different configurations of ideals and their manifestations. The analysis shows how the retailers, by engaging with the different worlds of justification through different strategies of negotiation, promoted four overarching ideals of food production-consumption. Although we must be cautious of overstating the change-making potential of very marginal actors, the view opened by the convention theory perspective is one of active, strategic negotiation taking place in the margins of the dominant food regime, with potentially interesting interactions with the growing landscape pressures to take the food system in a more sustainable direction.

Covarrubias, A.V., 2018, When disruptors converge: the last automobile revolution, *International Journal of Automotive Technology and Management*, 18(2), 18-104

While the automobile industry is in a transition prompted by cutting-edge technologies that enable old and new players to envision more efficient ways of mobilising people and goods, a debate boils up as to the depth and breadth of such transition. This paper joins the debate from an analytical approach based on the dialectic issue life cycle (DILC) model, the theory of disruptive innovations and organisational concepts of neo-institutional scholars. It identifies that automakers are well involved into a phase of strategic diversification spurred by a unique historical convergence of alternative drive systems, digital technologies, new business models and newcomers. While changes take place at the level of sustaining innovations and industrial mindset is the dimension more radically changed, automakers are struggling in the search for an anew business-balancing act of value propositions, alliances, and organisational structures.

Dijk, M., de Kraker, J., and Hommels, A., 2018, Anticipating constraints on upscaling from urban innovation experiments, *Sustainability*, 10, 2796.

The upscaling of innovations from urban experiments is often assumed to be relatively easy, as if they can simply be 'rolled out'. In practice, however, upscaling is usually constrained by a range of factors in the wider context of the innovation, typically a context of interconnected and 'obdurate' urban socio-technical networks and institutions. Innovation studies have used the notion of upscaling from experiments most explicitly in studies of transitions, especially of strategic niche management (SNM) and transition management (TM). However, these studies have focused more on niche internal dynamics and future visions, respectively, and much less on constraints in the present socio-institutional context. This paper offers a conceptual contribution on 'constraints on upscaling', elaborating on how upscaling can be more effective when constraints on upscaling are first identified in retrospective systems analysis, and then anticipated in the design of urban experiments. Our focus is on innovation in urban mobility systems. After a conceptualization of 'constraints on upscaling', based on a review of the literature of transition, social innovation, geography and science & technology studies, we present a retrospective analysis of urban mobility in Maastricht (NL) in which these interrelated constraints can be recognized. Further, we analyze a pilot on electric bus mobility which was relatively successful in anticipating future constraints. Based on this, we offer some guidelines on how to anticipate upscaling in the design of urban experiments with socio-technical innovations.

Dijk, M., Givoni, M., and Diederiks, K., 2018, Piling up or packaging policies? An ex-post analysis of modal shift in four cities, *Energies*, 11, 1400

Recently, there has been wider acknowledgement that sustainable urban mobility will not be triggered by one 'silver bullet' policy, or by piling up various policies, but requires a deliberate package of policies. Until recently, studies on policy instrument (or measure) interaction have been primarily ex-ante studies, estimating interactions in the future. However, from an evidence-based policy-making perspective, ex-ante evaluations need to use knowledge gained through ex-post evaluations, a crucial link in the policy cycle. To contribute to the

strengthening of this poor link, this paper provides an ex-post analysis of instrument interaction in four northwest European, medium-sized cities: Bruges, Ghent, Jena & Erfurt. By exposing the relationships between the range of mobility policies implemented in relation to modal shift achieved, we offer insight into the crucial difference between ‘piling up policies’ and deliberate policy packages. As such, the paper offers evidence to inform ex-ante analysis for urban mobility policy-making and contributes to policy learning as part of effective governance.

Huang, P., Ma, H. and Liu, Y., 2018, Socio-technical experiments from the bottom-up: The initial stage of solar water heater adoption in a ‘weak’ civil society, *Journal of Cleaner Production*, in press

Recent years have witnessed the proliferation of urban experiments responding to low-carbon and sustainable transitions. There is a tendency of prioritizing the role of government interventions in transitions while neglecting the agency of other parties. This tendency is especially true in China, where an authoritarian governance dominates the transition process. The Rizhao case, however, exhibited a distinct bottom-up pattern in the early-stage development of solar water heater (SWH) technology, when both the civil society and the market were still immature. Through this rare case of urban energy transitions in China, this study looks into the sociotechnical experiments from the bottom-up. The study shows that before the intervention of local governments, a niche market of SWH technology was established and consolidated successfully in Rizhao through the mutual effects of both resident-led social experimentation and entrepreneur-led technological experimentation. The study further uncovers that in a less-developed civil society in China, the diffusion of novel innovations relied heavily on interpersonal social networks.

Jedelhauser, M. and Binder, C.R., 2018, The spatial impact of socio-technical transitions – The case of phosphorus recycling as a pilot of the circular economy, *Journal of Cleaner Production*, 197, part 1, 856–869

Socio-technical innovations for the recovery of phosphorus (P) from sewage sludge (ashes) and the recycling of the secondary material in the agri-food system have been gaining prominent roles in current debates on circular economy. While research has been primarily focusing on questions on technical feasibility, the impact of the innovations on the social and material structures of the underlying socio-technical wastewater and agri-food systems has been receiving less attention. Drawing on theoretical insights from transition theory and empirical data from expert interviews, our analysis of two approaches to P recycling – phosphoric acid and struvite – shows how innovations create different spatial structures of actors, institutions, infrastructure, and material flows and in doing so promote or hamper fundamental changes in the socio-technical systems. In the wastewater system, both approaches foster the incumbent socio-technical regime of centralized wastewater treatment. In the agri-food system, on the one hand, the phosphoric acid approach supports large-scale industrial structures comprising the fertilizer industry and global P flows fostering the incumbent globalized agri-food regime. On the other hand, struvite facilitates the local distribution of fertilizers between wastewater treatment plants and farmers and supports small-scale P cycling providing opportunities for a structural reconfiguration of the agri-food system.

Jedelhauser, M., Mehr, J., Binder, C.R., 2018, Transition of the Swiss phosphorus system towards a Circular Economy—Part 2: Socio-technical scenarios, *Sustainability*, 10(6), 1980

A transition towards a circular economy of phosphorus (P) in Switzerland is a multi-faceted challenge as P use is subject to a variety of influencing factors comprising policy interventions, consumption trends, or technological innovations on different spatial scales. Therefore, scenarios for P use that take into account both the social and the technical dimension of change are needed for investigating possible pathways of a transition towards more sustainable P futures. Drawing on the multi-level perspective of transition theory, we

develop scenarios on the landscape level, i.e., a balanced and healthy human diet, on the regime level, i.e., P recovery from sewage sludge (ash) and meat and bone meal, and on the niche level, i.e., urine separation. Based on the P system of the year 2015, we assess the quantitative implications of the scenarios for the Swiss P system. While scenario 1 mainly affects the agricultural system by reducing the overall P throughput, scenario 2 significantly changes P use in waste management, because P losses to landfills and cement plants decrease and the production of secondary P increases. Scenario 3 shows little quantitative impact on the national P system. From a qualitative transition perspective, however, urine separation entails fundamental socio-technical shifts in the wastewater system, whereas P recovery from sewage sludge (ash) represents an incremental system adaptation. The combination of flow- and transition-oriented research provides more general insights into how a circular economy of P can be reached. Furthermore, the analysis of P recycling scenarios reveals that transition processes in Switzerland are embedded in a global resource economy. Thus, a sole focus on concepts of national P self-sufficiency and the reduction of Switzerland's P import dependency tend to fall short when analysing the economisation of secondary P materials in the face of transnational resource flows and markets

Tvinnereim, E. and Mehling, M., 2018, Carbon pricing and deep decarbonisation, *Energy Policy*, 121, 185-189

Experts frequently point to carbon pricing as the most cost-effective tool for reducing greenhouse gas emissions. Empirical studies show that carbon pricing can successfully incentivise incremental emissions reductions. But meeting temperature targets within defined timelines as agreed under the Paris Agreement requires more than incremental improvements: it requires achieving net zero emissions within a few decades. To date, there is little evidence that carbon pricing has produced deep emission reductions, even at high prices. While much steeper carbon prices may deliver greater abatement, political economy constraints render their feasibility doubtful. An approach with multiple instruments, including technology mandates and targeted support for innovation, is indispensable to avoid path dependencies and lock-in of long-lived, high-carbon assets. We argue that carbon pricing serves several important purposes in such an instrument mix, but also that the global commitment to deep decarbonisation requires acknowledging the vital role of instruments other than carbon pricing.

Matschoss, K.J. and Heiskanen, E., 2018, Innovation intermediary challenging the energy incumbent: enactment of local socio-technical transition pathways by destabilisation of regime rules, *Technology Analysis and Strategic Management*, in press

The energy sector needs to transform towards sustainability. The multi-level perspective on sociotechnical transitions is embracing an enactment perspective, which focuses on the agency of various actors in shifting transitions pathways but has yet to study local urban experiments from such an enactment perspective. Our empirical research examines an innovation intermediary's work in destabilising the regime rules in relation to the local energy incumbent company in Helsinki, Finland. Our paper seeks answers to the questions: How does the collaboration of the intermediary and the local energy company unfold? What are the impacts of the intermediary work on the local energy company in terms of enactment of transition pathways and what are the mechanisms causing the impact? Our research shows that the intermediary contributes to the transition by disturbing existing rules, structures, practices and networks by convening innovation champions from different constituencies, renegotiating regime rules and disrupting existing R&D alliances.

Breetz, H., Mildenerger, M. and Stokes, L., 2018, The political logics of clean energy transitions, *Business and Politics*, in press

Technology costs and deployment rates, represented in experience curves, are typically seen as the main factors in the global clean energy transition from fossil fuels towards low-

carbon energy sources. We argue that politics is the hidden dimension of technology experience curves, as it affects both costs and deployment. We draw from empirical analyses of diverse North American and European cases to describe patterns of political conflict surrounding clean energy adoption across a variety of technologies. Our analysis highlights that different political logics shape costs and deployment at different stages along the experience curve. The political institutions and conditions that nurture new technologies into economic winners are not always the same conditions that let incumbent technologies become economic losers. Thus, as the scale of technology adoption moves from niches towards systems, new political coalitions are necessary to push complementary system-wide technology. Since the cost curve is integrated globally, different countries can contribute to different steps in the transition as a function of their individual comparative political advantages.

Coles, A-M., Piterou, A. and Sentic, A., 2018, Is small really beautiful? A review of the concept of niches in innovation, *Technology Analysis & Strategic Management*, 30(8), 895-908

This article reviews the concept of innovation niches through three categories: strategic niche management (SNM), specialised markets and niches formed as a technology declines. In the literature, innovation niches generate interest from both innovation and marketing perspectives. This review focuses predominately on the former from which the niche types have been adopted and analysed. Mostly, contributions since 1980 have been included, representing the period of academic interest in innovative small firms, while both temporal and locational filters were applied to the study. It is noted that SNM has been proposed as a means to protect potentially useful innovations from full market competition, while specialist niches supply technologies to few customers in more stable environments. Incumbent technologies at the stage of decline may also retreat to niches where they can still remain competitive. Finally, it is suggested that further research on innovation niches would extend our understanding of technology dynamics.

Edelenbosch, O.Y., Hof, A.F., Nykvist, B., Girod, B. and Van Vuuren, D.P., 2018, Transport electrification: The effect of recent battery cost reduction on future emission scenarios, *Climatic Change*, in press

Although the rapid fall in the costs of batteries has made electric vehicles (EVs) more affordable and boosted their sales, EVs still account for only a fraction of total car sales. In the last years, the battery costs of electric vehicles have dropped faster than previously estimated in the empirical literature. As a result, future cost projections have been adjusted. The larger than expected reduction in costs also shows the uncertainty of battery cost development, which will affect the success of a transition to low-carbon transport. Integrated assessment models show that reducing greenhouse gas emissions is more challenging in the transport sector than in other sectors. Switching to EVs could significantly reduce passenger road-transport emissions. In this study, we test the sensitivity of the projected sales of EVs to different battery costs and climate policy futures. The model suggests that the effectiveness of policy incentives will strongly depend on the battery floor costs, as EVs only gain significant shares (15% or more) of global car sales within our model framework when battery costs reach 100 \$/kWh or less. We therefore conclude that besides the pace of the battery costs decline, which has been rapid in the last years, it is important to understand the lower boundary of battery costs for modelling long-term global energy transitions.

Wierling, A., Schwanitz, V.J., Zeiss, J.P., Bout, C., Candelise, C., Gilcrease, W. and Gregg, J.S., 2018, Statistical evidence on the role of energy cooperatives for the energy transition in European countries, *Sustainability*, 10(9), 3339

The share of renewable energy is increasing throughout Europe. Yet, little is known about how much can be attributed to different actors, other than those commercially active. This paper provides empirical evidence of activities by energy cooperatives in the field of renewable energy in four different European countries. It draws from a database consisting

of 2671 entries, contrasting results from current literature. We find that energy cooperatives are important enablers of the energy transition. However, their role is shrinking in recent years due to a tightening or removal of supportive schemes. We conclude that it is necessary to develop a systematic accounting system to properly track and make visible the contributions by different actors. In turn, this will help to better model the likely speed of Europe's energy transition.

Beuse, M., Schmidt T.S, and Wood V., 2018, A “technology-smart” battery policy strategy for Europe, *Science*, 361(6407), 1075-1077

The world market for battery and hybrid electric vehicles (EVs), including passenger cars, buses, and freight trucks, is growing rapidly. Currently, almost all lithium-ion (Li-ion) battery cells for EVs are produced by East Asian (Chinese, Japanese, and Korean) manufacturers. Meanwhile, the European automotive industry, among the largest in the world, generates 4% of European gross domestic product, and 12 million jobs (1); however, Europe houses less than 1% of the global Li-ion battery cell manufacturing capacity, and this production capability largely addresses niche markets. Manufacturing of batteries for EVs is thus at the center of industry policy discussions at the European Commission (EC), with calls for “European sovereignty” in Li-ion battery manufacturing (2). Here, we offer insights from battery research and innovation studies to suggest that catching up with East Asian companies is worthwhile, but can only be achieved step by step, by bringing competences to Europe through strategic global collaborations, supported by creation of an attractive European market for EVs.

David, M., 2018, The role of organized publics in articulating the exnovation of fossil-fuel technologies for intra- and intergenerational energy justice in energy transitions, *Applied Energy*, 228, 339-350

Whereas campaigners for energy justice frequently seek to achieve decarbonization through innovation, little light has been shed on how energy justice might be won through the removal of carbon intensive energy structures—a process known as exnovation, which is the opposite of innovation. Whereas practicing exnovation to decarbonize energy systems and thus achieving greater energy justice appears to be a promising approach, it remains a challenge in light of the deep incumbency of established fossil-fuel-based energy industries. Using the example of Germany, which represents such a setting of deep fossil fuel incumbency, this article compares two organizations aiming to achieve energy justice via exnovation when formal policy-making toward decarbonization seems impossible. Offering a perspective on strategies for energy justice, the article identifies the repertoires of contention of two organizations. This concerns knowledge dissemination, symbolic protest, and rule compliance, which can be understood as soft (non-obligatory) policy instruments to bring about exnovation. The article then discusses the relationship between exnovation and intra- and intergenerational energy justice. It concludes that the means of contention analyzed here are successful in divesting and in stopping the construction of planned coal plants.

Hielscher, S. and Sovacool, B., 2018, Contested smart and low-carbon energy futures: Media discourses of smart meters in the United Kingdom, *Journal of Cleaner Production*, 195, 978-990.

The Smart Meter Implementation Programme (SMIP) is arguably one of the most expansive and complex smart meter programmes globally. The UK government regards smart meters to be enablers of a low-carbon energy grid and has set out ambitious consumer-orientated aims within their programme across England, Scotland, and Wales. Despite considerable amount of research on how consumers will (or not) engage with smart meters, media discourses, where some public debates about smart meters are created and reproduced, have received little attention. This paper presents a content analysis of how smart meters are discussed within 11 years of popular print media coverage. A collection of nine discourses are identified: Four of these – “empowered consumers”, “energy conscious

world”, “low-carbon grid”, and “future smart innovation” – depict smart meters as a harbinger of positive social change. Five of these – “hacked and vulnerable grid”, “big brother”, “costly disaster”, “astronomical bills”, and “families in turmoil” – represent smart meters as negative forces on society. The results show that discourses and associated storylines mainly represent continuous struggles over particular socio-technical promises linked to smart meters. Somewhat missing are attempts to open up the smart energy debate to broader issues of democracy and energy justice within the print media coverage.

Sovacool, B.K., Kester, J., Noel L., De Rubens, G.Z., 2018, The demographics of decarbonizing transport: The influence of gender, education, occupation, age, and household size on electric mobility preferences in the Nordic region, *Global Environmental Change*, 52, 86-100

Many researchers, policymakers and other stakeholders have explored and supported efforts to transition towards more sustainable forms of low-carbon mobility. Often, discussion will flow from a narrow view of consumer perceptions surrounding passenger vehicles—presuming that users act in rationalist, instrumental, and predictable patterns. In this paper, we hold that a better understanding of the social and demographic perceptions of electric vehicles (compared to other forms of mobility, including conventional cars) is needed. We provide a comparative and mixed methods assessment of the demographics of electric mobility and stated preferences for electric vehicles, drawing primarily on a survey distributed to more than 5000 respondents across Denmark, Finland, Iceland, Norway and Sweden. We examine how gender influences preferences; how experience in the form of education and occupation shape preferences; and how aging and household size impact preferences. In doing so we hope to reveal the more complex social dynamics behind how potential adopters consider and calculate various aspects of conventional mobility, electric mobility, and vehicle-to-grid (V2G) systems. In particular, our results suggest that predominantly men, those with higher levels of education in full time employment, especially with occupations in civil society or academia, and below middle age (30–45), are the most likely to buy them. However, our analysis also reveals other market segments where electric vehicles may take root, e.g. among higher income females and retirees/pensioners. Moreover, few respondents were orientated towards V2G, independent of their demographic attributes. Our empirical results can inform ongoing discussions about energy and transport policy, the drivers of environmental change, and deliberations over sustainability transitions.

Van Welie, M., Cherunya, P.C., Truffer, B. and Murphy, J.T., 2018, Analysing transition pathways in developing cities: The case of Nairobi's splintered sanitation regime, *Technological Forecasting and Social Change*, in press

Today's rapid global urbanization highlights the need for long-term transformations of basic service sectors in developing cities in order to improve the livelihoods of the urban poor. Sustainability transitions frameworks have proven fruitful for addressing these sort of challenges. However, they have been at pains so far in accounting for the heterogeneity and complexities that typically characterize informal settlements in the Global South. We therefore propose a conceptual framework that extends the conventional analysis of socio-technical regimes by distinguishing the two levels of *sectoral regime* and *service regime*. Challenges for sustainability transitions may then be identified by missing alignments within and among the two regime levels. The framework is applied to the sanitation sector of Nairobi, Kenya, a city experiencing rapid population growth and a highly uneven provision of basic services. Drawing on a set of 152 in-depth interviews, observations, and five focus group discussions, the paper reconstructs the prevailing service regimes and shows how they suffer from misalignments and dysfunctions creating all sorts of problems at a sectoral level. We conclude that Nairobi's sanitation sector can best be characterized as representing a *splintered regime*. The paper concludes with a discussion of how the new conceptualization of socio-technical regimes suggests some new sustainable transition pathways and how this framework might also be instructive for transition challenges in cities of the Global North.

Delina, L., 2018, Climate mobilisation and democracy: The promise of community energy transitions in a deliberative system. *Journal of Environmental Policy and Planning*, in press.

Climate mobilizations to address the rapidly accelerating impacts of climate change are now an imperative; but can these processes be accomplished democratically? This paper shows how climate mobilizations and democracy can be mutually inclusive and explores the promise of scaling democratically produced climate mobilization actions in understudied locations in developing countries. This paper focuses on a case study of deliberation as communally practiced for expanding energy transitions in rural Thailand. Using observations, complemented by interviews and group discussions, the paper proceeds in two stages: (1) an empirical description of how such practice performed well against the ideals of deliberation: inclusive, authentic, and influential—thus underlining the compatibility between a robust democratic exercise and green outcomes; and (2) a normative proposal on how such small-scale transitions can be connected in a deliberative system thus enriching climate mobilizations.

Delina, L., 2018, Energy democracy in a continuum: The remaking of public engagement on energy transitions in Thailand. *Energy Research and Social Science* 42, 53-60.

Sustainable energy transitions are fundamental in making climate actions effective and in attaining sustainable development. To achieve the transition inclusively, fairly, and justly, democratizing these processes seems imperative; yet, not all human societies are thriving in democratic spaces. Focusing in the non-democratic state of Thailand, this paper explores the materiality of energy democracy in such locations. Using mixed qualitative methods and a grounded approach, the paper offers a case study of community-oriented renewable energy transitions as practices occurring outside the realms of state-sanctioned and government-fostered apparatuses for public engagement. The case shows how these practices continually shape and co-produce energy sociotechnical orders. The paper further shows how a space for communal deliberation can become a site for the making and remaking of public engagement, and how, over time—of hits-and-misses, of consensus-and-dissensus, of stability-and-uncertainty—it could become durable, yet remained open-ended and provisional.

Mahzouni, A., 2018, Urban brownfield redevelopment and energy transition pathways: A review of planning policies and practices in Freiburg, *Journal of Cleaner Production*, 195, 1476-1486

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.

Haelg, L., Waelchli, M., and Schmidt, T.S., 2018, Supporting energy technology deployment while avoiding unintended technological lock-in: A policy design perspective. *Environmental Research Letters*, in press

Technology deployment policies can play a key role in bringing early-stage energy technologies to the market and reducing their cost along their learning curves. Yet, deployment policies may drive unintended and premature lock-in of currently leading technologies. Here we develop an empirically calibrated agent-based model to analyse how deployment policy design influences which technologies are selected by investors. We focus on Germany's solar photovoltaics feed-in tariff policy between 2003 and 2011 and analyse two design features, technology specificity and application specificity. Our results show that both features are highly important in technology selection and that spillover effects between applications exist. Policies that fail to consider these effects can unintentionally lock in or lock out technologies. To avoid this, policymakers can leverage the fact that different technologies are competitive in different applications and, by designing application-specific deployment policies, effectively offer a level playing field for competing technologies.

Van den Buuse, D. and Kolk, A., 2018, An exploration of smart city approaches by international ICT firms. *Technological Forecasting and Social Change*, in press

As part of the growing interest in cities to address persistent sustainability issues in society, 'smart cities' have increasingly become a ubiquitous phenomenon globally. For multinational enterprises (MNEs), this has provided opportunities to develop and market technological innovations to facilitate the creation of smart cities, given that the deployment of information and communication technology (ICT) is commonly considered to be a central tenet of smart cities. This paper explores the strategic approaches of three MNEs from the ICT industry (IBM, Cisco, and Accenture) as suppliers of 'smart city technologies', rooted in an international business perspective. Based on qualitative data collected from semi-structured interviews and documentation on firm activities related to smart cities, our study offers two contributions. First, the empirical analysis provides insight into how MNEs have developed resources and capabilities in the smart city realm from a multitude of smart city engagements globally, and shows how firm-specific strategies and programmes for smart cities (IBM Smarter Cities, Cisco Smart + Connected Communities, and Accenture Intelligent Cities) have facilitated this process. Second, it provides an actor-centric perspective on the (potential) role of business in the emergence and spread of technological innovations for urban development, helping to address the need for further insights into (smart) cities and stakeholder involvement in sustainability transitions

Steffen, B., Matsuo, T., Steinemann, D., & Schmidt, T.S., 2018, Opening new markets for clean energy: The role of project developers in the global diffusion of renewable energy technologies. *Business and Politics*, in press

As renewable energy supply chains have grown increasingly globalized, national clean energy transitions have become highly influenced by international dynamics. However, these dynamics are themselves collectively shaped by domestic policy that drives the deployment of renewables. While spatial spillovers of domestic renewable energy policies have been studied on an aggregate level regarding policy diffusion or the flows of technology across countries, implications on an actor-level have been largely neglected. This article addresses this gap by analyzing global patterns of market openings for wind, solar PV, and biomass, focusing on the role of private project developers in developing countries. We use a mixed method design, based on a newly merged dataset encompassing eighty countries, and on interviews with pioneering project developers. Results highlight how patterns in market openings are shaped considerably by technology characteristics. Further, empirical results show international private developers are a key first mover in many developing countries. We explore drivers for this internationalization trend, including the impact of international developers' home country policies and the accumulation of tacit knowledge from home country markets for market openings abroad. Finally, we discuss implications for industrial

policy and argue for further research on global spillovers of national policies on the actor-level.

Jefferson, M., 2018, Exaggeration and/or denial: Twin towers of industrial and commercial interests supposedly intended to accelerate energy transition in the United Kingdom, *Energy Research & Social Science*, 43, 8-15

Over the past twenty years debates on the supply of, and demand for, useful energy have often been characterised by exaggeration on the one part and denial on the other. Exaggeration has primarily come from vested interests in promoting certain forms of renewable energy. These interests have been pitted against fossil fuel ones in claiming the need for transition to a low carbon world. Such views have often taken insufficient account of locational, technical, and other performance limitations. Their views have increasingly rested upon the politicisation of the climatic change debate, despite this topic's basic uncertainties. Local interests and concerns, and the claims of 'populism', have also intruded. Denial has come from those who are inclined to dismiss the notion that human activities can change global near surface temperatures, whereas given the uncertainties a precautionary approach is required. Sustainable energy transformation is occurring, but we also see sub-optimal decision-making and exaggerated claims, as is to be expected in an age of "post-truth politics". "Post-truth politics" need to be abandoned in the genuine pursuit of truth and realism. Failing this, social networking will hinder effective policymaking and its implementation.

Graff, M., Carley, S., Konisky, D.M., 2018, Stakeholder perceptions of the United States energy transition: Local-level dynamics and community responses to national politics and policy, *Energy Research & Social Science*, 43, 144-157

The literature on energy transitions tends to focus on forces operating within entire sectors or across multiple sectors, and usually at the national or international-level. This focus can disguise the fact that transitions often have uneven geographic effects, and specifically adverse consequences for some frontline communities. In this article, we examine how U.S. communities have fared during the current transition toward lower carbon sources of energy. We analyze data compiled from interviews and surveys with stakeholders working in three locations: Detroit, Michigan; St. Louis, Missouri; and Appalachian coal country. We find that a majority of stakeholders perceive evidence of the energy transition in their communities and are concerned about their community's ability to adapt. Our results, however, suggest heterogeneity among perceptions across the study sites. Stakeholders in Appalachia are most concerned about local job loss and employment availability, with more severe implications for younger and older generations, while those in Detroit and St. Louis express more concerns about the rising cost of energy and the implications for low-income residents. We also find that these stakeholder perceptions do not substantially change after recent political shifts at the federal level but sub-national activism and collaboration has increased.

Wyss, R., Mühlermeier, S. and Binder, C.R., 2018, An indicator-based approach for analysing the resilience of transitions for energy regions. Part II: Empirical application to the case of Weiz-Gleisdorf, Austria, *Energies*, 11, 2263

In this paper, we apply an indicator-based approach to measure the resilience of energy regions in transition to a case study region in Austria. The indicator-based approach allows to determine the resilience of the transition of regional energy systems towards higher shares of renewables and potentially overall higher sustainability. The indicators are based on two core aspects of resilience, diversity and connectivity. Diversity is thereby operationalized by variety, disparity and balance, whereas connectivity is operationalized by average path length, degree centrality and modularity. In order to get a full picture of the resilience of the energy system at stake throughout time, we apply the measures to four distinct moments, situated in the pre-development, take-off, acceleration and stabilization phase of the transition. By contextually and theoretically embedding the insights in the broader transitions context and empirically applying the indicators to a specific case, we

derive insights on (1) how to interpret the results in a regional context and (2) how to further develop the indicator-based approach for future applications.

Fastenrath, S. and Braun, B., 2018, Lost in transition? Directions for an economic geography of urban sustainability transitions, *Sustainability*, 10(7), 2434

Socio-technical transitions towards more sustainable modes of production and consumption are receiving increasing attention in the academic world and also from political and economic decision-makers. There is increasing demand for resource-efficient technologies and institutional innovations, particularly at the city level. However, it is widely unclear how processes of change evolve and develop and how they are embedded in different socio-spatial contexts. While numerous scholars have contributed to the vibrant research field around sustainability transitions, the geographical expertise largely has been ignored. The lack of knowledge about the role of spatial contexts, learning processes, and the co-evolution of technological, economical, and socio-political processes has been prominently addressed. Bridging approaches from Transition Studies and perspectives of Economic Geography, the paper presents conceptual ideas for an evolutionary and relational understanding of urban sustainability transitions. The paper introduces new perspectives on sustainability transitions towards a better understanding of socio-spatial contexts.

Kuokkanen, A. and Yazar, M., 2018, Cities in sustainability transitions: Comparing Helsinki and Istanbul, *Sustainability*, 10, 1421; doi:10.3390/su10051421

Systemic sustainability transitions are manifested as the needed scope to meet sustainability challenges at the local and global scales. While sustainability transitions are ubiquitous, each transition is nested in a specific spatial context. Especially, due to accelerating urbanization, cities are increasingly important agents, but they are also understudied geographical loci of change. Urban transitions are interesting because they operate at both the national and global scales, concentrating people, wealth, and resources. They have both regime and niche elements, as they act as an incubation space for novel experiments, ideas, and alternative social movements. Thus, this paper aims to improve understanding of the geographical context and spatial scales from a multilevel perspective and develop a framework for analytic comparison. Furthermore, the paper draws insights from two empirical cases, namely the cities of Helsinki and Istanbul. Consequently, opportunities and challenges for instigating context-specific sustainability transitions can be identified.

Skjølsvold, T.M., Throndsen, W., Ryghaug, M., Fjellså, I.F., Koksvik, G.,H., 2018, Orchestrating households as collectives of participation in the distributed energy transition: New empirical and conceptual insights, *Energy Research & Social Science*, 46, 252-261

Building on recent dialogue between sustainability transition theories and Science and Technology Studies (STS), this article conceptually and empirically studies and analyses the orchestration of households as collectives of participation in the process of distributed energy transition. Synthesising across past studies, we explore three types of what we call 'collectives of orchestration', relatively durable collectives that work to orchestrate participation at a distance in space and time. These are: a) collectives of policy production and regulation, b) collectives of research, development and innovation, and c) collectives of technology design. We explore how these collectives enroll households, and the ways in which they mediate participation through different strategies and techniques, producing conditions for various modes of participation. We proceed to discuss the co-production of participation in and by households, including ways in which households can re-configure issues around which research and demonstration projects are set up. Through this exercise, we identify four distinct processes through which orchestration is enacted: 1) the production of visions, expectations and imaginations, 2) network construction and re-configuration, 3) scripting and 4) domestication.

Yu, Z. and Gibbs, D., 2018, Social ties, homophily and heterophily in urban sustainability transitions: User practices and solar water heater diffusion in China, *Energy Research & Social Science*, 46, 236-244

This paper aims to explore the potential of latecomer cities in sustainability transitions from the demand side. The case study investigates the role of users and their social ties in influencing the popularisation of solar water heaters in a latecomer city Dezhou, in contrast to a more developed counterpart, Beijing. The two cities show vast differences in user preferences towards the low-tech environmental innovation, and the stronger social ties in Dezhou facilitate the diffusion through not only frequent social learning and peer pressure, but also enhancing user-producer trust and relation. These findings suggest that latecomer cities could provide less harsh selection environments for disruptive environmental innovations and their comparatively homogenous social ties could be harnessed to empower niche development.

Kemp-Benedict, E., 2018, Investing in a green transition, *Ecological Economics*, 153, 218-236

At the Rio + 20 conference the world's governments affirmed a need to transition toward green economies, and background reports in preparation for the event emphasized the role of investment. Subsequent authors noted that private investment flows overwhelm public ones, arguing that private investment must be mobilized for a transition. However, the role of private investment in a major economic transition is poorly understood, particularly when the investment is not inherently attractive to investors and must be made attractive through policy. We present a model representing investment-macroeconomic interactions with classical features. Among its novel features is a distinction between “affected” sectors, which are sensitive to the amount of green capital in the economy because of network effects and forward-backward linkages, and “unaffected” sectors, which are relatively insensitive. We argue that affected sectors are both harder to change and nearer to the base of the economy. In model runs, we observe that in a green transition, the affected sector lags the unaffected sector with possible implications for a transition strategy. Thus, in the model, firm and investor behavior postpones deeper and more systemic changes until late in the transition.

Alvial-Palavicino and Opazo-Bunster, J., 2018, Looking back to go forward? The interplay between long-term futures and political expectations in sustainability transitions in Chile, *Futures*, in press

One of the challenges of energy transitions is implementing governance schemes able to frame socio-technical transformations. This involves aligning the views and interests of diverse actors, guiding and intervening as a means of realizing a long-term vision. Backcasting is a technique often used in sustainability transitions, but its use is relatively new to emerging and developing countries. This paper follows Energy 2050, a long-term policy design exercise developed in Chile. In a country with few mechanisms for energy planning, Energy 2050 was to produce a long-term policy with social legitimacy; a roadmap of interventions leading the transition to a sustainable energy system. We analyse the introduction of novel, future-oriented methods in the Chilean context as a “policy innovation”, focusing on the trade-offs between long-term thinking and the instrument’s immediate value. Focusing on the role of consensus-building, visioning and scenario building, and participation, we show the reflexive relation between promises and expectations, and the process that shapes them, highlighting how expectations about policies shape and limit the way in which futures are imagined and articulated. In this respect, we stress the importance of designing backcasting exercises which consider the political cultures in which they are embedded.

Schaffartzik, A. and Fischer-Kowalski, M., 2018, Latecomers to the fossil energy transition, frontrunners for change? The relevance of the energy ‘underdogs’ for sustainability transformations, *Sustainability*, 10(8):2650

The global energy system subsumes both extreme wealth (and waste) and extreme poverty. A minority of the global population is consuming the majority of the fossil fuel-based energy and causing global warming. While the mature industrialized economies maintain their high levels of energy consumption, the emerging economies are rapidly expanding their fossil energy systems, emulating traditional patterns of industrialization. We take a global, socio-metabolic perspective on the energy transition phases—take-off, maturation, and completion—of 142 countries between 1971 and 2015. Even within our global fossil energy system, the transition to fossil energy is still ongoing; many countries are in the process of replacing renewable energy with fossil energy. However, due to globally limited supplies and sinks, continuing the fossil energy transition is not an indefinite option. Rather than a “Big Push” for renewable energy within pockets of the fossil energy system, a sustainability transformation is required that would change far more than patterns of energy supply and use. Where this far-reaching change requires pushing back against the fossil energy system, the energy underdogs—the latecomers to the fossil energy transition—just might come out on top.

Sarrica, M., Richter, S., Thomas, S., Graham, I. and Mazzara, B.M., 2018, Social approaches to energy transition cases in rural Italy, Indonesia and Australia: Iterative methodologies and participatory epistemologies, *Energy Research & Social Science*, in press

Energy transition is often described as the shift from deterritorialised models developed in tandem with the rise of capitalism towards a paradigm based on small-scale infrastructures and short supply chains. In this new paradigm the local dimension is pivotal. This paper takes a self-reflective stance on situated research conducted with local communities in Italy, Indonesia and Australia. The three rural communities are characterised by community ownership of energy production sites (past, current, and future ownership respectively), and by the copresence of alternative visions of energy sustainability among the locals. Drawing on the research experiences the paper reflects on the interrelated methodological, epistemological, and practical challenges encountered. Immersive and participatory approaches enabled the research teams to avoid prescriptive approach to the research, to access local understandings of energy and sustainability, and to gain insights into local interactions between multiple forms of knowledge and power. Across the three cases, methodological and epistemological challenges call for a careful consideration of the role of research and its interaction with power dynamics, capacity of collecting voices and knowledges, and democratization goals. Such challenges are discussed taking into account the “transferability” of methods and approaches across space, time and related project specificities.

Noboa, E. and Upham, P., 2018, Energy policy and transdisciplinary transition management arenas in illiberal democracies: A conceptual framework, *Energy Research & Social Science*, 46, 114-124

While the theory and practice of transition management has been articulated and tested in Europe, little work in this vein has been undertaken in illiberal democracies, where state institutions may be captured by commercial interests, clientelism may operate and democratic rights may be constrained. We argue that a combination of insights from transition management and transdisciplinary research offers a basis for developing local strategies by which informal institutions can nurture alternative energy policy visions and prescriptions, in order to exploit policy windows that periodically arise. We articulate a conceptual framework to underpin such strategies, which emphasises the role of academics or other knowledge brokers as policy entrepreneurs, helping to build knowledge and capabilities, create networks of social capital and establish alternative discourse coalitions. While our particular applied interest here is in arenas for the development of low carbon energy scenarios in Latin America, the framework is also intended to have wider applicability.

Ryghaug, M., Skjølsvold, T. M., & Heidenreich, S., 2018, Creating energy citizenship through material participation. *Social Studies of Science*, 48(2), 283-303.

Transitions towards low-carbon energy systems will be comprehensive and demanding, requiring substantial public support. One important contribution from STS is to highlight the roles of citizens and public engagement. Until recently, energy users have often been treated as customers and passive market actors, or as recipients of technology at the margins of centralized systems. With respect to the latter role, critical or hesitant public action has been explained in terms of NIMBYism and knowledge deficits. This article focuses on the production of energy citizenship when considering public participation in low-carbon energy transitions. We draw upon the theory of 'material participation' to highlight how introducing and using emergent energy technologies may create new energy practices. We analyze an ongoing introduction of new material objects, highlighting the way these technologies can be seen as material interventions co-constructing temporalities of new and sustainable practices. We argue that artefacts such as the electric car, the smart meter and photovoltaic panels may become objects of participation and engagement, and that the introduction of such technologies may foster material participation and energy citizenship. The paper concludes with a discussion about the role of policies for low-carbon energy transitions on the making of energy citizenship, as well as limits of introducing a materially based energy citizenship.

Carrington, G. and Stephenson, J., 2018, The politics of energy scenarios: Are International Energy Agency and other conservative projections hampering the renewable energy transition?, *Energy Research & Social Science*, 46, 103-113

Scenario-building assists commissioning organisations to understand the multiple forces that shape their future. Governments and investors use the scenario projections of authoritative organisations to help drive their planning and decision-making. But what if scenarios consistently fail to represent a credibly established technology trajectory, particularly for a topic as critical as the world's future energy systems? We examine solar PV projections in 26 recent global energy scenarios, contrasting them with academic studies and other analyses, and find that they all fail to account fully for technology developments and recognise plausible upper levels of solar PV growth. Drilling deeper into the influential World Energy Outlook scenarios of the International Energy Agency, which are amongst the more conservative of the 26 scenarios, we explore possible reasons for, and the implications of, their projections for solar PV growth. We conclude that low scenario projections such as the IEA's are likely to deter investments in innovation and development that would otherwise occur. If authoritative scenarios fully acknowledge the possibility of continuing rapid growth of solar PV, investors, governments and the energy sector will be encouraged to take a more optimistic view of the market potential, thus creating positive feedback loops of belief, investment, and growth.

Warbroek, B., Hoppe, T., Coenen, F. and Bressers, H., 2018, The role of intermediaries in supporting local low-carbon energy initiatives, *Sustainability*, 10(7):2450

Recent scholarly attention shows that grassroots civil society low-carbon energy initiatives increasingly become part of the subnational climate change governance landscape. Despite their potency in view of consumer-owned distributed generation and enhanced citizen influence in the organization of the energy infrastructure, local low-carbon energy initiatives (LLCEIs) struggle to become viable alternatives to the centralized, private oriented energy system. To further LLCEI development, support needs to build their capacities; alleviate institutional hurdles and barriers stemming from the fossil fuel-based energy regime; and open up the system for the uptake, acceptance or breakthrough of LLCEIs. Evidence suggests that so-called "intermediaries" form a part of the solution in addressing these issues. Despite previous attempts at analyzing intermediary roles and activities vis-à-vis the development of community energy, the reality of the various roles and strategies intermediaries can employ and the support LLCEIs require to further develop have not yet been synthesized in a comprehensive analytical framework. This article aims to fill this gap

by developing such a framework. We reflect on the analytical framework by evaluating the intermediary support structure in a specific case: the Province of Fryslân. From the analysis, we conclude that the Frisian case provided modest support to the claim that intermediary support is effective in addressing the needs of LLCEIs as the strategies and roles observed represent a complete and coherent support structure.

Von Wirth, T., Fuenfschilling, L., Frantzeskaki, N. and Coenen, L., 2018, Impacts of urban living labs on sustainability transitions: Mechanisms and strategies for systemic change through experimentation, *European Planning Studies*, in press

Urban Living Labs (ULL) are considered spaces to facilitate experimentation about sustainability solutions. ULL represent sites that allow different urban actors to design, test and learn from socio-technical innovations. However, despite their recent proliferation in the European policy sphere, the underlying processes through which ULL might be able to generate and diffuse new socio-technical configurations beyond their immediate boundaries have been largely disregarded and it remains to be examined how they contribute to urban sustainability transitions. With this study, we contribute to a better understanding of the diffusion mechanisms and strategies through which ULL (seek to) create a wider impact using the conceptual lens of transition studies. The mechanisms of diffusion are investigated in four distinct ULL in Rotterdam, the Netherlands and Malmö, Sweden. The empirical results indicate six specific strategies that aim to support the diffusion of innovations and know-how developed within ULL to a broader context: transformative place-making, activating network partners, replication of lab structure, education and training, stimulating entrepreneurial growth and narratives of impact.

Puerari, E., De Koning, J.I.J.C, von Wirth, T., Karré, P.M, Mulder, I., Loorbach, D. (2018) Co-creation dynamics in urban living labs; *Sustainability* 10(6), 1893

Citizens and urban policy makers are experimenting with collaborative ways to tackle wicked urban issues, such as today's sustainability challenges. In this article, we consider one particular way of collaboration in an experimental setting: Urban Living Labs (ULLs). ULLs are understood as spatially embedded sites for the co-creation of knowledge and solutions by conducting local experiments. As such, ULLs are supposed to offer an arena for reflexive, adaptive, and multi-actor learning environments, where new practices of self-organization and novel (infra-) structures can be tested within their real-world context. Yet, it remains understudied how the co-creation of knowledge and practices actually takes place within ULLs, and how co-creation unfolds their impacts. Hence, this paper focuses on co-creation dynamics in urban living labs, its associated learning and knowledge generation, and how these possibly contribute to urban sustainability transitions. We analyzed empirical data from a series of in-depth interviews and were actively involved with ULLs in the Rotterdam-The Hague region in the Netherlands. Our findings show five distinct types of co-creation elements that relate to specific dynamics of participation, facilitation, and organization. We conclude with a discussion on the ambivalent role of contextualized knowledge and the implications for sustainability transitions.

Bulkeley, H., Marvin, S.J., Voytenko Palgan, Y., McCormick, K., Breiffuss-Loidl, M., Mai, L., von Wirth, T., Frantzeskaki, N., 2018, Urban living laboratories: Conducting the experimental city?, *European Urban and Regional Studies* (in press)

The recent upsurge of interest in the experimental city as an arena within and through which urban sustainability is governed marks not only the emergence of the proliferation of forms of experimentation – from novel governance arrangements to demonstration projects, transition management processes to grassroots innovations – but also an increasing sensibility amongst the research community that urban interventions can be considered in experimental terms. Yet as research has progressed, it has become clear that experimentation is not a singular phenomenon that can be readily understood using any one conceptual entry point. In this paper, we focus on one particular mode of experimentation – the urban living

laboratory (ULL) – and develop a typology through which to undertake a comparative analysis of 40 European ULLs, to understand how and why such forms of experimentation are being designed and implemented, and to identify the particular forms of experimentation they entail. We argue that there are distinct types of ULL taking shape, delimited by the ways in which they are designed and deployed through, on the one hand, specific kinds of configuration and practice and, on the other hand, by the ways in which they take laboratory form: the different dispositions towards the laboratory they entail. We propose three ‘ideal’ ULL types – strategic, civic and organic – and argue that these can be placed along the spectrum of four dispositions: trial, enclave, demonstration and platform.

Edling, L. and Danks, C., 2018, To adopt or not to adopt? That was our question: Insights on energy transitions from a study of advanced wood heating, *Energy Research & Social Science*, in press

The study of energy system transitions requires research methods that incorporate multilayered systemic factors that span shifts in time, contexts, and actor groups. To integrate this complexity into energy transition research can be a daunting methodological challenge. However, it can illuminate how an energy system operates and help identify the levers that influence a transition to sustainable energy sources. This article describes how a multistate study of the strategies and policies to promote advanced wood heating technology in the northeastern United States encountered methodological challenges indicative of the broader problems faced in energy system transitions. In particular, we found that changes in macrolevel systemic factors (e.g. price of oil) and the early stage of diffusion of this particular technology complicate sampling and ultimately affect the application of results. While a participatory research approach and use of key informants helped in developing the sampling strategy, survey questions and access to study participants, it also introduced logistical difficulties and the potential for pro-innovation bias. We describe the mixed methods used to capture the systemic factors that affect adoption of this technology and highlight implications for research on interventions that seek to promote alternative energy technologies.

Davidescu, S., Hiteva, R. and Maltby, T., 2018, Two steps forward, one step back: Renewable energy transitions in Bulgaria and Romania, *Public Administration*, in press

This article examines renewable energy policy in Bulgaria and Romania (2007–17) and the reasons behind the unexpected rapid growth in renewables followed by a policy reversal. While we find strong formal compliance with EU legislation regarding targets for renewable energy, an examination of institutional change and policy dismantling in both countries finds that this was not supported by a paradigmatic policy change or a transformation of the energy system. Veto players worked to dismantle renewable energy policy once targets were reached. We use insights from the intersection of socio-technical systems and historical institutionalist literatures to explain policy dismantling in the energy sector. In doing so, we develop a socio-technical account of renewable policy in Romania and Bulgaria. We show that this is related to the historically conditioned, path-dependent processes of institutional change, where energy materiality shapes the parameters of political possibility and the costs of policy implementation.

Doukas, H., Nikas, A., Gonzales-Equino, M., Arto, I. and Anger—Kraavi, A., 2018, From integrated to integrative: Delivering on the Paris agreement, *Sustainability*, 10(7), 2299

In pursuit of the drastic transformations necessary for effectively responding to climate change, the Paris Agreement stresses the need to design and implement sustainable, robust, and socially acceptable policy pathways in a globally coordinated and cooperative manner. For decades, the scientific community has been carrying out quantitative modelling exercises in support of climate policy design, primarily by means of energy systems and integrated assessment modelling frameworks. Here, we describe in detail the context of a

hitherto ineffective scientific contribution to policymaking, highlight the available means to formulate a new paradigm that overcomes existing and emerging challenges, and ultimately call for change. In particular, we argue that individual modelling exercises alone widen the gap between formal representation and real-life context in which decisions are taken, and investigate major criticisms to which formalised modelling frameworks are subject. We essentially highlight the importance of employing diverse modelling ensembles, placing the human factor at the core of all modelling processes, and enhancing the robustness of model-driven policy prescriptions through decision support systems. These altogether compose a truly integrative approach to supporting the design of effective climate policy and sustainable transitions and, therefore, strengthen the modelling–policymaking interface.

Levin-Keitel, M., Mölders, T., Othengrafen, F., Ibendorf, J., 2018, Sustainability transitions and the spatial interface: Developing conceptual perspectives, *Sustainability*, 10(6), 1880

Sustainability transitions research lacks a crucial perspective: the spatial dimension. The interrelations between space and sustainability transition processes are thus underexposed. The spatial dimension is, of course, implicitly addressed in transition research but it often remains unclear which spatial concept is used and how the spatial conditions are embedded in the transition processes. This paper approaches the problem in two steps: (1) analysing the various understandings of transitions research and their implications for different spatial concepts relating to spatial sustainability transition; and (2) focusing on different spatial concepts (from a positivist mode to relational and socio-cultural approaches) and their reflections in different disciplines of social, natural and technical sciences as well as in practice. By identifying the links between sustainable transition approaches on the one hand and spatial conceptualizations on the other hand, this paper aims at deepening both the spatial perspective and the understanding of sustainable transition research. The results of this paper are three conceptual perspectives wherein space or spatial conceptualizations can provide added value for sustainability transition research in inter- and transdisciplinary modes. These three perspectives include (1) space as a “bridging concept,” (2) space as a “normative concept,” and (3) space as an “approach to action.”

Koehrsen, J., 2018, Exogenous shocks, social skill, and power: Urban energy transitions as social fields, *Energy Policy*, 117, 307–315.

The constantly growing scholarship on urban energy transitions needs a framework to analyze these transitions. This article proposes the Field Perspective (FP) as an approach for the study of urban energy transitions. FP analyses how the interplay of actors, who are dedicated to a similar purpose, and the structures guiding this interplay, co-evolve. By applying FP to the energy transition in the German city Emden, the article shows how the transition evolves through (a) alterations in the exogenous context of the city (e.g. national feed-in-tariffs for renewables), (b) the social skill and changing interplay of local actors engaged in the transition, and (c) the emergence of power-constellations and rules.

Koehrsen, J., 2018, Eco-spirituality in environmental action: Studying dark green religion in the German energy transition, *Journal for the Study of Religion, Culture and Nature*, 12 (1), 34-54.

There is a rising debate about the religious dimensions of environmentalism. A prominent approach to this phenomenon is Bron Taylor’s Dark Green Religion. Taylor proposes that Dark Green Religion is a globally growing phenomenon which involves ‘para-religious’ perceptions and feelings towards nature. Followers of Dark Green Religion would experience feelings of connectedness to nature, consider it to be sacred and worthy of reverent care, and reject anthropocentrism. I discuss Taylor’s argument in the light of a study on an urban energy transition process in Northern Germany. Interviewing actors strongly participating in this process, I found some evidence for features of Dark Green Religion while also revealing ongoing anthropocentric orientations. The findings suggest a need for more

in-depth studies to improve our understanding of eco-religious worldviews among environmentally engaged actors and their impact on sustainability transitions.

Sareen, S. and Haarstad, H., 2018, Bridging socio-technical and justice aspects of sustainable energy transitions, *Applied Energy*, 228, 624-632

Sustainable energy transitions necessarily comprise both socio-technical aspects as well as important implications for social justice. However, in existing scholarship, these are mainly treated as distinct phenomena. The purpose of this paper is to outline a comprehensive approach that pulls together critical aspects of both socio-technical development and energy justice in understanding sustainable transitions. Drawing on the strengths of both sets of literature, we argue that a comprehensive approach requires analyses to account for the co-evolution of *institutional* change, *material* change and *relational* change, with a cross-cutting concern for multiple spatialities and normative implications. We then illustrate this approach through three brief case studies of multi-scalar solar uptake in Portugal, bringing out how justice considerations are intricately involved in the practices and politics of these concrete, broadly representative instances of sustainable energy transitions.

Feola, G., Jaworska, S. 2018. One transition, many transitions? A corpus-based study of societal sustainability transition discourses in four civil society's proposals. *Sustainability Science*, DOI: 10.1007/s11625-018-0631-9.

When the civil society makes 'transition' its label, it cannot be assumed that different civil society actors share compatible varieties of localist or radical transformationists discourses. This study has comparatively analyzed the discourses in four civil society sustainability transition proposals using a corpus-based methodology. We found that the proposals are similar as they identify the economy as an object and an entry point for transition, frame the economy as embedded in the socio-ecological system, ascribe agency to grassroots movements for transitions from the bottom-up. We also found crucial differences among the discourses regarding the role of the State, the degree of reform or radical innovation, the degree of imaginative character of the sustainability vision, the degree of opposition to capitalism. We suggest that insights on how the civil society employs notions of transition with respect to the themes of politics, emotions and place can help advance theorizations and practices of societal sustainability transitions led by the civil society.

Oliver, T., Boyd, E., Balcombe, K., Benton T. G., Bullock, J. M., Donovan, D., Feola, G., Head, M., Mace, G. M., Mortimer, S., Nunes, R. J., Pywell, R., Zaum, D. 2018. Overcoming undesirable resilience in the global food system. *Global Sustainability*, 1, e9.

The current configuration of our global food system is undermining many of the UN Sustainable Development Goals (UN SDGs), leading to calls for major food system reform and transformation. Concurrently, other science-policy and business initiatives call for a food system more resilient to economic and environmental shocks, for example, by improving the economic resilience of current supply chains. Prioritization of short-term security to a subset of vested interests, however, can undermine the resilience of longer term beneficial outcomes for society. Here we advocate a more inclusive and farsighted approach focussing on the resilience of positive outcomes for the whole of society, that is, capturing the aim to promote resilient delivery of multiple UN SDGs. A significant challenge is to prioritize suites of interventions that can effectively transform the global food system to deliver these goals. Here, we use a transdisciplinary lens to identify 'lock-in' mechanisms that span four key areas – knowledge-based, economic/regulatory, sociocultural and biophysical constraints – which will help avoid ineffective siloed solutions to food system reform. Furthermore, we show how emergent system dynamics need to be considered using a more holistic approach. We highlight the importance of well-coordinated actions on multiple leverage points during windows of opportunity for food system transformation.

Kerschner, C., Wächter, P., Nierling, N. and Ehlers, M.-H. 2018, Degrowth and technology: Towards feasible, viable, appropriate and convivial imaginaries, *Journal of Cleaner Production*, 197(2), 1619-1636

Mainstream sustainability discourses are firmly built on the mantra that more technology leads to more economic growth, which in turn leads to more welfare and sustainability. With economic growth becoming ever more difficult and undesirable, and sustainability challenges ever more pressing, alternative post-growth and Degrowth discourses have gained momentum in the last decade. However, the role of technology on the path towards a 'Degrowth Society' is far from clear and subject to intense debate between enthusiasts and sceptics of technology. This editorial to the special issue on 'Degrowth and Technology' represents the first in-depth analysis of the multiple perspectives on technology present in the Degrowth community. Using an artistic analogy, we illustrate four main areas of exploration for a future Degrowth and Technology research agenda: 1) theoretical and conceptual approaches, 2) case studies of innovative socio-technical arrangements, 3) evaluation of technologies according to their feasibility, viability, appropriateness and conviviality and 4) governance approaches. Moreover, we identify and discuss reoccurring themes in the texts such as energy, agency and democratisation of technology and introduce new concepts such as 'Degrowth Technology' and 'Degrowth Society'. Finally, we offer guidance for future research and for the development of a shared socio-technological imaginary of the Degrowth community.