

Newsletter 24: June 2017

This is the 24th newsletter from the steering group of the Sustainability Transitions Research Network. The newsletter is divided into the following sections:

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

The STRN steering group

Words from the Chairman

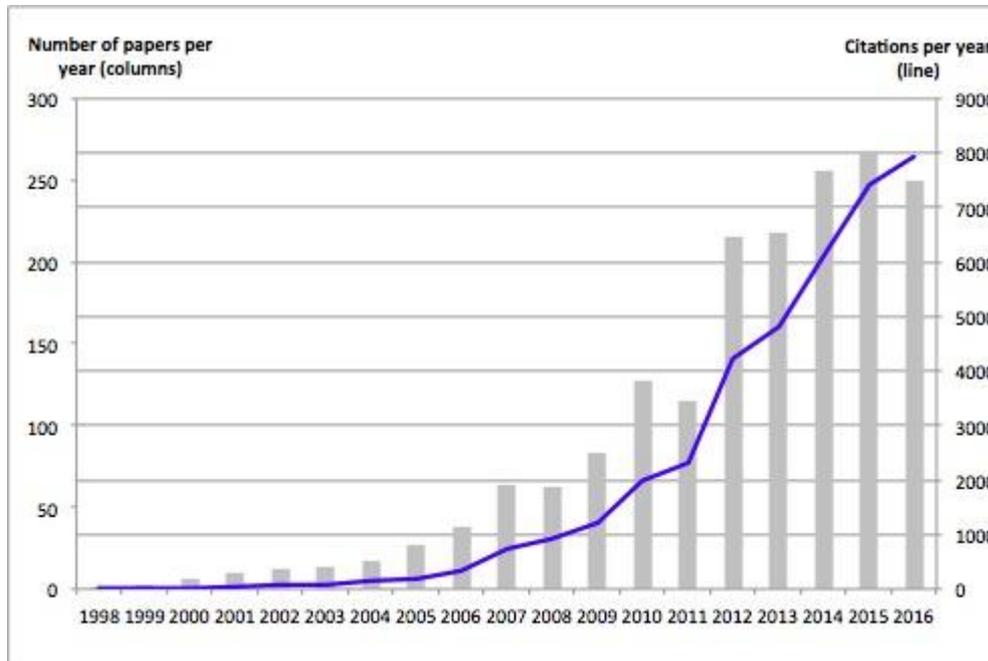
Dear transition research colleagues,

It was great to see so many of you at the 8th International Sustainability Transitions conference in Gothenburg, which was very well organized and highly stimulating in terms of content and social events. With 470 attendants it was the largest conference in the IST-series, but the high number did not lead to lower quality, which is indicative of a quality improvement trend. I've heard several people suggest that the transitions community may be entering a second phase because of several developments: 1) move from a small set of innovation-oriented theories to a wider set of questions and perspectives, 2) diversification in terms of countries, disciplinary backgrounds, and universities, 3) increased political impact and visibility, as sustainability transitions are beginning to gain pace in the real-world (this was also visible in the high-level speakers in the policy engagement session), 4) increasing specialization on sub-themes, which enable focused discussions and depth. This last development, however, also raises the risk of the 'donut-model' (a metaphor used by Lars Coenen at the second IST-conference in Lund, 2011): that increasing disciplinary specialization (which is probably inevitable for expanding fields) leads to less attention for multi-actor processes and co-evolution of multiple system dimensions (the 'missing middle').

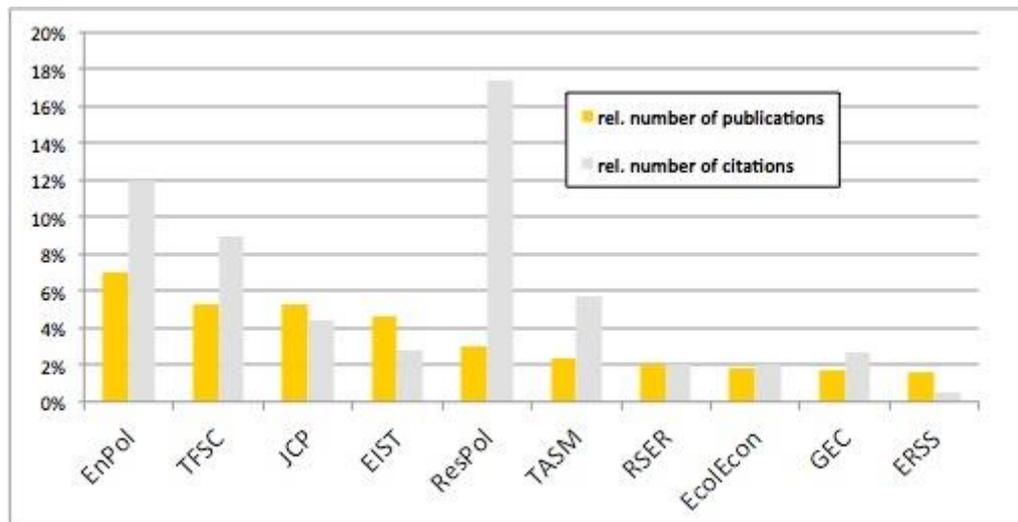
On the whole, these developments are positive in contributing to a vibrant and intellectually stimulating field. There was a real buzz at IST-2017, which makes me very positive about the future and our ability to address possible dilemmas. I want to thank the Gothenburg organisers for this wonderful event and wish the Manchester organisers (including myself) good luck in emulating this success.

With regard to STRN, I'd like to draw your attention to a few novelties. First, our membership continues to increase and has now reached 1358 (see update Rob Raven below). Second, our website has been renewed (<https://transitionsnetwork.org/>), which has improved access and navigability. I particularly want to thank Jens Marquardt for his excellent work on this! Third, we have made some further changes to the composition of the STRN Steering Group (see update Jochen Markard below). I particularly want to thank members that are stepping down for their support and contributions to the Steering Group over the past years. These members include: John Grin, Flor Avelino, Fjalar de Haan, Uwe Schneidewind, and Marko Hekkert. Fourth, the various working groups of STRN and the Steering Group have been active in the past year. Updates from these working groups can be found under the 'network news' category in this newsletter.

Another encouraging development is that the number of annual publications on sustainability transitions continues to increase, as the figure below shows. This figure, which was made by Jochen Markard using his database of transition papers, also shows that citations to these articles continues to grow, signaling increasing academic impact of our community.



Jochen’s analysis also reveals in which journals most transition papers and citations have been published. This analysis shows that energy/sustainability journals and innovation studies journals (TFSC, RP, TASM) are the most important outlets. We have, so far, less visibility in disciplinary journals (in sociology, business/management, political science etc).



To further assess our academic impact, I looked at the ‘most cited’ and ‘most downloaded’ in these journals (which you find on the journal websites). The table below shows how many transition-related articles were present in both categories. Clearly, transition-related articles are having a very large impact in the three innovation studies journals: transitions are clearly one of the main topics of debate in innovation studies, attracting both high citations (as an indication of past success) and high downloads (indicating contemporary interest). There is

also high interest in transitions in ERSS, and somewhat less in Energy Policy (although this journal publishes so many papers that ‘drowning out’ effects occur). The other five journals from Jochen’s analysis show less sign of high impact of transition-related articles. Maybe transition articles in these journals are being drowned out by high numbers of other publications (JCP, for instance, publishes many papers each issue). Or perhaps, researchers in these journals are (so far) less interested in transition articles (the qualitative, big picture, interdisciplinary style may not resonate with all journals...). On the one hand, this brief analysis underlines the importance of choosing the ‘right’ journal for your articles. On the other hand, it suggests there is still a world to win, which may require careful tailoring of transition articles to ongoing debates in those other journals.

	Most cited in last 5 years	Most downloaded in last 90 days
Research Policy	4 in top-25	5 in top-25
Technological Forecasting and Social Change	4 in top-25	1 in top-25
Technology Analysis & Strategic Management	6 in top-10 (all years)	5 in top-10
Energy Policy	2 in top-25	3 in top-25
Energy Research and Social Science	5 in top-25	5 in top-25
Global Environmental Change	1	1
Renewable & Sustainable Energy Reviews	0	1
Journal of Cleaner Production	0	1
Ecological Economics	0	0

Another observation is that the topic of transitions is attracting increasing attention from mainstream disciplines (like economics, engineering, integrated assessment modelling), which are not always aware of STRN-related research. As the transitions area is getting more ‘crowded’, it will be a challenge for STRN to maintain its identity and visibility vis-a-vis mainstream disciplines (which are often larger, more resources, and better connected). This also applies to policy engagement, where I recently learned about the existence of the Energy Transitions Commission (<http://www.energy-transitions.org/>). This commission consists of celebrities like Al Gore and Nicholas Stern, but also of CEOs from major companies (BHP Billiton, Shell, Tata, Bank of America), industry disruptors, equipment suppliers, non-profit organizations, advisors, and academics. On the one hand, this is important and probably necessary to gain global traction. On the other hand, their approaches and views are rather mainstream and dominated by economics and engineering. STRN-researchers may have useful complementary insights to offer, but it is a challenge to be heard and seen as the transitions area becomes more crowded. Perhaps we need to build alliances with established academic and policy actors? Or perhaps we need to engage more actively with policymakers (as some STRN-related research groups are already doing)?

So, as STRN is perhaps moving into a second phase, we should be both proud of historical achievements and aware of future challenges (and opportunities) in the broader environment. This newsletter informs you about more recent achievements in the last few months, informing you about new projects, events and articles. I hope you enjoy reading it and wish you all a very good and enjoyable summer.

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

PS. The references of the most-cited and most-downloaded articles are available on request.

Environmental Innovation and Societal Transitions

Volume 23 of *Environmental Innovation and Societal Transitions* has just been published in June. It concerns a special issue about “Sustainability Perspectives on the Sharing Economy”. In the editorial to it, guest editor Koen Frenken from Utrecht University gives a brief account of this new topic and summarizes the special issue. This is followed by nine original articles:

- Putting the sharing economy into perspective, by Koen Frenken and Juliet Schor
- A netnographic study of P2P collaborative consumption platforms' user interface and design, by Javier de Rivera, Ángel Gordo, Paul Cassidy and Amaya Apesteguía
- Sharing for people, planet or profit? Analysing motivations for intended sharing economy participation, by Lars Böcker and Toon Meelen
- Millennials and the sharing economy: Lessons from a 'buy nothing new, share everything month' project, by Raz Godelnik
- Theorising the dynamics of collaborative consumption practices: A comparison of peer-to-peer accommodation and cohousing, by Andreas Huber
- Sustainability framings of accommodation sharing, by Yuliya Voytenko Palgan, Lucie Zvolska and Oksana Mont
- Mobility and environmental impacts of car sharing in the Netherlands, by Hans Nijland, Jordy van Meerkerk
- Framing the collaborative economy —Voices of contestation, by Katarzyna Gruszka
- Neoliberalism and the legality of peer platform markets, by Derek McKee

We hope you will find this issue inspiring and offering useful connections with your own research on sustainability transitions. As always, we look forward to receive your submissions and comments. Don't forget to read, and if relevant cite, EIST.

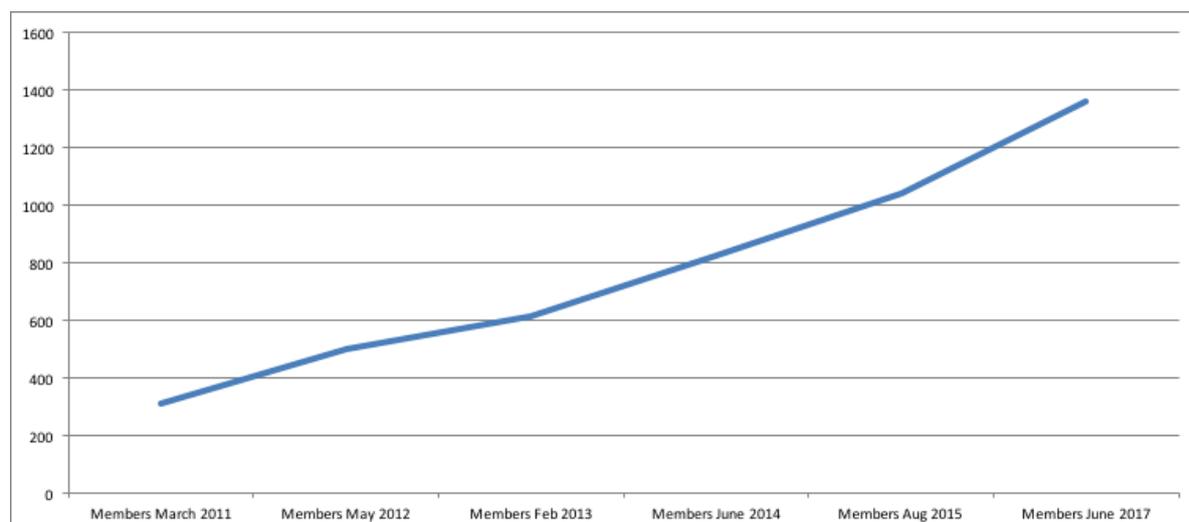
Jeroen van den Bergh, Editor-in-Chief [jeroen.bergh@uab.es]

Network News

Any news related to ongoing activities of STRN

Update on STRN website and membership

We are very pleased to announce that the STRN website has received an update. Whilst the website has a new, nicer frontend, the largest improvements is a shift in backend. The website now runs on Wordpress, which makes it a lot easier to make changes in the future. There may still be a few bugs, which we hope to fix in the coming period. Here I would like to express major thanks to Jens Marquardt from the Free University Berlin, who has been extremely helpful in moving the website, and who has kindly agreed to continue to be involved in future website management. Also thanks to Jochen Markard for providing feedback along the way. In the meanwhile, the STRN community continues to grow with registered membership now over 1358 members (compared to about 1000 members two years ago, and about 600 members 4 years ago). **Rob Raven** (r.p.j.m.raven@uu.nl).



Update on the STRN research manifesto

The STRN Steering Group has formed a working group to update the STRN research agenda, written in 2010. The working group has organised an extensive process of consultation with the STRN community. The ideas from IST 2015 at SPRU have been reviewed and further ideas for topics were received from STRN members in December 2016. The working group has asked several scholars to draft initial 3 page outlines for the following themes, taking into consideration the wide range of suggestions:

1. Understanding transitions
2. Governance, power and politics in transitions
3. Civil society, culture and social movements in transitions
4. Organizations, business, firms and industries in transitions
5. Transitions in practice and everyday life
6. Geography of transitions: Spaces, scales, places
7. Ethical aspects of transitions: distribution, justice, poverty, gender
8. Implementing transitions and instruments for stimulating transitions
9. Methodologies for transitions research

The working group is now in the process of reworking these drafts, so that they each have:

a) a brief summary of the topic, b) state of the art description, c) suggestions for future research directions. These brief summaries are complemented by references for further reading and are intended to form an introduction to the issues addressed in transitions research. We wish to emphasise that this agenda is neither comprehensive nor exclusive. It is not the role of the agenda to limit the directions in which transitions research develops; indeed the broadening of the themes and methods that we have seen at IST 2017 in Gothenburg is very encouraging.

Due to unfortunate delays, the working group did not manage to complete the new research manifesto before IST-2017. We are now in the process of consolidating the sections into a consistent format and then the steering group will have the opportunity to review and comment. The agenda will be published on the STRN website and we hope that it will facilitate a discussion of the directions of transitions research. We would like to thank all those who have contributed and we will of course acknowledge all the authors involved.

Jonathan Kohler (Jonathan.Koehler@isi.fraunhofer.de)

Update on STRN Steering Group

Moreover, the STRN steering group welcomes Floortje Alkemade (TU Eindhoven), Anna Bergek (Chalmers University) and Susan Mühlemeier (EPFL Lausanne, special representative for the 'PhDs in transitions' network) as new members. We also congratulate Anna Wieczorek and Jonathan Köhler on being re-elected. With 24 applications, we had an overwhelming response to this year's call for SG members and we thank all applicants for their willingness to support the network. We will also establish a new thematic group on policy outreach, which will be coordinated by Bruno Turnheim (bruno.turnheim@kcl.ac.uk) and Kathy Arau (Kathleen.Araujo@stonybrook.edu).

Jochen Markard (jmarkard@ethz.ch)

Update on the PhDs in Transitions network

Following its inception during the preparations for the 6th IST Conference in Brighton, UK, the PhDs in Transitions Network has consistently developed in terms of generated content, events and membership numbers. The initial set of PhD-led activities connected to the network took place at the IST, and included a newcomer session where a mixed panel of Transitions scholars discussed key theoretical concepts, a series of agenda-generating sessions chaired by PhD students and a career pathway workshop. Representatives of the initial core group also presented the network idea to the STRN steering committee.

Following the conference, the developing network set up an online presence in the form of a Wordpress blog (<https://phdsintransitions.wordpress.com/>), and initiated a mailing list which was used to disseminate relevant information. The network blog is used to disseminate important information from the Transitions community aimed at PhD students, publish

reports from conferences, summer schools and similar events, and provide useful advice for early career researchers. In addition to the blog, the network periodically publishes short editorials and updates in the STRN newsletter. The next key network activity was the organisation of the first network conference, which took place on April 27th and 28th 2016 at the University of Greenwich, London, UK. Further discussion and dissemination of information was done in the form of a webinar session, and informally at the 50th Anniversary SPRU Conference in Brighton, UK. Entering into 2017, the PhDs in Transitions Network is rapidly growing. The active core counts about 10 PhDs and ECRs from the Netherlands, Germany, Kenya, Switzerland and the United Kingdom, meeting twice a year and coordinating the network's activities aiming at the representation of the PhDs and ECRs in the transition community. The second edition of the PhDs in Transitions conference was organised at the EPFL, Lausanne, Switzerland. It was a real success with more than 50 PhD students and early career scholars presenting their work, with sessions, workshops and keynotes by around 20 senior researchers, who also provided feedback to the conference participants. The PhDs in Transitions had an active presence at the IST2017 in Gothenburg, Sweden, organising another newcomer session and a PhD workshop supported by multiple senior Transitions researchers. We are looking forward to extending our network with new members and new ideas! So, if you are interested, please contact us or register online.

Susan Mühlemeier (susan.muehlemeier@epfl.ch) and **Anton Sentić**
(A.Sentic@greenwich.ac.uk)

Update on the TransLACASAF network (Transitions in Latin America and the Caribbean, Asia and Africa)

Ever since Brighton, the annual IST conferences are major events where the network can meet. During IST-2016 in Wuppertal we have had one dedicated session and an informal lunch meeting where we discussed ways to move forward. The network decided to continue with the webinar series, try to encourage participation of the STRN committee members in these online sessions and develop an online participant list. The webinars however, as much as they attracted sufficient interest, they were technically challenging. With people calling in from all over the world and often with poor internet connection, the quality of the webinar suffered. We therefore decided to give this activity up for the time being. We stayed with an email list. At the IST-2017 in Gothenburg we have reconnected again. There were a number of great sessions dedicated to the theme of developing world transitions and one dialog session where research agenda on this theme was discussed in an interactive manner. We hope the network and the activities will get a new kick from now on. We are shifting to a new mailing list and whoever provided contact details then, will be included in that list. If you are not or not sure but would like to be included, please contact Anna. We also plan a small sub-page in the STRN website to inform about developments, articles and activities of the network members. In terms of research output, two or three special issues are being produced on various aspects of systemic change in the developing contexts. The overall number of publications on this very broad theme grows. **Anna Wieczorek**
(A.J.Wieczorek@tue.nl)

Update on the TransLACASAF network (Transitions in Latin America and the Caribbean, Asia and Africa)

Ever since Brighton, the annual IST conferences are major events where the network can meet. Also IST-2016 in Wuppertal brought a number of scholars interested in studying transitions in the emerging and developing world together. As a network we have had one dedicated session and an informal lunch meeting where we discussed ways to move forward. For example, the network decided to continue with the webinar series, try to encourage participation of the STRN committee members in these online sessions and develop an online participant list. The webinars however, as much as they attracted sufficient interest, esp. from the PhD students, were not highly attended by senior researchers, who could provide with comments and feedback. I could not do all of them.

Furthermore, with people calling in from all over the world and often with poor internet connection, the quality of the webinar suffered. We therefore decided to give this activity up. We stayed with an email list. At the upcoming IST-2017 in Gothenburg we have reconnected again. There were a number of sessions dedicated to the theme of developing world transitions and one dialog session where research agenda on this theme will be discussed in an interactive manner (unconnected with what we do now at STRN). I have also organised an informal get together to discuss further development of the network. I hope with the engagement of Helene Ahlberg from Chalmers, the network and the activities will get a new kick. In terms of research output, two or three special issues are being produced on various aspects of systemic change in the developing contexts. The overall number of publications on this very broad theme grows. **Anna Wiczorek** (A.J.Wiczorek@tue.nl)

Update on the STRN journal *Environmental Innovation and Societal Transitions (EIST)*

EIST is slowly becoming a household name. The number of article submissions to it and the speed of editorial handling of submissions is stable over time. In line with this, the publication of volumes (previously called issues) is regular. Elsevier has decided that EIST will move to so-called “Article Based Publishing” (APB), meaning that after acceptance articles will immediately be published online with volume and page number. According to Elsevier, allows for separate listing of subscription and open access content, which arguably improves visibility of the latter. This may in turn contribute to more citations. EIST has a Scopus CiteScore of 2.65 (<https://journalmetrics.scopus.com>) which is reasonable. Many older and respectable journals with an official impact factor score lower. The assignment of such an impact factor by Thomson/Reuters is still uncertain. As noted, the process for formal inclusion in their database/index system is not very transparent. Elsevier has little influence over it, and evidently doesn't want to risk its relationship with Thomson/Reuters for a single journal. The main strategy we can follow is assure that EIST is well read and cited, so that it is at a certain point impossible to ignore it by Thomson/Reuters. This requires continuing with the serious review procedure we have always imposed upon EIST. In addition, researchers on EIST themes have to think about relevant EIST articles when they make references to literature in their studies. Several special issues are in preparation: “low-carbon China” (Sam Geall, SPRU), “grassroots policies” (Filippo Celata et al.), “The role of history for policy” (Peter Pearson from Imperial College London) and “Learning in Sustainability Transitions” by Barbara van Mierlo (Wageningen University) and others. The original plan to have a special issue on “IST2016” was cancelled by Wuppertal. The special issue “Sustainability Perspectives on the Sharing economy” (edited by K. Frenken) was just published in June. Last year we published a special section on “The politics of innovation spaces for low-carbon energy” (edited by R. Raven et al.), and at the break of 2015/2016 on “The geography of sustainability transitions” (edited by B. Truffer et al.). The journal editorial system EVISE is not perfect and causes frequent frustrations on part of the editors and sometimes authors. But we are stuck with it. The good news is that it seems to be continuously evaluated and improved. Moreover, once one gets used to it it works fine. We look forward to see many high-quality papers presented during the IST conference as submissions to EIST. **Jeroen van den Bergh** (Jeroen.Bergh@uab.cat)

Update from the modelling working group

The modelling group has written a paper on modelling methods for transitions, which has been submitted to the Journal of Artificial Societies and Social Simulation. Fjalar de Haan and Enayat Moallemi are going to co-edit a book on transitions modelling in the Routledge transitions series. Members of the group organised four modelling session at IST 2017, which were well attended. **Jonathan Kohler** (Jonathan.Koehler@isi.fraunhofer.de)

Building connectivity among and with North American Transitions Scholars

As the STRN community and transitions scholarship continue to evolve in theory and practice, promising opportunities emerge to connect interested scholars in new regions. North America represents one such region. To foster synergies among North American

transitions scholars, community-building events were sponsored at recent conferences in April 2017. At the Association of American Geographers (AAG) Annual Meeting held in Boston, Massachusetts, a roundtable discussion was sponsored to examine how transitions research and funding streams are characterized in North American contexts. Amidst the exceptionally large conference, the panel discussion was wide-ranging and substantive. Along somewhat different lines, a networking event was also held at the International Energy and Society (IES) Conference in Sitges, Spain. The international and socio-technical nature of the conference provided an opportunity to bring together North Americans and others who supported the development of North American transitions scholarship. Turnout was exceptional and discussions were varied, introducing peers through a range of topics, including publications and collaborations. Looking ahead, this initiative continues in collaboration Jennie Stephens. Currently, we are evaluating the possibility of developing a Facebook page as an accessible platform to share news and connect scholars. For people who are interested in being added to a working list of North American scholars, feel free to contact me **Kathy Araujo** (Kathleen.Araujo@stonybrook.edu)

In Canada, scholars interested in Sustainability Transitions have organized a conference in Montréal (see Event Reviews) and want to foster collaboration on sustainability transition topics within Canada and beyond. For more information, contact:

<https://chairetransition.esq.ugam.ca/nous-joindre/>

Event announcements

Calls for upcoming relevant events such as workshops and conferences

EIT Climate-KIC PhD Summer School: “Sustainable Production Systems: Shaping cross-company innovation” August 21 – Sept 1, 2017, Gothenburg and Frankfurt

This two-week summer school – organised by Chalmers University and Provdadis School of International Management and Technology – aims at creating innovation strategies and ideas for stakeholder cooperation by applying circular economy models in practice.

The programme will support participants in shaping transformative business models and identifying solutions for companies and service providers at European industrial clusters in the chemical industry to face future challenges. Engage with stakeholders, discuss with experts, work in interdisciplinary teams and develop innovative solutions for the real-life challenges during two weeks in Sweden and Germany. Turn your research into practice!

Apply until 1st July <http://catapult.climate-kic.org>

Conference tracks

There is a special track on "Organizations in Sustainability Transitions" at the EGOS Symposium in Copenhagen (July 6-8, 2017) organized by Raghu Garud, Joel Gehman and Jochen Markard (https://www.egosnet.org/jart/prj3/egos/main.jart?rel=de&reserve-mode=active&content-id=1493586858301&subtheme_id=1442568082292&show_prog=yes)

There is also an All Academy Symposium on "Systems & Sustainability" at the Academy of Management Conference in Atlanta (August 6, 2017) organized by Sylvia Grewatsch and Christina Bidmon (<http://my.aom.org/program2017/SessionDetails.aspx?sid=12568>)

Jochen Markard (jmarkard@ethz.ch)

Event Reviews

Review of events interesting to the STRN community

Canadian symposium on sustainability transitions, 2 June 2017, Montreal (UQAM)

Organized in Montreal at Université du Québec à Montréal (UQAM), the first Canadian Symposium on Sustainability Transitions took place on June 2nd and brought together more than 100 participants from academic research, grassroots movements, administration, and policy consulting. Researchers from across the country came together to reflect and discuss

the theory and practice of Sustainability Transitions; highlighting the role of Sustainability Transitions for social transformation in Canada. The symposium also fostered dialogue between actors from a wide range of sustainability perspectives and approaches, such as sustainable development and de-growth, creating opportunities for cross-fertilization with researchers from the field of Sustainability Transitions. Participants also debated on action research and multi-stakeholder collaborations in Sustainability Transitions, with the objective of making transition initiatives in Canada more effective. In addition, graduate students and grassroots innovators had the chance to show case their (research) projects on a multitude of challenges; ranging from sustainable food systems, to carbon neutral cities, participative democracy, learning, and policy. The following day, several professors and graduate students met to discuss the establishment of a Canadian Sustainability Transitions research network, with the group being interested in an affiliation with STRN, as a thematic network representing the study of Sustainability Transitions in Canada. This is just the beginning of what seems to be an exciting road ahead for the study and practice of Sustainability Transitions in Canada, stay tuned for upcoming news and events! For more information, contact: <https://chairetransition.esq.uqam.ca/nous-joindre/>

New research projects

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

Co-producing and co-financing renewable community energy projects (Co2mmunity)

Renewable energy (RE) projects facilitated, implemented and co-financed by citizens, called community energy (CE), are fundamental for achieving the Europe 2020 strategy by significantly contributing to higher RE shares in Europe's energy mix. Co2mmunity will enhance the capacity of local and regional actors to enable widespread utilisation of CE by co-creating knowledge about CE projects, developing respective instruments, and embed CE approaches in regional strategies and programmes. The Co2mmunity project will (1) enable a transnational exchange about CE opportunities, (2) bring together frontrunners and followers, (3) support various CE stakeholders to anchor CE in energy strategies, and thereby (4) enhance institutional capacities for CE. Main tools are Renewable Energy Source Cooperative Partnerships (RENCOP) that will be established in all partner regions, empowering local actors to facilitate CE projects and disseminate the exchanged transferable best-practices beyond the partnership. For more information please contact **Fabian Faller** (faller@geographie.uni-kiel.de).

Conditions for growth in renewable energy industries (RENEWGROWTH)

The energy transition and increased global investments in renewable energy present large opportunities for Norwegian firms. Several Norwegian firms have established themselves within the fields of offshore wind and solar energy, to some extent drawing on knowledge and resources from established industries. The challenge is to move beyond a nascent stage and achieve significant growth in new renewable energy industries in Norway. RENEWGROWTH (2017-2021) analyses conditions for growth of renewable energy industries, with a focus on industrial and geographical dimensions. We analyze industrial conditions by looking at how established industrial competences and resources can contribute to development of new industries. As part of this, we analyze the opportunities and challenges involved in using and transforming knowledge, resources and technology from established industries in new niches. Second, the project analyses how industry growth can occur by linking up with markets and technology development globally. RENEWGROWTH is led by TIK Center for technology, innovation and culture at the University of Oslo in collaboration with researchers at Utrecht University and SINTEF Technology and Society. RENEWGROWTH is funded by the Research Council of Norway over the ENERGIX programme. For further information, contact Taran Thune (t.m.thune@tik.uio.no).

STAR-ProBio - Sustainability Transition Assessment and Research of Bio-based Products

A multi-actor collaborative Research and Innovation Action (RIA) coordinated by Unitelma Sapienza University (Bioeconomy in Transition BiT-RG) and including 15 partners from 11 European countries – has been awarded three-year Horizon 2020 funding. The STAR-ProBio project is pleased to announce the launch of its 3-years activities starting on May 2017. STAR-ProBio supports the European Commission in the full implementation of European policy initiatives, including the Lead Market Initiative in bio-based products, the industrial policy and the European Bio-economy Strategy. STAR-ProBio does so by developing sustainability assessment tools for bio-based products, and by developing credible cases for bio-based products with the highest actual market penetration and highest potential for the future markets. STAR-ProBio integrates scientific and engineering approaches with social sciences and humanities-based approaches to formulate guidelines for a common framework promoting the development of regulations and standards supporting the adoption of business innovation models in the bio-based products sector. The aim of STAR-ProBio is to cover gaps in the existing framework for sustainability assessment of bio-based products, and improve consumer acceptance for bio-based products by identifying the critical sustainability issues in their value chains. For more information, contact **Piergiuseppe Morone** (piergiuseppe.morone@unitelma.it).

Publications

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

PhD thesis: Georgina Villarreal Herrera, 2017, *Sustaining Dairy*, RSO | Wageningen University

Dairy in Europe has undergone many changes in the last few years—the abolition of milk production quotas being a fundamental one. This study explores these changes in relation to the sustained social and environmental viability of the sector and how dairy processors' sustainability programs are a part of that. Regime change as outlined in transition theory enhanced through a sociological approach on actors informed this research. More specifically, the notion of obligatory passage points was used to explore the mechanisms through which dominant actors make certain actions mandatory and reify their status as indispensable. The thesis consists of three case studies: the dairy sectors in the Netherlands, Ireland and the United Kingdom. The cases trace the evolution of all sectors since the post-war era, outlining the dominant logic that has guided its development. The sustainability programs of three dairy processors—located in each of the case countries—are also part of the analysis. Data was collected through document analysis and semi-structured interviews.

The analysis shows that the post-war logic based on the increase of scale and intensification of dairying has continued to shape the development of the sector through today. While the visible impacts of intensive dairy have led to adaptations to the dominant rules and practices, these changes have not been fundamental in nature. The analysis of dairy processors and their sustainability programs revealed that these programs can be an additional tool for compliance to legal standards and the alleviation of pressing societal concerns. However, processors address social and environmentally relevant dairy-related challenges when an effective link to profit can be established. These programs have been unable to ensure that the dairy sector operates within established environmental limits and societal expectations, while providing a stable livelihood for farmers.

This research contributes to the understanding of sustainability (agri-food) transitions by identifying the mechanisms through which the regime adapts to the shifting environment and dominant actors strive for their own continuity. It also adds to the debate about the role that incumbent actors can have in sustainability transitions—their involvement is important but they are unable to guide such processes. This study advances the empirical ground in sustainability transition studies by focusing on systems in which change is less likely to be

technologically driven and where social change plays a larger role. Finally, this thesis connects past development, current challenges, and present engagement in a discussion about the future development of the dairy sector; this adds to the further conceptualization of the complexity and co-evolutionary nature of sustainability transitions.

Book: Arent, D., Arndt, C., Miller, M., Tarp, F., and Zinaman, O. (eds.), 2017, *The Political Economy of Clean Energy Transitions*, Oxford University Press

The 21st Conference of the Parties (CoP21) to the United Nations Framework Convention on Climate Change (UNFCCC) shifted the nature of the political economy challenge associated with achieving a global emissions trajectory that is consistent with a stable climate. The shifts generated by CoP21 place country decision-making and country policies at centre stage. Under moderately optimistic assumptions concerning the vigour with which CoP21 objectives are pursued, nearly every country will attempt to design and implement the most promising and locally relevant policies for achieving their agreed contribution to global mitigation. These policies will vary dramatically across countries as they embark on an unprecedented era of policy experimentation in driving a clean energy transition. This book steps into this new world of broad-scale and locally relevant policy experimentation. The chapters focus on the political economy of clean energy transition with an emphasis on specific issues encountered in both developed and developing countries. The authors contribute a broad diversity of experience drawn from all major regions of the world, representing a compendium of what has been learned from recent initiatives, mostly (but not exclusively) at country level, to reduce GHG emissions. As this new era of experimentation dawns, their contributions are both relevant and timely.

Book: Frantzeskaki, N., Castan-Broto, V., Coenen, L. and Loorbach, D. (eds.), 2017, *Urban Sustainability Transitions*, Routledge, 2017

This book provides new insights into how sustainability transitions unfold in different types of cities across the world and explores possible strategies for governing urban transitions, emphasising the co-evolution of material and institutional transformations in socio-technical and socio-ecological systems. With case studies of mega-cities such as Seoul, Tokyo, New York and Adelaide, medium-sized cities such as Copenhagen, Cape Town and Portland, and nonmetropolitan cities such as Freiburg, Ghent and Brighton, the book provides an opportunity to reflect upon the comparability and transferability of theoretical/conceptual constructs and governance approaches across geographical contexts.

Book: Schicklinski, J., 2017, *The Governance of Urban Green Spaces in the EU. Social Innovation and Civil Society*. Routledge Explorations in Environmental Studies, Routledge, London and New York

World-wide climate change, biodiversity loss, and the end of fossil resources require a paradigmatic shift in direction of sustainable forms of organising society and economy within a limited time frame. Such a socio-ecological transition requires a fundamental “new” way of conceiving the relationship between economy and society which does away with the still dominant growth paradigm. It is unimaginable without an active contribution from civil society and cannot succeed without a shift to sustainable land use. Across European cities, the use of urban space is highly controversial and subject to diverging interests, yielding a high conflict potential. In this context, on the one hand citizens are becoming increasingly aware of the necessity for self-organising, to reclaim green spaces, for example by taking care of them, in some places also for food production, thereby turning these spaces into common space. On the other hand local authorities have started to increasingly involve citizens in urban green spaces governance. While an increased level of citizen participation and conducive conditions for citizens’ self-organisation are a desirable development per se, the risk of functionalising civil society actors by the local authority for neoliberal city development must be kept in mind. This book examines how civil society’s potential and activities can best be supported by the local authority to achieve a triple-win situation of (a) increased citizen participation and self-organisation and (b) civil society’s support in urban green spaces

governance to eventually achieve (c) a sustainable governance of these spaces, contributing to integrated local and regional socio-ecological-economic development.

Special issue: Urban transitions to sustainability and resilience, *Current Opinion in Environmental Sustainability*, 2016, Volume 22

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Child, M. and Breyer, C., 2017, Transition and transformation: A review of the concept of change in the progress towards future sustainable energy systems, *Energy Policy*, 107, 11-26

It seems generally accepted that change will occur in global energy systems. There also appears to be consensus on the kinds of changes that may be possible for the future, even though there may be disagreement over the exact mix of technologies and policies needed to increase sustainability or mitigate climate change. The terms transition and transformation have both been used to denote the type of change needed in large socio-technical systems. However, the terms have been used both in contradiction of each other and synonymously by different authors. A comprehensive review of both theory and usage in scientific publications was conducted to determine if the terms have been used to denote fundamentally different concepts and if the concept of change is framed differently by usage so as to affect understanding. Despite two camps being readily identifiable, it was concluded that the terms generally refer to the same fundamental concept. At the same time, framing of the concept can be viewed as somewhat different, resulting in a potential for confusion on the part of the reader that may detract from achieving the outcome of change. It is suggested that change to physical forms and systems be denoted as transformations, and that changes to large socio-technical systems be denoted as transitions when the focus is on a higher order of change that highlights the ways that society motivates, facilitates, and benefits from change.

Walrave, B., Talmar, M., Podoyinitsyna, K.S., Romme, A.G.L., and Verbong, G.P.J., 2017, A multi-level perspective on innovation ecosystems for path-breaking innovation, *Technological Forecasting and Social Change*, in press

Path-breaking innovations are increasingly developed and commercialized by networks of co-creating actors, called innovation ecosystems. Previous work in this area demonstrates that the 'internal' alignment of actors is critical to value creation in the innovation ecosystem. However, the literature has largely overlooked that the success of an innovation ecosystem also depends on its 'external' viability, determined by the broader socio-technical environment. That is, path-breaking innovations inherently challenge the prevailing socio-technical regime in a domain (e.g., established rules, artifacts and habits) that tends to be resistant to change. Overcoming this resistance is a major challenge for ventures pioneering path-breaking innovations. The paper contributes to the literature on innovation ecosystems by explicitly considering the socio-technical viability of the innovation ecosystem around a path-breaking innovation. In particular, we theorize about the objects of manipulation in an innovation ecosystem and discuss the strategies that a focal venture, orchestrating the innovation ecosystem, can employ in manipulating these objects so as to increase the socio-technical viability of the ecosystem. We arrive at a multi-level perspective on innovation ecosystem development that integrates internal alignment and external viability and informs a research agenda for future studies in this field

Arranz, A.M., 2017, Lessons from the past for sustainability transitions? A meta-analysis of socio-technical studies, *Global Environmental Change*, 44, 125-143

To break away from techno-institutional lock-in in climate change and in other sustainability problems, many have focused on innovation in technological 'niches'. The destabilisation of the incumbent 'regime' has been neglected and external 'landscape' pressures under-analysed. With this in mind, this article examines the factors of regime destabilisation and forms of regime resistance in past technological transitions in energy and transport. It analyses 23 energy (electricity, heat & chemicals) and 11 transport (drive chain, networks, fuels & land planning) transitions pre-1990. Furthermore, in order to properly frame these results and make any "lessons from the past" applicable to the present, this article includes an assessment of current sustainability trends. The key lessons from past energy transitions are that regime outsiders with the right ideology and influence on the market can destabilise the energy sector, which has traditionally had strong incumbents. As incumbents are

weakened, past transport transitions show that further change may come from emphasising the Health and Lifestyle benefits of sustainability transitions.

Levidow, L. and Upham, P., 2017, Linking the multi-level perspective with social representations theory: Gasifiers as a niche innovation reinforcing the energy-from-waste (EfW) regime, *Technological Forecasting and Social Change*, in press

The multi-level perspective (MLP) theorises technological change as a process of niche innovations competing with incumbent socio-technical regimes. As a mid-range theoretical framework, the MLP invites complementary, more detailed theorisation of salient issues, especially the roles of socio-political agency in changing regime rules around technological competition. Taking a socio-cognitive perspective, this paper links the MLP with social representations theory, to show how a new technology is diversely 'anchored' in a familiar one for different agendas. The case study is a specific niche innovation – thermal treatments of municipal solid waste (MSW) within the UK's wider regime of energy-from-waste (EfW). Through landscape-level changes, controversy over incinerators has destabilised the EfW regime's rules. This instability has opened up opportunities for gasifiers as a niche innovation, yet gasifiers have also become an extra focus for conflict over incinerators' wider role in the waste hierarchy. Agents compare thermal-treatment options for MSW according to various criteria which have unstable, changing rules. These express different socio-cognitive frameworks, analysed here as diverse social representations of novelty. The case study offers an insiders' perspective on endogenous enactment, i.e. the conflicting roles of socio-political agency in shaping transition pathways.

Dzebo, A. and Nykvist, B., 2017, A new regime and then what? Cracks and tensions in the socio-technical regime of the Swedish heat energy system, *Energy Research & Social Science*, 29, 113-122

Since the 70s, Sweden has gradually replaced oil with renewables to provide energy for heating, and today the country uses the highest total amount of renewable energy for heating of all EU Member States. However, there are signs of new tensions in the heat-energy system, and of lock-in of less sustainable practices. Using the multi-level perspective (MLP), this paper assesses to what degree the sociotechnical regime in Sweden's heat-energy system is stable and locked-in, and whether there are emerging tensions. We identify three key characteristics of the regime – interconnectedness, complementarity and saturation – that together risk creating tensions and lock-in of less sustainable practices. We conclude that the heat regime is facing an unstable future, with several challenges of growing importance.

Bush, R.E., Bale, C.S.E., Powell, M., Gouldson, A., Taylor, P.G., Gale, W.F., 2017, The role of intermediaries in low carbon transitions - Empowering innovations to unlock district heating in the UK, *Journal of Cleaner Production*, 148, 137-147

The literature on socio-technical transitions considers how technological innovations can be established within the context of an incumbent regime that is often resistant or inflexible to change. Strategic niche management is an approach to catalysing a transition to a new regime using protected 'niche' spaces to enable development and experimentation with an innovation. Intermediary actors play an important role in establishing these niches as they facilitate knowledge sharing and build the wider networks and systems needed to support an innovation. The influence of intermediaries within socio-technical transitions and strategic niche management is still an under-researched area. In this paper, we use a decision theatre research process to collect empirical evidence from a range of local stakeholders involved in establishing new district heating projects in the United Kingdom (UK). This method, carried out in a group workshop format, enables understanding of the interactions between stakeholders throughout the stages of the district heating development process. The study suggests that intermediaries can play a role in supporting niche empowering processes. The existing institutional framework surrounding intermediary actors, and the geographical scale at which they work within that framework, are shown to be influential on

actors' agency to choose their approach to empowering an innovation. The work highlights the potential for intermediaries to support the restructuring of this institutional framework to enable more radical 'stretch and transform' empowering activities.

Santos, D. and Lane, R., 2017, A material lens on socio-technical transitions: The case of steel in Australian buildings, *Geoforum*, 82, 40-50

Steel is a critical material for modern-day societies, and more than half of the world's steel is used in buildings. As the extraction of iron ore and the production and transport of manufactured steel have significant environmental costs, the fate of steel is important for socio-technical transitions towards more sustainable materials use. Using steel in buildings as a case study socio-technical transition, this paper develops a novel application of the multi-level perspective (MLP) that adopts an explicitly material lens. We focus on the circulation of steel between three key life stages for buildings which are treated as socio-technical regimes as described in the MLP. Drawing on concepts from assemblage theory, we consider the role played by the material and expressive qualities of steel within each of these regimes. Our material focus also requires attention to the spatial dimensions of these three regimes and their implications for socio-technical transitions. We describe the nexus of material affordances and inter-scalar relations that influences the use of steel in buildings and consider the potential for change. The main contribution of this paper is to extend the MLP to incorporate a focus on materiality and, in a related way, spatiality. Based on the analysis presented we consider how steel use in Australian buildings may be rendered more sustainable.

De Almeida, M.F.L. and De Melo, M.A.C., 2017, Sociotechnical regimes, technological innovation and corporate sustainability: from principles to action, *Technology Analysis & Strategic Management*, 29(4), 395-413

Increased environmental and social responsibility awareness, while producing unique opportunities for sustainability-oriented innovations, has generated important challenges for companies. The path to sustainability requires corporate strategies that guarantee profitability, managing simultaneously environmental and social responsibilities. An attempt is made to provide an understanding of sustainable development thinking in business, discussing how the combination of the transition management, adaptive planning and sociotechnical approaches can contribute towards an effective implementation of sustainability-oriented innovations in business context. The article proposes a conceptual model, which incorporates this contribution, developed through a four-year action-research project carried out within a large Brazilian energy company – Petrobras. The authors argue that the adoption of the proposed model by other large firms operating in different societal sectors might trigger organisational changes related to current corporate practices of technological innovation management.

Roberts, C., 2017, Discursive destabilisation of socio-technical regimes: Negative storylines and the decline of the American railroads, *Energy Research and Social Science*, in press

Incumbent socio-technical regimes based on fossil fuels probably cannot be destabilised to the extent necessary to achieve major reductions in carbon emissions without significant policy action. Policy actors, however, remain loyal to fossil fuels. Effective transitions to sustainability will therefore require the identification of political vulnerabilities in fossil fuel regimes. This article identifies one such vulnerability in the form of negative storylines. It describes the development of these storylines using the multi-level perspective on socio-technical transitions, as well as four dimensions of frame resonance developed in social movement theory. It then illustrates this phenomenon using an historical case study describing the development of negative storylines portraying the American railways as abusive monopolists during the late nineteenth and early twentieth century. These storylines played an important role in destabilising the railways, particularly when they also faced pressures from road transport, as policymakers were unwilling to relax regulations on a

regime whose key actors they believed could not be trusted. This article argues that this pattern is unlikely to be unique to this case, but is rather a common development in incumbent socio-technical regimes. This article concludes by considering some implications of these findings for the destabilisation of existing fossil fuel regimes.

Winfield, M. and Weiler, S., 2017, Institutional diversity, policy niches, and smart grids: A review of the evolution of Smart Grid policy and practice in Ontario, Canada, *Renewable and Sustainable Energy Reviews*, in press

Jurisdictions around the world are responding to the potential of smart grids in different ways. This paper employs a multi-level perspective approach to socio-technological transitions to examine why the Canadian province of Ontario has seen a relatively smooth transition of smart meter technologies from the niche to regime levels as compared with other Canadian provinces, and other jurisdictions in the United States, European Union, and Australia. The paper also examines the reasons for Ontario's advanced legislative and policy framework around Smart Grid development, relative to those of other provinces. The complex institutional landscape around electricity that has emerged in Ontario since the break-up of the province's monopoly utility Ontario Hydro in the late 1990s emerges as a significant factor in both outcomes. The role of the province's municipally-owned LDCs spell out "local distribution companies (LDCs) as the primary agents for smart meter deployment, as opposed to a dominant vertically integrated utility, appears to have had an important mediating effect on public opposition to smart meters. With respect to Smart Grid policy, the diversity of high capacity institutional actors that now define the province's electricity policy landscape has facilitated the emergence of several interagency policy development niches. In a manner consistent with the concept of technological niches in the socio-technical transitions literature, the interagency status of these policy niches has shielded them from the regime level selective pressures that would likely have existed in a more unified institutional structure, and empowered new policy ideas to move from the niche to regime levels. These outcomes have significant implications for the understanding of socio-technological transitions, particularly around the role of institutional complexity in the emergence of niches for technology and policy development purposes and in niche to regime level transitions.

Blomkvist, P. and Nilsson, D., 2017, On the need for system alignment in large water infrastructure: understanding infrastructure dynamics in Nairobi, Kenya. *Water Alternatives*, 10(2), 283-302

In this article we contribute to the discussion of infrastructural change in Africa, and explore how a new theoretical perspective may offer a different, more comprehensive and historically informed understanding of the trend towards large water infrastructure in Africa. We examine the socio-technical dynamics of large water infrastructures in Nairobi, Kenya, in a longer historical perspective using two concepts that we call *intra-systemic alignment* and *inter-level alignment*. Our theoretical perspective is inspired by Large Technical Systems (LTS) and Multi-Level Perspective (MLP). While inter-level alignment focuses on the process of aligning the technological system at the three levels of niche, regime and landscape, intra-systemic alignment deals with how components within the regime are harmonised and standardised to fit with each other. We pay special attention to intra-systemic alignment between the supply side and the demand side, or as we put it, *upstream* and *downstream* components of a system. In narrating the history of water supply in Nairobi, we look at both the upstream (large-scale supply) and downstream activities (distribution and payment), and compare the Nairobi case with European history of large infrastructures. We emphasise that regime actors in Nairobi have dealt with the issues of alignment mainly to facilitate and expand upstream activities, while concerning downstream activities they have remained incapable of expanding service and thus integrating the large segment of low-income consumers. We conclude that the present surge of large-scale water investment in Nairobi is the result of sector reforms that enabled the return to a long tradition – a 'Nairobi style' – of upstream investment mainly benefitting the high-income earners. Our proposition is that much more

attention needs to be directed at inter-level alignment at the downstream end of the system, to allow the creation of niches aligned to the regime.

Ramos-Mejía, Franco-Garcia, M-L., Jauregui-Becker, J.M., 2017, Sustainability transitions in the developing world: Challenges of socio-technical transformations unfolding in contexts of poverty, *Environmental Science & Policy*, in press

The transitions to sustainability approach has proved to be useful for academics, policy makers and practitioners to understand and promote socio-technical transformations, often aiming at climate change alternatives in European countries. However, little attention has been paid to the limitations of using frameworks such as the Multi-level perspective and the Strategic Niche Management approach in the developing world. Here, countries exhibit a mixture of well- and ill-functioning institutions, in a context of market imperfection, clientelist and social exclusive communities, patriarchal households and patrimonial and/or marketised states. In order to explore such limitations, we have used an institutional framework documented in the development studies literature, which describes three types of institutional settings: 'welfare', 'informal security' and 'insecurity'. This institutional analysis shows that (1) the context for innovation in developing countries is a loose scenario where the concepts of 'pockets' or 'layers' can be useful; (2) the characteristics of the institutional setting shape in several ways the quality of the niche structuration processes that create and unfold. Our rationale and illustrations call for bringing the poverty alleviation agenda into sustainability transitions studies in developing countries. We propose areas of further reflection attempting to inspire future research pathways.

Schmidt, T.S, Matsuo, T., and Michaelowa, A., 2017. Renewable energy policy as an enabler of fossil fuel subsidy reform? Applying a socio-technical perspective to the cases of South Africa and Tunisia. *Global Environmental Change* 45, 99-110

Fossil fuel subsidies are a key barrier for economic development and climate change mitigation. While the plunge in international fuel prices has increased the political will to introduce fossil fuel subsidy reforms, recently introduced reforms may risk backsliding when fuel prices rebound – particularly if they fail to address the underlying mechanisms that create demand for low fossil fuel prices. Extant literature has mostly focused on the consequences of fossil fuel subsidies, including their economic or environmental impact, and the social contract that make their reform difficult. In this paper, we complement the extant literature with a socio-technical perspective of fossil fuel subsidies to explore the systemic mechanisms that often keep subsidies in place and how these mechanisms can be weakened. Specifically, in case studies of the electricity sectors in South Africa and Tunisia, we trace the socio-technical foundations of their fossil fuel subsidy regimes and the potential of renewable energy policy in disrupting this regime We discuss the relevance of our results for national policymakers wishing to implement and international actors wishing to support fossil fuel subsidy reform. In particular, we highlight that the socio-technical perspective of fossil fuel subsidies offers new intervention points for subsidy reform and that policy designs and assistance should strengthen technologies and actors that are most likely to destabilize the fossil fuel subsidy regime.

Schmidt, T.S., Sewerin, S., 2017. Technology as a driver of climate and energy politics. *Nature Energy*, 2, 17084.

Technological innovation, often induced by national and subnational policies, can be a key driver of global climate and energy policy ambition and action. A better understanding of the technology–politics feedback link can help to further increase ambitions.

Chapman, A.J. and Itaoka, K., 2017, Energy transition to a future low-carbon energy society in Japan's liberalizing electricity market: Precedents, policies and factors of successful transition, *Renewable and Sustainable Energy Reviews*, in press

This paper investigates the precedents, policies and factors relevant to a successful energy regime transition which may be applied in the Japanese case, through a review of national

leaders in renewable energy deployment. The examples of Germany, Italy and Spain are of particular note for their progress along the transition pathway toward a low carbon energy regime. Transition theory is used as a framework to enable this assessment, and exogenous impacts specific to Japan such as recent and ongoing market liberalization and the Fukushima nuclear incident are considered as pertinent factors which impact upon the transition landscape. Through a comparative assessment of policy approaches, technologies deployed, and social factors impacting upon deployment, lessons are drawn for comparison with current Japanese transition progress, identifying factors critical to the future estimation of the Japanese transition pathway. Future energy transition pathway projections will need to incorporate policy approaches and mechanisms as well as being cognizant of Japan's geographic and cost-competitive RE resource deployment limitations. These limitations alongside existing generation assets (including nuclear energy) are expected to have a significant impact upon Japan's transition from the current pre-development phase toward take-off, acceleration and the stabilization of a new, low-carbon energy regime.

Edomah, N., Foulds, C. and Jones, A., 2017, Influences on energy supply infrastructure: A comparison of different theoretical perspectives, *Renewable and Sustainable Energy Reviews*, 79, 765-778

Changes to the energy supply infrastructure are a vital component of climate change mitigation strategies. But what exactly underlies changes to energy supply infrastructure? This paper, through exploration and critical analysis of relevant literature, explores the various underpinning influences on energy infrastructure supply using a comparison of different theoretical perspectives. These influences were explored with specific emphasis on techno-economics, social psychology, socio-technical transitions, social practices and institutional dimensions to energy supply. The aim was to have a better understanding of the (direct and indirect) role of politics and the political system in influencing energy supply infrastructure decisions through the various theoretical lenses. The study revealed that techno-economics uses financial instruments and market information as intervention tools. Its effectiveness is measured by social welfare and cost effectiveness. Social psychology uses a combination of information, incentives and innovative informative instruments as its intervention tools. Its effectiveness is measured by behavioural change. Institutions use regulatory instruments as its intervention tool. Its effectiveness is measured by regulatory compliance. Social practices look at change in broader social systems. Its effectiveness is measured by social change. Socio-technical transitions focus on determining social movements and social innovations. Its effectiveness is measured by legitimacy and social learning.

Pettit, S., Wells, P., Haider, J. and Abouarghoub, W., 2017, Repeating history? Can shipping achieve a second socio-technical transition for sustainability? *Transportation Research Part D*, in press

This paper draws on socio-technical transitions theory to contextualise recent developments in the technological and operational eco-efficiency of ships, which may ameliorate but not resolve sustainability challenges in shipping. Taking an historical perspective, the paper argues that shipping is fundamentally a derived demand arising out of, but also enabling, the spatial separation of production and consumption that are integrated through global value chains. It is argued that the twin processes of innovation-enabled specialisation (into e.g. container ships; bulk carriers etc.) and increased scale both of ships and of shipping operations have embedded shipping into logistics systems of increasing complexity and reach. The objective of the paper is to demonstrate, using secondary data, the long-run trends in the growth of shipping carbon emissions for bulkers and tankers, as well as the impact of increased scale and vessel speed on such emissions. A fuel-based, top-down, methodology, based on fuel consumption estimates derived from secondary source industry data that are suitable for a macro-level analysis, is used to estimate global shipping carbon emissions. It is argued that technologies or operational innovations that reduce the environmental burdens of shipping, while useful, do not represent the socio-technical system

'regime' shift that international maritime logistics requires in order to contribute to improved sustainability. Rather, in the relative absence of strong governance mechanisms in the maritime field, it is underlying 'landscape' shifts in production and consumption that are likely to act to reduce the demand for shipping and hence to be more significant in the longer run.

Pesch, U., Vernay, A-L., Van Bueren, E. and Iverot, S.P., 2017, Niche entrepreneurs in urban systems integration: On the role of individuals in niche formation, *Environment and Planning A*, in press

In many sustainable urban innovation projects, the efforts, endurance and enthusiasm of individuals at key positions are considered a crucial factor for success. This article studies the role of individual agency in sociotechnical niches by using Kingdon's agenda-setting model. Although strategic niche management is commonly used to study processes of urban innovation, the process of niche formation and the role of individual agency has been understudied. We will introduce the notion of the 'niche entrepreneur' as an actor who, analogous to Kingdon's policy entrepreneur, connects the elements that are needed to develop a successful niche that allows learning for sustainability transitions. We will study the process of niche formation and the role of individual entrepreneurship therein, and identify the strategies that have been used by individuals to create a successful niche. This will be done for three cases in urban systems integration: the development of Eva Lanxmeer, a residential district in a drinking water retention area in Culemborg, the Netherlands; the transformation of the waste management practices of Lille Métropole Urban Community, France; and the development of the urban district Hammarby Sjöstad, Sweden. Our findings show that for the successful formation of niches, it is necessary to create ambitious, but clear goals and matching concrete operational plans; niche entrepreneurs may play the role of project champions that contribute significantly to the operationalization, monitoring and the effectuation of the original goals of the project; the strategies of niche entrepreneurs emphasize the building of coalitions and the securing of space for learning.

Burnham, M., Eaton, W., Selfa, T., Hinrichs, C. and Feldpausch-Parker, A., 2017, The politics of imaginaries and bioenergy sub-niches in the emerging Northeast U.S. bioenergy economy, *Geoforum*, 82, 77-76

As part of a transition to lower carbon energy systems, bioenergy development is often assumed to follow a uniform pathway. Yet the design, organization, and politics of bioenergy production in specific regional contexts may be contested. This study examines contestation within an emerging perennial crop bioenergy sector in the U.S. Northeast. Synthesizing conceptual contributions from the multi-level perspective on the significance of niches and sub-niches in sustainability transitions and from science and technology studies on the material and moral implications of sociotechnical imaginaries and object conflicts, this paper analyzes the politics of bioenergy sub-niche imaginaries. It identifies two main bioenergy sub-niches centered on (1) regional production and (2) community energy. Examining proposed and current production of perennial energy crops on marginal land, the study draws on 42 semi-structured interviews with bioenergy actors (e.g., scientists, industry representatives, policymakers, farmers/landowners) and secondary documents. The two bioenergy sub-niche imaginaries revealed political contestations around scale of operations, control and beneficiaries, and about definitions and uses of marginal land relative to livelihoods and community. This study highlights the potency of rival imaginaries *within* a developing sociotechnical niche and implications for sustainability transitions. Tracing the contours and emphases of, as well as conflicts between, bioenergy sub-niche imaginaries can clarify which pathways for transition to a lower carbon energy future could garner political and public support. The paper concludes by considering how disagreements between sub-niche actors could lead to productive mutual learning and the possibility of forging solutions contributing to more robust and equitable sustainability transitions.

Osunmuyiwa, O., Kalfagianni, A., 2017, The Oil Climax: Can Nigeria's fuel subsidy reforms propel energy transitions?, *Energy Research & Social Science*, 27, 96-105,

Recent studies in the field of political science and environmental resource governance suggest that oil-exporting economies have begun to implement fuel subsidy reforms. However, while most studies on this issue focus largely on the broader environmental and economic consequences of fuel subsidy reforms, few have examined specifically the effects on renewable energy transitions. Drawing insights from the literature on political economy and the multi-level perspective on socio-technical transitions, with empirical examples from Nigeria, first this study provides an explanation of which factors triggered fuel reforms on the basis of the interaction between landscape and regime elements and second the effects of such fuel reforms on renewable energy transitions. Findings suggest that landscape factors such as global oil crashes and pressures from international financial organisations played crucial roles in the drive for fuel reforms. Nonetheless, rentier regime members responded to these pressures by adopting institutional, discursive and redistributive measures. Of all three strategies, the institutional strategy was significantly pivotal in the proliferation of renewable energy in Nigeria. This study concludes by discussing lessons learned in shaping a transition away from fossil fuels in Nigeria and rentier countries in general.

Strambach, S. and Pflitsch, G., 2017, Micro-dynamics in regional transition paths to sustainability - Insights from the Augsburg region, *Applied Geography*, in press

While there has recently been an increased interest in urban and regional transitions to sustainability, there are little profound insights about the emergence, design and enforcement of regional transition paths to sustainability (RTPS). The latter are characterized by organizational and institutional dynamics that affect multiple regimes and cannot fully be captured with the niche-regime categories of the multilevel perspective (MLP). This paper is therefore based on recent approaches from evolutionary economic geography (EEG) that focus on how actors at the micro-level use the plasticity of paths to enact change. The transition path and underlying micro-dynamics over more than 30 years in the Augsburg region revealed in an empirical study are visualized in the form of a transition topology. The results show that RTPS do not exclusively originate in protected spaces. Actors use the interpretative flexibility of institutions and establish organizational proximity between different institutional logics thereby eroding institutional consolidations and allowing new configurations within the path. Gradual institutional changes lead to more fundamental changes in social practices over the long run.

Moallemi, E.A., Aye, L., De Haan, F.J. and Webb, J.M., 2017, A dual narrative-modelling approach for evaluating socio-technical transitions in electricity sectors, *Journal of Cleaner Production*, in press

The sustainability transition of electricity sectors is a matter of competition between multiple emerging renewable systems and dominant, established conventional systems. These transitions are multi-dimensional and are featured with non-linear and causal interactions between social, technical, economic and political components. Understanding the dynamic of transitions, i.e. how transitions unfold, can inform effective policy interventions. This paper aims to present a narrative-modelling approach to improve the understanding and description of transition dynamics in electricity sectors. The central ideas of the paper are: (1) the use of qualitative transition narratives helps to capture the co-evolving nature of society and technology which are simplified in modelling approaches; (2) narratives, with concepts from the sustainability transitions field, also guide the development of a model structure; and (3) computational models, in return, reproduce the complexity of transition dynamics, i.e. feedback loops, non-linearity, and time delays—the features which are impracticable to analyse with transition narratives alone. We use the historical transition of India's electricity sector to demonstrate the implementation of our proposed approach. First, an overview of the transition narratives is presented and the model structure, developed based on the narratives, is explained. Then, it is argued how the coupling of the narratives and model improves our understating of the positive impacts as well as the side-effects of

stable feed-in tariffs and accelerated depreciation on the penetration levels of wind and solar electricity.

Binder, C.R., Mühlemeier, S., and Wyss, R., 2017, An indicator-based approach for analyzing the resilience of transitions for energy regions. Part I: Theoretical and conceptual considerations. *Energies* 10.1, 36.

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

Gaziulusoy, A. İ., and Ryan, C. (2017). Roles of design in sustainability transitions projects: A case study of visions and pathways 2040 project from Australia. *Journal of Cleaner Production*, 162, 1297-1307.

Sustainability transitions require structural and systemic changes. Transitions research poses creative as well as analytical challenges due to high complexity and uncertainty associated with these projects. In this article we present an initial and exploratory investigation of roles design plays in transition projects focusing on Visions and Pathways 2040 (VP2040) project as a case study. VP2040 aims to develop visions, scenarios and pathways for low-carbon resilient futures in Australian cities. The project adopts a design-led approach, linking research and engagement in design-led future visioning. Our findings indicate that the roles design can play in sustainability transitions projects is various covering very tangible, technical, skills-based roles, to very intangible roles, relating to how information is received, processed and synthesised. Our findings also imply that, increasingly more, design practitioners will need to bring in skills and knowledge that have not been part of conventional design education, and therefore, institutions providing design education need to start developing and implementing curriculums that will equip graduates with these new professional capacities.

Bos, M.W., Hofman, E. and Kuhlmann, S., 2016, An assessment method for system innovation and transition (AMSIT), *International Journal of Foresight and Innovation Policy*, 11(4), 185 - 214

To address comprehensive system innovations that may occur in a future transition, a suitable ex ante assessment method is required. The technological innovation system approach is useful for the retrospective study of the conditions for success or failure of innovation trajectories, and the multilevel framework helps to understand transition dynamics. Drawing on these concepts and on the hypercube of innovation, we suggest, as an ex ante approach, the assessment method for system innovation and transition (AMSIT). This method not only helps to anticipate the requirements for a system innovation and transition, but it also provides an indication if these requirements are being met. The method helps to assess innovation system initiatives that not only face technological challenges in the niche in which it operates, but also challenging factors related to the sociotechnical regime and the political and societal landscape in which the niche is located. This paper

describes the construction of the anticipatory AMSIT and illustrates its application in a case linked to the Dutch railway network involving a transition to a system operating at an increased voltage.

Morales, J.E.R., López, F.R., 2017, The political economy of bioenergy in the United States: A historical perspective based on scenarios of conflict and convergence, *Energy Research & Social Science*, 27, 141-150,

The paper analyzes the historical evolution of the production of liquid bioenergy in the US on the basis of the political economy of fuels for road transport, largely determined by the dynamics of the opportunity cost that arises from the connection between energy and agricultural markets. We have developed an analysis framework to build a set of scenarios suitable to explain the evolution of biofuel markets in the historical period analyzed. These scenarios, strongly associated with conditions of convergence and conflict between the regulatory state and the agro-industry, have then been statistically verified using an interrupted time series analysis. The analysis shows that the evolution of governance, institutions, and markets around bioenergy have been determined not just by the political goals of the US regulatory state, but also by private economic drivers related to agro-industry. This suggests that bioenergy transition in the US can be understood as the agricultural dimension of the political economy that underlies the socio-technical regime of energy for transport in the US, characterized by institutional inertia and technological lock-in.

Williams, J., 2017, Lost in translation: Translating low carbon experiments into new spatial contexts viewed through the mobile-transitions lens, *Journal of Cleaner Production*, in press

Low carbon urban transition experiments are emerging across cities globally. These experiments are socio-technical innovations with a high potential to contribute to a low carbon. Through the Global Intelligence Corps knowledge of these experiments is being disseminated across a variety of spatial contexts. Foreign cities are keen to replicate these examples of best practice; whilst technical experts, technology providers and governments are keen to export their expertise and technologies. However, the factors influencing the successful translation - movement, transformation and adaptation - of these experiments across spatial contexts requires deeper investigation. This paper explores the process using a mobile transitions conceptualisation. In this paper we develop a theoretical conceptualisation of the mobile transition process and test it using two low carbon experiments - Hammarby Sjostad (Stockholm) and BedZed (London). We identify the type of knowledge that is translatable (in the global form), and how this is modified both by the global and local assemblages throughout the process. The implication of our findings is that greater clarity is needed throughout the translation process if outcomes are to improve. Firstly, in order to determine the potential for an urban experiment to translate into a new spatial context the practitioner must understand the context from which it emerged and the context into which it will be translated. Secondly practitioners need to clearly define the translatable global form emerging from an experiment. It must be possible to decontextualise and re-contextualise the global form if it is to translate successfully. In some cases it may be impossible to decontextualise the global form without undermining the fundamental principles underlying the experiment. Thirdly, practitioners need to be aware of how the global form can be manipulated and re-represented by the global and local assemblages during the translation process. The global form is not fixed. Finally practitioners should be aware that new socio-technical systems (adopting the fundamental principles developed in the experiment) will emerge from the translation process.

Mori, A., 2017, Temporal dynamics of infrasystem transition: The case of electricity system transition in Japan, *Technological Forecasting and Social Change*, in press

While a multi-level perspective on system innovation offers an analytical tool for explaining the role of landscape development and niche innovations in a transition of infrasystems toward sustainability, it has limitations in capturing hard-fought, inter- and intra-scalar

contestations, and thus in exploring the role of governance structure and institution in a transition. Against this background, this paper aims to explore how the temporal dimension have influenced market competition, power and interpretation, and the dynamics of electricity systems in a welfare state by examining Japan as a case study. Our conclusions are as follows. First, periods of possessing and exercising power are important, both in terms of reinforcing the current infrasystem and in moving it toward a sustainable pathway. The longer that incumbents and their alliance possess and exercise power, the deeper that infrasystems can be embedded into society and the narrower the space created by landscape pressures becomes for developing niche innovators. Second, long time dominance of incumbents and its alliance in power enables them to capitalize on landscape pressures to reinforce them, realigning the currently unsustainable electricity system while to prevent niche innovations from sufficiently developed as reliable alternatives. Third, long time dominance can change the extent of feedback effects in policy instruments and institutional reform, weakening driving force for transition to sustainability.

Lazarevic, D. and Valve, H., 2017, Narrating expectations for the circular economy: Towards a common and contested European transition, *Energy Research and Social Science*, in press

The European Union (EU) has set its sights on becoming a circular economy, envisaging a transition that implies systemic changes in natural resource transformations and material flows; and offering a response to what is commonly labelled as the 'take-make-dispose' conventional economic model. What does the transition toward a circular economy entail and what can it do? This paper analyses the emergence and mobilisation of expectations that are shaping the EU transition to a circular economy. It traces the narrative elements through which the circular economy is configured through an analysis of position papers presented to inform the debate on the European Commission's circular economy package. Expectations for the circular economy are articulated as: (1) a perfect circle of slow material flows; (2) a shift from consumer to user; (3) growth through circularity and decoupling; and (4) a solution to European renewal. Extending boundaries of what is 'in' benefits actors driving the circular economy as, in the short-term, they can actively support a deliberately vague, but uncontroversial, circular economy. On the one hand, the expectations present a strong sense of a collective 'we', on the other hand we are yet to see the contentions and contestations being full playing out.

Heiskanen, E., Hyvönen, K., Laakso, S., Laitila, P., Matschoss, K., and Mikkonen, I., 2017, Adoption and use of low-carbon technologies: Lessons from 100 Finnish pilot studies, field experiments and demonstrations, *Sustainability*, 9(5), 847.

Experimentation is critical for the deployment of low-carbon technologies. New solutions need to be selected and adapted to their contexts of use, and users need to learn new skills. Society as a whole needs to create new modes of production, consumption and governance. We investigated how local pilot projects, demonstrations and trials of low-carbon technologies promote learning in Finnish society, where the government has made a commitment to a culture of experimentation. We drew on a database of 100 pilot projects and experiments and 15 detailed case studies. We identified several types of learning, beyond the formal evaluation of "what works where and when": pilot projects served to inspire, to create commitment and to develop networks. We also investigated how lessons learned are transferred to other sites and into societal knowledge. We contribute by conceptualizing different forms of learning and transfer—particularly situated and embodied forms—alongside more techno-scientific ones. While highlighting this form of learning, we also note that it is not particularly strong in acknowledging challenges faced in experimentation. We argue that there is scope for more systematic evaluation, alongside more situated forms of learning and sharing. We also pinpoint tensions between these two forms of learning that need to be addressed.

Reichardt, K., Rogge, K.S. and Negro, S.O., 2017, Unpacking policy processes for addressing systemic problems in technological innovation systems: The case of offshore wind in Germany. *Renewable and Sustainable Energy Reviews*, 80, 1217–1226.

While empirical studies on technological innovation systems (TIS) usually focus on policy instruments and their suitability for curing identified weaknesses of such emerging systems, the underlying policy processes and their effects have been largely disregarded. We address this gap by exploring the style of two crucial policy-making processes and how it influences the functioning and performance of a TIS, taking the case of offshore wind in Germany. Our findings indicate important positive and negative impacts of the policy style on the TIS. For example, the muddling through character apparent in one of the policy processes negatively influenced entrepreneurial activities, knowledge development and finally technology diffusion, whereas the participatory nature of both processes had a positive impact both on TIS functioning and performance. Based on our findings we derive implications on how to improve policy making so as to foster the development of an emerging TIS.

Davidson, D.J., 2017, Is urban agriculture a game changer or window dressing? A critical analysis of its potential to disrupt conventional agri-food systems, *International Journal of Sociology of Agriculture and Food*, 23(2), 63-76

Is urban agriculture capable of becoming a 'game changer', contributing to the sustainable transition of our conventional agri-food systems? Or is it more likely to be 'window dressing', characterized by limited participation and influence? The answer depends upon how we measure system change. The value of urban agriculture is often measured in physical – caloric – terms. By assessing the multiple emergent effects of urban agriculture activities through an extensive, interdisciplinary literature review, this article provides a more informed context to a discussion of the disruptive potential of urban agriculture. Several features of urban agriculture suggest its potential to be an important contributor to agri-food system transition; however, a number of key challenges must be acknowledged and addressed. Ultimately, producing food in cities is not inherently transformative in and of itself, but the potential and observed new forms of social engagement emerging in many contexts create institutional conditions that can disrupt conventional agri-food systems by building social capital as much as physical capital.

Falcone, P.M., Morone, P. and Sica, E., 2017, 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*, in press

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.

Jänicke, M. and Quitzow, R., 2017, Multi-level reinforcement in European climate and energy governance: Mobilizing economic interests at the sub-national levels, *Environmental Policy and Governance*, 27(2), 122-136

This article explains the relatively successful performance of the European Union (EU) in climate and energy governance by two factors: (1) multi-level reinforcement and (2) the mobilization of economic interests at different levels of governance through low-carbon industrial policy. The article adds to the literature by further developing existing arguments on multi-level reinforcement in climate and energy policy. We stress the point that economic co-benefits of climate protection have been successfully mobilized at all levels of governance, including the sub-national level, in recent times. This is illustrated by examples from pioneer countries as well as laggards and waverers in terms of national climate and energy policy. While it is far from certain whether the EU will indeed deliver the needed CO₂ reductions to reach its internationally agreed targets, this paper, nevertheless, highlights why the EU system of climate governance remains relatively robust in light of the various challenges it currently faces.

Quitow, R., Huenteler, J. and Asmussen, H., 2017, Development trajectories in China's wind and solar energy industries: How technology-related differences shape the dynamics of industry localization and catching up, *Journal of Cleaner Production*, 158, 122-133

China has been very successful in creating conditions for industry localization in solar and wind energy manufacturing. In terms of their competitiveness in foreign markets, however, Chinese solar photovoltaics firms have shown significantly greater achievements than their counterparts in the wind energy sector. Moreover, the success of China's solar photovoltaics industry has come in spite of significantly lower levels of domestic market support. The paper argues that technology-related factors and their implications for international technology transfer are critical for explaining the different speeds with which Chinese firms have been able to catch up in the two sectors. This is supported by a comparative analysis of technology transfer in the two sectors.

Metze, T., Schuitmaker, T.J., Bitsch, L. and Broerse, J., 2017, Breaking barriers for a bio-based economy: Interactive reflection on monitoring water quality, *Environmental Science & Policy*, 74, 1-7

In a transition to a bio-based economy new ways of monitoring waste-streams and water quality can then contribute to sustainable production processes. As niche innovation, new ways of monitoring face systemic barriers. The present article examines how barriers to change manifest in discursive practices with differing normative attachments and implications. A frame analysis revealed two competing frames: (1) the dominant 'norm water' frame in which thresholds of chemical compounds are used to set policy targets; and (2) the contesting 'living water' frame, which entails innovative continuous monitoring tools that take into account the ecological effects of chemical compounds. We introduce the concept of *interactive reflectivity*, as a discursive tool, to collaboratively visualize, scrutinize and overcome discursive barriers to innovations. The stakeholder dialogue shows how systemic barriers are uttered discursively in niches – or other forms of responsible research and innovation – and may hinder change even at the niche-level.

Brown, K.P., and Hess, D.J., 2017, The politics of water conservation: identifying and overcoming barriers to successful policies, *Water Policy*, 19(2): 304-321.

Policies that increase the reliance of a water-supply organization (WSO) on water conservation have economic and environmental benefits, but some cities and WSOs have been reluctant to pursue such policies to their full extent. Previous research has identified barriers such as WSOs' concerns with revenue loss and consumers' concerns with changes in lifestyle. Based on interviews in four U.S. cities with representatives of local business, government, WSOs, and environmental and other organizations, our research shows how the reluctance to pursue water conservation policies to their fullest extent is also related to

more general political factors. We bring together growth coalition theory and sociotechnical transition theory to show how opposition varies by type of water conservation policy, including the distinction between mandates and flexible policies and between end-use policies and infrastructure policies. This approach shows how the transition to higher levels of water conservation is a political process, and we argue that understanding both the political process and the political meanings of different water conservation policies provides insights into strategies and their potential efficacy.

Gosens, J., Hedenus, F., and Sandén, B.A., 2017, Faster market growth of wind and PV in late adopters due to global experience build-up, *Energy*, 131, 267–278

Different perspectives on the diffusion of technologies have suggested that market growth of technologies in late adopter countries may be either slower (because the technology is adopted later in areas where the technology has poorer economic performance) or faster (because global experience has resulted in maturation and improved performance of the technology). We compare the pace of market growth of wind and PV power in early and late adopters. We use panel data analysis on a database spanning all countries of the world, and years 1980–2014. We find that late adopters manage to access the global experience with these technologies, and utilize it to accelerate domestic market growth. Despite their lower GDP, late adopter countries have managed market growth for wind power that was up to 4.7 times faster than it was in early adopters, and up to 16 times faster for PV. These results suggest increased development efforts of novel clean-tech may kick-start rapid global deployment. Beneficial effects are less for very late adopters and less developed economies, signalling attention is needed for these in global climate change mitigation efforts.

Turner, J.A., Williams, T., Nicholas, G., and Horita, A., 2017, Triggering system innovation in agricultural innovation systems: Initial insights from a community for change in New Zealand, *Outlook on agriculture*, 46(2),125-130 .

This article describes a process for stimulating engagement among change agents to develop a shared understanding of systemic problems in the agricultural innovation system (AIS), challenge prevalent institutional logics and identify actions they might undertake to stimulate system innovation. The process included (i) multiple actors from the AIS, (ii) reflexivity regarding underlying institutional logics, (iii) an iterative process of practical experimentation to challenge current practices and (iv) actions to encourage generative collaboration. Problem structuring supported change agents' development of a shared understanding of systemic problems and the role that interrelationships, perspectives and boundaries play in reinforcing or destabilizing current practices and institutional logics. Involving multiple actors from the AIS in challenging underlying institutional logics and encouraging collaboration appeared to stimulate project-level actions and recognition of wider AIS barriers. Collective system analyses for addressing structural changes, including the potential for system innovation, were beneficial. Simultaneously resolving innovation project actions with AIS actions remains a challenge.

Frenken, K., 2017, Political economies and environmental futures for the sharing economy, *Philosophical Transactions of the Royal Society A*, Volume 375, Issue 2095,

The sudden rise of the sharing economy has sparked an intense public debate about its definition, its effects and its future regulation. Here, I attempt to provide analytical guidance by defining the sharing economy as the practice that consumers grant each other temporary access to their under-utilized physical assets. Using this definition, the rise of the sharing economy can be understood as occurring at the intersection of three salient economic trends: peer-to-peer exchange, access over ownership and circular business models. I shortly discuss some of the environmental impacts of online sharing platforms and then articulate three possible futures of the sharing economy: a capitalist future cumulating in monopolistic super-platforms allowing for seamless services, a state-led future that shifts taxation from labour to capital and redistributes the gains of sharing from winners to losers, and a citizen-led future based on cooperatively owned platforms under democratic control.

The nature and size of the social and environmental impacts are expected to differ greatly in each of the three scenarios.

Barrie, J., Zawdie, G. and João, E., 2017, Leveraging triple helix and system intermediaries to enhance effectiveness of protected spaces and strategic niche management for transitioning to circular economy, *International Journal of Technology Management & Sustainable Development*, 16(1), 25-47(23)

The transition to circular economy has been heralded as a vision to overcome the challenges of rapid population growth, economic stagnation and environmental degradation. A promising policy tool for accelerating such a transition is strategic niche management (SNM), the central tenet of which is the formation of 'protected spaces' to support the growth of sustainable innovation. Studies have demonstrated that current top-down policy approaches to governing protected spaces have led to the unintended consequences of network tensions, low quality learning processes and low innovation adoption rates outside protected spaces. This limits the impact of SNM as a transition tool. Through a detailed literature review, this article looks into a novel devolved governance framework for protected spaces in the context of transition to circular economy. The framework addresses current limitations of SNM by acknowledging the synergistic relationship with the triple helix innovation system; and innovation intermediation. Transition to circular economy turns on the achievement of 'triple helix consensus' across 'protected spaces' to provide the requisite platform for sustained innovation and for the recurrent choice of knowledge and market systems that are consistent with the circular economy growth trajectory.

Noseleit, F., 2017, Renewable energy innovations and sustainability transition: How relevant are spatial spillovers?, *Journal of Regional Science*, in press

In the societal challenge to switch to renewable energy, innovation has become an ever-increasing critical determinant. However, while sustainability transition is a global challenge, diffusion and adoption of innovation tends to be uneven in space and unequal access may cause substantial heterogeneity in energy transition. This research analyzes how domestic and foreign innovation activities in the renewable energy sector influence energy transition over time. Empirical testing shows that a country's domestic innovation activity impacts renewable electricity generation capacity sooner than foreign technological innovations. I document that there are substantial barriers to substitute foreign technologies for domestic innovation efforts in the short run but also observe that foreign technologies have a stronger impact after some years. These findings have implications for cross-border coordination of governmental innovation support and complementary policy instruments that aim at increasing adoption speed across borders.

Shum, K.L., 2017, Renewable energy deployment policy: A transition management perspective, *Renewable and Sustainable Energy Reviews*, 73, 1380-1388

This paper analyzes major categories of renewable policy instruments in light of the framework of Transition Management. We leveraged the concept of levelized cost of electricity (LCOE) to unify the discussion of these instruments by elaborating the differing effects such instruments have on the formation of the socio-technological regime. Regimes are sets of grammar, logics and contexts which enable and constrain the interaction of actors associated with a physical technology. We compare these instruments by assuming the normative organization objective of a regime to be that of enhancing the cost-effectiveness of respective instruments. In other words, the socio-technological regime is to be organized and optimized to improve the LCOE of the energy technology. Our main contribution is to propose the rationalization of the regime objective and the implications to regime management and development strategy. This in turn would facilitate a much needed synthesis of normative and evolutionary deliberation in the framework of Transition Management.

Markard, J. and Erlinghagen, S., 2017. Technology users and standardization: Game changing strategies in the field of smart meter technology. *Technological Forecasting and Social Change* 118, 226-235.

Struggles over technology standards are typically reported for competing technology providers. Technology users often play not much of a role in standard development. This paper presents findings from the emerging innovation system of smart meter communication, in which large technology users act as standard developers. This phenomenon is relatively rare, as users often lack the resources and competences to actively engage in standard development. Over a period of 14 years (2000-2013), we track how different standards emerged and changed, why and how users became standard sponsors, and what impact this had on the field. Our analysis is based on variety of data sources, including participatory observation and expert interviews. After an initial period, in which only proprietary standards were available, two large users started to develop open standards together with alliance partners and standard development organizations. Consequently, sponsors of proprietary standards change their strategies, also toward open, alliance-based standards. A central condition for this shift in standardization was that the two users controlled large shares of the market. Our research points to the conditions for user involvement in standardization, thereby contrasting three different settings for standard development. We interpret the case as an example for the larger issue of institutional structures in technological innovation systems developing over time in a patchwork-like way, thereby shaping and changing the conditions for strategic action

Chilvers, J., Foxon, T.J., Galloway, S., Hammond, G.P., Infield, D., Leach, M., Pearson, P.J.G., Strachan, N., Strbac, G. and Thomson, M., 2017, Realising transition pathways for a more electric, low-carbon energy system in the United Kingdom: Challenges, insights and opportunities, *Proceedings of the Institution of Mechanical Engineers, Part A*,

The United Kingdom has placed itself on a transition towards a low-carbon economy and society, through the imposition of a legally-binding goal aimed at reducing its 'greenhouse gas' emissions by 80% by 2050 against a 1990 baseline. A set of three low-carbon, socio-technical *transition pathways* were developed and analysed via an innovative collaboration between engineers, social scientists and policy analysts. The pathways focus on the power sector, including the potential for increasing use of low-carbon electricity for heating and transport, within the context of critical *European Union* developments and policies. Their development started from narrative storylines regarding different governance framings, drawing on interviews and workshops with stakeholders and analysis of historical analogies. The quantified UK pathways were named *Market Rules*, *Central Co-ordination* and *Thousand Flowers*; each reflecting a dominant logic of governance arrangements. The aim of the present contribution was to use these pathways to explore what is needed to realise a transition that successfully addresses the so-called *energy policy 'trilemma'*, i.e. the simultaneous delivery of low carbon, secure and affordable energy services. Analytical tools were developed and applied to assess the technical feasibility, social acceptability, and environmental and economic impacts of the pathways. Technological and behavioural developments were examined, alongside appropriate governance structures and regulations for these low-carbon *transition pathways*, as well as the roles of key energy system 'actors' (both large and small). An assessment of the part that could possibly be played by future demand side response was also undertaken in order to understand the factors that drive energy demand and energy-using behaviour, and reflecting growing interest in demand side response for balancing a system with high proportions of renewable generation. A set of interacting and complementary engineering and techno-economic models or tools were then employed to analyse electricity network infrastructure investment and operational decisions to assist market design and option evaluation. This provided a basis for integrating the analysis within a *whole systems* framework of electricity system development, together with the evaluation of future economic benefits, costs and uncertainties. Finally, the energy and environmental performance of the different energy mixes were appraised on a 'life-cycle'

basis to determine the greenhouse gas emissions and other ecological or health burdens associated with each of the three *transition pathways*. Here, the challenges, insights and opportunities that have been identified over the transition towards a low-carbon future in the United Kingdom are described with the purpose of providing a valuable evidence base for developers, policy makers and other stakeholders.

Vivero-Pol, J.L., 2017, Food as commons or commodity? Exploring the links between normative valuations and agency in food transition, *Sustainability*, 9, 442

The food system, the most important driver of planetary transformation, is broken. Therefore, seeking a sustainable and socially-fair transition pathway out of this crisis becomes an issue of utmost priority. The consideration of food as a commodity, a social construct that played a central role in this crisis, remains the uncontested narrative to lead the different transition pathways, which seems rather contradictory. By exploring the normative values on food, this paper seeks to understand how relevant is the hegemonic narrative of food as commodity and its alternative of food as commons to determine transition trajectories and food policy beliefs. Applying the multi-level perspective framework and developing the ill-studied agency in transition, this research enquired food-related professionals that belong to an online community of practice (N = 95) to check whether the valuation of food is relevant to explain personal stances in transition. Results suggest that the view of food as commodity is positively correlated with a gradually-reforming attitude, whereas food as commons is positively correlated with the counter-hegemonic transformers, regardless of the self-defined position in the transition landscape (regime or niches). At a personal level, there are multiple loci of resistance with counter-hegemonic attitudes in varied institutions of the regime and the innovative niches, many of them holding this discourse of food as commons. Conversely, alter-hegemonic attitudes are not positively correlated with the alternative discourse, and they may inadvertently or purportedly reinforce the neoliberal narrative. Food as commons seems to be a relevant framework that could enrich the multiple transformative constituencies that challenge the industrial food system and therefore facilitate the convergence of movements that reject the commodification of food

Binz, C. and Truffer, B., 2017, Global innovation systems—A conceptual framework for innovation dynamics in transnational contexts, *Research Policy*, in press

This paper proposes a framework for the analysis of technological innovation processes in transnational contexts. By drawing on existing innovation system concepts and recent elaborations on the globalization of innovation, we develop a multi-scalar conceptualization of innovation systems. Two key mechanisms are introduced and elaborated: the generation of resources in multi-locational subsystems and the establishment of structural couplings among them in a global innovation system (GIS). Based on this conceptualization, we introduce a typology of four generic GIS configurations, building on the innovation mode and valuation system in different industry types. The analytical framework is illustrated with insights from four emerging clean-tech industries. We state that a comprehensive GIS perspective is instrumental for developing a more explanatory stance in the innovation system literature and developing policy interventions that reflect the increasing spatial complexity in the innovation process.

Napp, T., Bernie, D., Thomas, R., Gambhir, A., 2017, Exploring the feasibility of low-carbon scenarios using historical energy transitions analysis, *Energies*,10(1):116

The scenarios generated by energy systems models provide a picture of the range of possible pathways to a low-carbon future. However, in order to be truly useful, these scenarios should not only be possible but also plausible. In this paper, we have used lessons from historical energy transitions to create a set of diagnostic tests to assess the feasibility of an example 2 °C scenario (generated using the least cost optimization model, TIAM-Grantham). The key assessment criteria included the rate of deployment of low carbon technologies and the rate of transition between primary energy resources. The rates of

deployment of key low-carbon technologies were found to exceed the maximum historically observed rate of deployment of 20% per annum. When constraints were added to limit the scenario to within historically observed rates of change, the model no longer solved for 2 °C. Under these constraints, the lowest median 2100 temperature change for which a solution was found was about 2.1 °C and at more than double the cumulative cost of the unconstrained scenario. The analysis in this paper highlights the considerable challenge of meeting 2 °C, requiring rates of energy supply technology deployment and rates of declines in fossil fuels which are unprecedented.

Steen, M. and Weaver, T., 2017, Incumbents' diversification and cross-sectorial energy industry dynamics, *Research Policy*, 46(5),1039-1054

Within the sustainability transitions literature, established, mature or incumbent firms have been stereotyped as 'locked-in' to socio-technical regimes. However, we believe regimes have been black-boxed, and few studies have explored incumbents' responses to transition processes. This article aims to achieve an improved understanding of incumbents in established energy sectors and their extent of involvement in other (niche) energy sectors. To this avail, we analyze data from a first-of-its-kind survey of 133 incumbent firms in Norway's two main energy sectors, namely oil/gas and hydropower. Providing inter-temporal dimensions, our data covers incumbents' diversification activities beyond their primary sector both in the past (cancelled activities), present (ongoing activity in secondary sectors) and future (ambitions of diversification), and also distinguishes between producers and product/service suppliers. By incorporating insights on firm diversification, our analysis sheds new light on the complex transformation processes associated with sustainability transitions. Empirical results show considerable heterogeneity in incumbents' responses to changing selection pressures, which can be explained by recognition that windows of opportunity are opening and some incumbents see potential to leverage their resources and capabilities to capture value in new niche energy sectors in both domestic and international markets.

Pel, B. and Bauler, T., 2017, A Transitions-theoretical perspective on the Social Economy; exploring capture dialectics in Flemish 'insertion' practices, *Annals of Public and Cooperative Economics*, 88(2), 279-298,

Current persistent challenges of sustainable and equitable development call for systemic technical and social innovations. The 'insertion' practices of work integration social enterprises (WISEs) can be considered examples of such innovation efforts. The underlying rationales and institutional frameworks have been elaborated extensively in social economy scholarship. However, as WISEs are frequently reported to fall victim to pressures towards isomorphism or 'capture' by incumbent institutional structures, transitions theory seems worthwhile to invoke in order to develop a dynamic understanding of these processes. As illustrated through case study data on the Flemish social economy, it is highlighted how 'insertion' displays longitudinal dynamics of institutional capture that are similar to those observed in sustainability transitions more generally. This empirical analysis helps to identify the scope for fruitful paradigmatic interplay between transitions studies and social economy scholarship.

Safarzynska, K., and J. van den Bergh (2017). Financial stability at risk due to investing rapidly in renewable energy. *Energy Policy* 108: 12-20.

We present novel insights about effective energy policies using an agent-based model. The model describes relevant feedback mechanisms between technological evolution, the interbank market and the electricity sector. Analysis with it shows that energy policies affect interbank connectivity and hence the likelihood of cascades of bank failures. This effect has not been studied before in the literature. In particular, we find that investments in renewable energy reduce interbank connectivity, increasing the probability of bank failures, while raising taxes on energy has an opposite effect. Increasing the share of renewable energy in electricity production initially increases the price of electricity, and thus improves profits and the ability to re-pay debts of incumbent power plants. However, when the share of renewable

energy increases too quickly, financial stability may be at stake as the burden of financing investments in renewable energy offsets the improved profitability of existing power stations. All in all, this study provides a unique and novel perspective on the relationship between renewable energy investments and financial stability.

Normann, H.E. and Hansen, J., 2017, The role of domestic markets in international technological innovation systems, *Industry and Innovation*, in press

This paper explores how countries in non-leadership positions can couple onto globally developing technological innovation systems (TISs) for renewable energy. The paper contributes to recent debates on relations between TISs and context, with a focus on how industries located in one country relate to the international TIS. Based on a survey of 102 firms in the offshore wind industry in Norway and semi-structured interviews, we find that even though Norwegian firms link up with international TISs, the lack of a domestic market represents a barrier. However, firms with activities in related industries and large firms are less exposed to this barrier. This poses a challenge as the offshore wind industry in Norway mainly consists of smaller firms. We therefore suggest that policies should aim to stimulate interaction between smaller suppliers and larger firms that potentially can act as intermediaries and provide access to international markets.

Moss, T., 2016, Discarded surrogates, modified traditions, welcome complements: The chequered careers of alternative technologies in Berlins infrastructure systems, *Social Studies of Science*, 46(4), 559-582

This article takes an historical perspective on current attempts to 'open up' established, centralized systems of urban infrastructure to alternative technologies designed to minimize resource use and environmental pollution. The process of introducing alternative technologies into, or alongside, centralized urban infrastructures is not a novel phenomenon, as is often assumed. The physical and institutional entrenchment of large technical systems for urban energy, water or sanitation services in industrialized countries in the late 19th and early 20th centuries did not close the door completely on alternatives. I investigate a number of alternative technologies used in Berlin in the interwar period (1920–1939), in order to reveal the rationales developed around each technology and the ways in which each emerged, disappeared and re-emerged or survived across highly diverse political regimes. The selection of cases is guided by the desire to illustrate three different phenomena of alternative technology diffusion (and exclusion) experienced in Berlin: (1) technologies promoted by early pioneers and discarded by their successors (waste-to-energy), (2) technologies modifying traditional practices that were at odds with modernized systems (wastewater reuse for agriculture) and (3) technologies co-existing alongside the dominant centralized system throughout the 20th century (cogeneration). The empirical findings are interpreted with reference to their contribution to scholarship on urban socio-technical transitions.

MacArthur, J.L., 2017, Trade, tarsands and treaties: The political economy context of community energy in Canada, *Sustainability*, 9(3), 464

Governments today are increasingly looking to non-state and bottom up community actors to help achieve climate change mitigation targets. Canada is a resource rich state with one of the highest per capita greenhouse gas footprints in the world. It is also a state where issues of political will, geographic scale and incumbent industries contribute to a challenging context for broad community participation. Despite this, a long history of co-operative and municipal activity exists in the energy sector, exhibited in diverse ways across its provinces and territories. Provincial variation in energy sources and actors illustrates a far more nuanced picture than exists at the national level, providing a case rich with both promising and cautionary tales for the community energy sector. This article examines the emergence of community energy in the context of broader energy sector moves towards increasingly powerful trade agreements, privatization, and conflicts over Indigenous rights in Canada. It argues that significant potential exists to strengthen the role of local actors in Canadian

energy governance, but that macro-level political and economic developments have also created significant challenges for widespread community energy transitions.

Järvensivu, P., 2017, A post-fossil fuel transition experiment: Exploring cultural dimensions from a practice-theoretical perspective, *Journal of Cleaner Production*, in press

Societies must rapidly abandon the use of fossil fuels to avoid the worst effects of climate change. This paper examines the cultural dynamics of the energy transition by focusing on a post-fossil fuel experiment in an international artist and researcher residency. The aims of the experiment were to explore how fossil fuels currently determine human lives and to imagine and build pathways forward. The six-year ethnographic case study was analysed from the perspective of practice theory, shedding light on how changes in the material arrangements of energy, food and transportation reconfigure meanings and competences. These transformations were found to have inspiring as well as unfortunate, even threatening aspects that need to be taken into account in transition design and governance.

Sovacool, B.K., 2017, Experts, theories, and electric mobility transitions: Toward an integrated conceptual framework for the adoption of electric vehicles, *Energy Research and Social Science*, 27, 78-95

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

Sovacool, B.K., Jeppesen, J., Bandsholm, J., Asmussen, J., Balachandran, R., Vestergaard, S., Andersen, T.H., Sörensen, T.K., Björn-Thygesen, F., 2017, Navigating the “paradox of openness” in energy and transport innovation: Insights from eight corporate clean technology research and development case studies, *Energy Policy*, 105, 236-245

Using an inductive case study approach drawn from original interview data, this article investigates the innovation approaches among a sample of international energy companies, or corporate firms. It first presents a conceptual framework synthesized from the business studies, entrepreneurship, evolutionary economics, innovation studies, management science, organization studies, political science, and sociology literature. This framework suggests that corporate approaches to clean technology innovation will cut across the four dimensions of organizational multiplicity and stakeholder involvement, information sharing, coordination and control, and market orientation. It then explores how eight firms—the Algal Carbon Conversion Flagship and Aurora Algae (biofuel), DONG and Statoil (carbon capture and storage), Tesla and Volkswagen (electric vehicles), and Siemens and Vestas (offshore wind turbines)—approach clean technology development with “open innovation” attributes mixed with “closed” attributes. Although the study finds striking similarities among the particular approaches embraced by each corporate actor, it also notes that approaches are technology and firm specific, and the potential for different permutations leads to an almost

endless number of possible stylistic combinations. The innovation profiles depicted also reveal conflict and competition among various stakeholders, the implication being that corporate innovation in the energy sector remains a conflicted, disjointed, and messy process.

Wesseling, J.H., Lechtenböhmer, S., Åhman, M., Nilsson, L.J., Worrell, E., Coenen, L. 2017, The transition of energy intensive processing industries towards deep decarbonization: Characteristics and implications for future research. *Renewable and Sustainable Energy Reviews* 79, 1303-1313.

Energy-intensive processing industries (EPIs) produce iron and steel, aluminum, chemicals, cement, glass, and paper and pulp and are responsible for a large share of global greenhouse gas emissions. To meet 2050 emission targets, an accelerated transition towards deep decarbonization is required in these industries. Insights from sociotechnical and innovation systems perspectives are needed to better understand how to steer and facilitate this transition process. The transitions literature has so far, however, not featured EPIs. This paper positions EPIs within the transitions literature by characterizing their sociotechnical and innovation systems in terms of industry structure, innovation strategies, networks, markets and governmental interventions. We subsequently explore how these characteristics may influence the transition to deep decarbonization and identify gaps in the literature from which we formulate an agenda for further transitions research on EPIs and consider policy implications. Furthering this research field would not only enrich discussions on policy for achieving deep decarbonization, but would also develop transitions theory since the distinctive EPI characteristics are likely to yield new patterns in transition dynamics.

Wesseling, J.H. and Edquist C., 2017, Public procurement for innovation to help meet societal challenges: a review and case study, *Science and Public Policy*, in press

Public Procurement for Innovation (PPI) is a powerful, underutilized demand-side innovation policy instrument. How this instrument can contribute to meeting societal challenges, which require goal-oriented transformation of socio-technical systems, remains unclear and is explored in this paper. This paper draws on the transitions and PPI literature to propose transformative processes to which PPI can contribute and identifies factors that determine the effectiveness of PPI in meeting societal challenges. The propositions are explored with a case study on the procurement of radically new flood barrier technology, using event history mapping analysis. The paper concludes that, under certain conditions, PPI can contribute to the transformative processes of 1) the articulation of societal demands to direct challenge-driven transformation; 2) the development and production, 3) selection and 4) the diffusion and use of new technologies to meet these societal demands. The paper ends with policy recommendations on how PPI can help meet societal challenges

Schäpke, N., Omann, I., Wittmayer, J.M., Van Steenbergen, F., and Mock, M., 2017, Linking transitions to sustainability: A study of the societal effects of transition management, *Sustainability*, 9(5), 737

Sustainability transitions as processes of fundamental change in societal systems are open-ended, nonlinear and uncertain. Respective research and governance approaches, e.g., transition management, propose a reflexive way of governing, aiming for a number of societal effects to help facilitating a transition. Effects include empowerment, social learning and social capital development. Jointly mentioned effects shall allow for reflexivity and innovation in developing socially robust and contextualized solutions to sustainability challenges that work in practice. But, understanding the mentioned societal effects and their interplay in more depth is necessary to design and assess transition management processes. While such understanding and related assessment framework is under development in the transition management literature, transdisciplinary sustainability research can provide a rich body of tools and experiences. Building on a review of the literature, this article develops an evaluation framework focusing on social learning, empowerment and social capital as important and hitherto under-conceptualised aspects of the sustainability

transition literature. This framework is used to empirically investigate the effects of two specific transition management processes at the local scale. In doing so, the article provides a conceptual and empirical understanding of how social learning, empowerment and social capital contribute to a transition towards sustainability. The three effects are shown to be interrelated, mutually supportive and bridging different scale levels from individuals to groups, niches and beyond. Results highlight possibilities to facilitate and assess societal effects, addressing sustainability as their inherent quality.

Caniglia, G., Schöpke, N., Lang, D. J., Abson, D. J., Luederitz, C., Wiek, A., Laubichler, M.D., Gralla, F., and von Wehrden, H., 2017. Experiments and evidence in sustainability science: A typology. *Journal of Cleaner Production*. In press

Experiments are crucial for sustainability science because they allow researchers to produce evidence about the causes of sustainability problems and about the effectiveness of solutions. Many laboratory and field studies, community-based initiatives, and pilot projects have been defined as experiments in this field. Yet, in sustainability science, it is still unclear what distinguishes scientific experiments from conventional projects or initiatives as well as how different scientific experiments compare to one another. In this article, we define an experiment as a scientific practice that relies primarily on an intervention and that allows for the production of empirical evidence. We show that, in sustainability science, researchers can have different types of control over the intervention (from full to no control) and that evidence can be about different subjects (sustainability problems or sustainability solutions). Relying on this differentiation, we introduce a typology that organizes experiments in sustainability science according to type of control over interventions and subjects of experimentation. The typology provides a synthetic, comprehensive, and comparative overview of the variety of experimental approaches in sustainability science. By providing a definition and a typology for scientific experimentation in this field, the article contributes to the further development of evidence-based approaches in sustainability science.

Truffer, B., Schippl, J., and Fleischer, T. 2017, Decentering technology in technology assessment: Prospects for socio-technical transitions in electric mobility in Germany, *Technological Forecasting and Social Change*, in press

Sustainability transitions of sectors like energy, transport or water have become explicit goals of national policy programs in several parts of the world. The governance of associated innovation and transformation processes requires an integrated assessment on how new and seemingly superior technologies will interact with manifold societal, economic, industrial and political contexts. Failing to do so is likely to quickly undermine political support for these ambitious and long term projects. Part of the program of technology assessment is to anticipate the impacts of new technologies on society and the environment. However, in order to address the challenge of sustainability transitions, institutional dynamics have not been considered explicitly enough in existing approaches. We elaborate a methodological proposal on how to analyze the interaction between technological and institutional developments in specific technology fields. We identify potential future variations of core institutional structures of a socio-technical regime, construct matching regime constellations, and elaborate on interactions with technological design alternatives. The framework will be applied to recent developments in the field of electric mobility in the context of the German *Energiewende*. The results provide some fresh perspectives for academics and policy makers on how to better consider interactive dynamics in socio-technical systems.

Silver, J. and Marvin, S., 2017, Powering sub-Saharan Africa's urban revolution: An energy transitions approach, *Urban Studies*, 54(4), 847-861

This paper develops a geographic understanding of urban energy transitions in sub-Saharan African towns and cities. In doing so this paper seeks to critically reflect on the value and limits of *urban transitions analysis* as a framework for understanding energy networks beyond the largely integrated systems across the Global North. We explore how these

potentials and deficits can be addressed by examining promising developments across a series of debates in urban studies that can help sensitise this approach to energyscapes in the African context. By reviewing urban transitions analysis through these debates the paper offers four important contributions to expand existing ways of understanding energy transition. These include the particular urbanisation dynamics of African towns and cities, the need to locate the urban across energy regimes, the agencies of various intermediaries and urban actors and the contested politics inherent in the governing of energy networks. In the conclusion we reflect on the specific directions that have emerged from the paper in relation to our contributions, offering a geographically informed framework that allows us to better examine the challenges and specificities of transition across these rapidly growing urban regions.

De Schutter, O., 2017, The political economy of food systems reform, *European Review of Agricultural Economics*, forthcoming

Modern food systems as they have developed over the past half-century are unsustainable: their health and environmental impacts, as well as their failure to reduce rural poverty in developing countries and the power imbalances in food chains, are a concern to a growing number of activists. However, the mainstream system is highly path-dependent, and resistant to reform. Change can be expected neither from government action, nor from business initiatives alone, and grassroots innovations led by ordinary people have a limited impact. Only by connecting these different pathways for reform by food democracy can lasting food systems reform be achieved.

Cuppen, E., Pesch, U., Remmerswaal, S. and Taanman, M., 2017, Normative diversity, conflict and transition: Shale gas in the Netherlands, *Technological Forecasting and Social Change*, in press

Few people disagree on the need for sustainable development, but ideas about what it exactly means and how to pursue it diverge considerably. Although such normative conflicts are key to sustainability transitions, attention to such conflicts is lacking in transition studies. In this paper we understand societal conflict as an informal assessment of sustainable transition pathways with the potential for learning about normative ideas about the direction, speed and means of transitions. We analyse the Dutch societal conflict on the plans for shale gas exploration between 2010 and 2013, based on a media-analysis and interviews, in order to identify the normative conflicts and to find out to which extent these normative conflicts resulted in higher-order learning. The two main normative conflicts in the case firstly concern the role of gas in the energy transition, and secondly the balance between local and national interests in defining the public interest. With that, the societal conflict challenges two key elements of the Dutch welfare state. We conclude that there has been higher-order learning as regards the first conflict, but not as regards the second.

Jolly, S., 2017, Role of institutional entrepreneurship in the creation of regional solar PV energy markets: Contrasting developments in Gujarat and West Bengal. *Energy for Sustainable Development*, 38, 77-92.

With political initiatives, such as the National Solar Mission by Government of India, rapid development of grid connected solar PV energy in India has occurred in the recent times. However, an interesting puzzle is with respect to significant regional differences in Indian states despite similar levels of solar radiation, government support and regional level policy and regulatory initiatives in the states. The paper discusses the implementation of grid-connected solar PV energy in two Indian states – Gujarat and West Bengal – under the national-level program Jawaharlal Nehru National Solar Mission by the government of India. The paper offers empirical insights into implementation barriers involved in regional sustainable energy initiatives by using insights from the institutional entrepreneurship literature. The study concludes by describing the reasons for successful implementation in Gujarat and less successful implementation in West Bengal by discussing regional similarities and differences of institutional entrepreneurship of three key actors: government

officials within regional government, regional regulatory agencies and regional industry associations.

Binz, C., Gosens, J., Hansen, T., Hansen, U.E., 2017, Toward technology-sensitive catching-up policies: Insights from renewable energy in China, *World Development*, in press

The voluminous literature on industrial catching-up in Southeast Asian countries has regularly argued that successful catching-up largely depended on a committed state, which orchestrated industry development with a relatively uniform set of policies, including R&D support, subsidies, trade restrictions, and local content requirements. In contrast, recent contributions from the technology lifecycle literature have argued that policies should be tailored to differing technological characteristics in industries for mass-produced standardised goods, complex engineered products, and - as we argue - complex product systems (CoPS). In this paper, we extend this argument by introducing a set of separate policy mixes for each industry type, which appears most capable of providing the key resources required for catching-up: knowledge, market access, financial investment and technology legitimacy. This framework is used to analyse catching-up patterns in China's wind, solar PV, and biomass power plant industries, drawing mainly on policy documents and 106 interviews with key industry actors. We find that traditional top-down catching-up policies played a decisive role in the development of China's wind industry, but were of limited importance in the early solar PV industry, and resulted only in a limited period of rapid growth in the biomass power plant industry. The relative progress achieved in these three industries is not related to top-down policy guidance alone, but also to private sector initiative, international interdependencies, and flexibility in adapting policy mixes to each industry's technological characteristics. These results suggest that policy makers in newly industrializing countries (NICs) should avoid drafting generic sector plans, but should tailor plans to individual industries, and respond to changing policy support needs as technological capacities and global competitiveness develop.

Baranzini, A., Van den Bergh, J.C.J.M., Carattini, S., Howarth, R.B., Padilla, E., Roca, J., 2017, Carbon pricing in climate policy: seven reasons, complementary instruments, and political economy considerations, *WIREs Climate Change*, in press

Carbon pricing is a recurrent theme in debates on climate policy. Discarded at the 2009 COP in Copenhagen, it remained part of deliberations for a climate agreement in subsequent years. As there is still much misunderstanding about the many reasons to implement a global carbon price, ideological resistance against it prospers. Here, we present the main arguments for carbon pricing, to stimulate a fair and well-informed discussion about it. These include considerations that have received little attention so far. We stress that a main reason to use carbon pricing is environmental effectiveness at a relatively low cost, which in turn contributes to enhance social and political acceptability of climate policy. This includes the property that corrected prices stimulate rapid environmental innovations. These arguments are underappreciated in the public debate, where pricing is frequently downplayed and the erroneous view that innovation policies are sufficient is widespread. Carbon pricing and technology policies are, though, largely complementary and thus are both needed for effective climate policy. We also comment on the complementarity of other instruments to carbon pricing. We further discuss distributional consequences of carbon pricing and present suggestions on how to address these. Other political economy issues that receive attention are lobbying, co-benefits, international policy coordination, motivational crowding in/out, and long-term commitment. The overview ends with reflections on implementing a global carbon price, whether through a carbon tax or emissions trading. The discussion goes beyond traditional arguments from environmental economics by including relevant insights from energy research and innovation studies as well.

Kuzemko, K., Mitchell, C., Lockwood, M. and Hoggett, R., 2017, Policies, politics and demand side innovations: The untold story of Germany's energy transition, *Energy Research & Social Science*, 28, 58-67

This article shines a light on a less examined aspect of sustainable energy transitions: governing for demand side innovations in Germany. Demand innovations are considered to be central to affordable, efficient and politically acceptable energy system transformations, however many argue that not enough is being done in governance terms. In a departure from much analysis on demand policy demand innovations are defined broadly here to explicitly include demand side response, demand reduction and distributed energy – given that each has important roles to play within demand-oriented markets. Demand governance is conceptualised as a long-term political process that is both contextually specific but also open to challenge and change at various points in time. The single case study is Germany where demand governance, recent changes in energy markets, and implications for how the politics of energy are changing are all analysed. This paper reveals the specific ways in which critical policy debates emerge over time and influence political decision-making; the ways in which these debates relate to changes in energy markets; as well as a lack of governance in relation to enabling demand side response and local energy markets.

Raven, R., Ghosh, B., Wieczorek, A., Stirling, A., Ghosh, D., Jolly, S., Karjangtimapron, E., Prabudhanitisarn, S., Roy, J., Sangawongse, S., Sengers, F. 2017, Unpacking sustainabilities in diverse transition contexts: solar photovoltaic and urban mobility experiments in India and Thailand, *Sustainability Science*, 12, 579.

It is generally accepted that the concept of sustainability is not straightforward, but is subject to ongoing ambiguities, uncertainties and contestations. Yet literature on sustainability transitions has so far only engaged in limited ways with the resulting tough questions around what sustainability means, to whom and in which contexts. This paper makes a contribution to this debate by unpacking sustainability in India and Thailand in the context of solar photovoltaic and urban mobility experimentation. Building on a database of sustainability experiments and multicriteria mapping techniques applied in two workshops, the paper concludes that sustainability transition scholarship and associated governance strategies must engage with such questions in at least three important ways. First, there is a need for extreme caution in assuming any objective status for the sustainability of innovations, and for greater reflection on the normative implications of case study choices. Second, sustainability transition scholarship and governance must engage more with the unpacking of uncertainties and diverse possible socio-technical configurations even within (apparently) singular technological fields. Third, sustainability transition scholarship must be more explicit and reflective about the specific geographical contexts within which the sustainability of experimentation is addressed.

Lutz, L.M., Fischer, L.-B., Newig, J., Lang, D.J., 2017, Driving factors for the regional implementation of renewable energy ? A multiple case study on the German energy transition, *Energy Policy*, 105, 136-147

Understanding what drives the regional implementation of renewable energy is a prerequisite for energy transitions toward a post-fossil-based energy economy. This paper presents an empirical analysis of driving factors for the regional implementation and use of renewable energy. We tested literature-derived driving factors in a comparative analysis of 18 selected study regions using Rough Set Analysis and performance analysis. We paid special attention to common combinations of driving factors, which we understand as established practices concerning the use and implementation of renewable energy. Our findings confirm most of the driving factors identified in the literature, for example the existence of key actors, knowledge exchange, or the use of goals and milestones. We also observe differences in key driving factors between highly successful and less successful regions, especially regarding funding opportunities. The results may support policy makers who aim to successfully implement renewable energy at a regional level.

Eagle, L., Osmond, A., McCarthy, B., Low, D. and Lesbirel, H., 2017, Social marketing strategies for renewable energy transitions, *Australasian Marketing Journal*, in press

Transitions to more sustainable energy systems are increasingly required to address the problem of climate change. Different stakeholder groups, however, may not share the same level of acceptability for an increase in renewable energy. This paper examines energy consumers' attitudes towards energy issues, their use of renewable energy in the home and constraints to energy conservation. Respondent-completed questionnaires from 325 people reveal strong support for renewable energy and a belief in human-induced climate change. A multitude of obstacles to energy-efficient practices are revealed by the survey. The paper also explores the role of social marketing in prompting behavioural change and encouraging a transition to renewable energy. Policy makers can utilise these findings to accelerate the transition to renewable energy and build capacity among residents.

Axsen, J., Langman, B., Goldberg, S., 2017, Confusion of innovations: Mainstream consumer perceptions and misperceptions of electric-drive vehicles and charging programs in Canada, *Energy Research & Social Science*, 27, 163-173

Consumer demand is an important aspect of a successful transition to low-carbon technology—where consumers must have basic awareness and understanding of a technology in order to purchase and use it. In this study we explore consumer knowledge, confusion and perceptions for two related technology cases: plug-in electric vehicles (PEVs) and a program that allows the electric utility to control the timing of PEV charging to support renewable electricity. We focus on “Mainstream” vehicle buyers, who differ from the first PEVs buyers. We conducted semi-structured interviews with 22 new-vehicle buying households in the greater Vancouver area of British Columbia, Canada. Overall, participant awareness was very low for both technologies; most participants were confused about hybrid and plug-in hybrid technology and did not understand the sources of electricity that PEVs might consume. Once the case technologies were explained, most participants expressed a wide range of positive and negative perceptions of both, which we categorize into a framework of perceived functional (e.g. cost and performance), symbolic (e.g. “strangeness” and loss of control), or societal (e.g. pollution reduction) attributes. We conclude with suggestions of how research and policy can consider and further examine the roles of knowledge and perceptions in markets for low-carbon technologies.

Schmid, E., Pechan, A., Mehnert, M., Eisenack, K., 2017, Imagine all these futures: On heterogeneous preferences and mental models in the German energy transition, *Energy Research & Social Science*, 27, 45-56

The implementation of theoretically designed low carbon energy transitions provided by scientific policy advice proves to be challenging in practice. For the case of Germany prominent rhetoric frontlines separate proponents of centralized and decentralized solutions for decarbonizing its electricity infrastructure. This paper investigates whether the claim that incumbent actors favor centralized and challengers decentralized solutions finds supporting evidence on a small sample of practitioners from different fields of the German electricity system. It further aims to identify qualitative infrastructure scenarios for its long-term future based on the practitioners' mental models of system effects. We find empirical evidence for the postulated claim; yet there are no clear-cut camps. Disagreements across elicited mental models of practitioners from the same fields render the identification of internally consistent scenarios impossible for the full sample. The largest possible subsamples lead to three related visions of a substantially transformed electricity system dominated by decentral, small and medium-scale solutions coexisting with some centralized, large-scale infrastructures. The strong heterogeneity in preferences and mental models we uncover leads us to conclude that transparent and participatory public discourse on underlying worldviews, norms and values is paramount for accelerating institutional reform paving the way for energy transitions in Germany and globally.

Canzler, W., Engels, F., Rogge, J-C., Simon, D., Wentland, A., 2017, From “living lab” to strategic action field: Bringing together energy, mobility, and Information Technology in Germany, *Energy Research & Social Science*, 27, 25-35,

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

Metze, T., Schuitmaker, T.J., Bitsch, L. and Broerse, J., 2017, Breaking barriers for a bio-based economy: Interactive reflection on monitoring water quality, *Environmental Science & Policy*, 74, 1-7

In a transition to a bio-based economy new ways of monitoring waste-streams and water quality can then contribute to sustainable production processes. As niche innovation, new ways of monitoring face systemic barriers. The present article examines how barriers to change manifest in discursive practices with differing normative attachments and implications. A frame analysis revealed two competing frames: (1) the dominant ‘norm water’ frame in which thresholds of chemical compounds are used to set policy targets; and (2) the contesting ‘living water’ frame, which entails innovative continuous monitoring tools that take into account the ecological effects of chemical compounds. We introduce the concept of *interactive reflectivity*, as a discursive tool, to collaboratively visualize, scrutinize and overcome discursive barriers to innovations. The stakeholder dialogue shows how systemic barriers are uttered discursively in niches – or other forms of responsible research and innovation – and may hinder change even at the niche-level.

Gralla, F., Abson, D.J., Mollers, A.P., Lang, D.J. and Von Wehrden, H., 2017, Energy transitions and national development indicators: A global review of nuclear energy production, *Renewable and Sustainable Energy Reviews*, 70 1251–1265

Energy use plays a vital role for human well-being. However, human well-being can also be affected by socio-economic and environmental impacts associated with the use of different primary energy sources. Nuclear energy production is perceived as one means of satisfying national energy demand while contributing to a potentially sustainable energy transition. The objective of this study is to further understand socio-economic, environmental and technological factors that characterize countries that choose nuclear energy production. Hence, this exploratory study reviews the socio-economic contexts of nuclear energy producing countries in comparison to countries without nuclear energy use. The study is based on world development indicators published by World Bank for 213 countries between 1960 and 2013 and follows two analytical steps. First, based on a comparison of countries average development indicator values over time, we descriptively explore which socio-economic, environmental and technological factors characterize the spectrum of countries following different ‘nuclear energy strategies’ (no nuclear production, phase-out, planning to produce, produce nuclear energy). Second we statistically analyze nuclear energy producing countries, exploring if there was significant change in socio-economic, environmental and technological characteristics after the start of nuclear energy production. Characteristics of our four country groups revealed nuclear countries (incl. phase-out) used more energy per

capita and showed higher levels of carbon emissions as well as household consumption compared to countries planning to use nuclear energy and countries without nuclear energy use. Adoption of nuclear energy does not appear to reduce fossil fuel use or enable energy independence. Hence, our study did not provide evidence that nuclear energy production can be seen as technological answer to global challenges like climate change or unequal energy distribution. It is therefore unclear if and how nuclear energy contributes to global human well-being as part of sustainable development.

Helena de Boer, M.A.F. and Caprotti, F., 2017, Getting Londoners on two wheels: a comparative approach analysing London's potential pathways to a cycling transition, *Sustainable Cities and Society*, in press

This article compares the current state of cycling in London to the Amsterdam cycling transition of the 1970s, applying the Multi-Level Perspective to identify potential pathways and obstacles to the wider adoption of the cycling niche in London. Our approach is two-pronged, consisting of a historical perspective to analyse the cycling transition in Amsterdam, and a policy analysis in contemporary London, based on semi-structured interviews with respondents involved in London's cycling policy. We identify factors that reinforce cycling's niche status in London, thus making the wider adoption of cycling more challenging than it was in Amsterdam. Based on our comparison, we also highlight policy, infrastructure and cultural changes that will aid in promoting a cycling transition in London.

Becker, S., Kunze, C., Vancea, M., 2017, Community energy and social entrepreneurship: Addressing purpose, organisation and embeddedness of renewable energy projects, *Journal of Cleaner Production*, 147, 25-36

In many European countries, renewable energy has evolved through decentralised and small-scale forms of organisation. These different initiatives are often denominated as community energy in both research and practice. By examining community energy initiatives through a social entrepreneurship lens, we develop an integrated approach for the analysis of small-scale and bottom up energy initiatives. Our approach relies on three specific analytical dimensions: the purpose of the initiative, its form of organisation and ownership, and its embeddedness into local community or wider social movements. We apply this analytical framework to four case studies selected from a larger empirical study on newly emerged forms of organisation in the field of renewable energy across the European Union. Drawing on our findings, we characterise social enterprises in the energy sector as collectively owned organisations that combine renewable energy production with more overarching goals of environmental and social transformation, and a specific quest for civic participation. These initiatives show strong relationships with different social movements and even a potential to transcend the local scale. We conclude that given similarities in the two areas of research provide fertile ground for mutual advancement, both conceptually and empirically.

Williams, A., Kenney, S., Philipp, F. and Whiteman, G., 2017, Systems thinking: A review of sustainability management research, *Journal of Cleaner Production*, 148, 866-881

Scholars from a wide range of disciplines and perspectives have sought to unravel the high complexities of sustainability. A mature understanding of sustainability management requires studies to adopt a multidisciplinary systemic lens capable of appreciating the interconnectivity of economic, political, social and ecological issues across temporal and spatial dimensions. Yet the field of systems thinking in the context of sustainability management research is disparate and can benefit from a comprehensive review in order to assimilate the current fragmented body of research and to identify promising research directions. To address this gap, we conducted a review of the systems thinking and sustainability management literature from 1990 up to 2015 including 96 articles. In this review, we first present descriptives that show an emerging body of work rapidly growing since 2011. We found that 54 percent of articles were published in two transdisciplinary

journals, demonstrating that a systemic approach is not yet prevalent in mainstream management journals. Second, we identify and describe the core theoretical concepts of systems thinking found in the literature including interconnections, feedbacks, adaptive capacity, emergence and self-organization. Third, findings show a number of research themes, including behavioral change, leadership, innovation, industrial ecology, social-ecological systems, transitions management, paradigm shifts and sustainability education. Finally we offer a cross-scale integrated framework of our findings, and conclude by identifying a number of promising research opportunities.