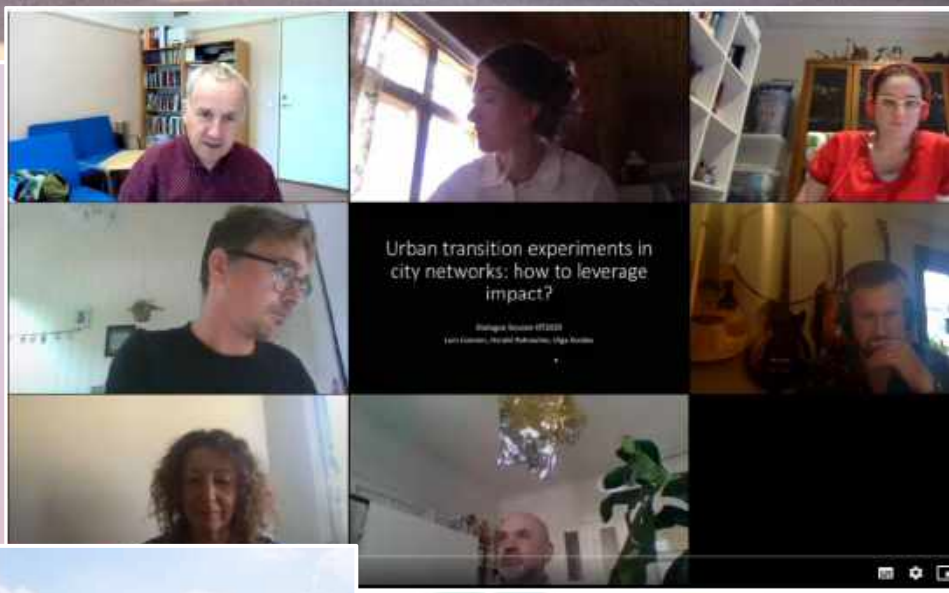
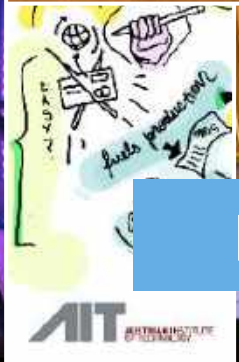
STRN Newsletter





N°37 | September 2020

Sustainability Transitions Research Network.

Newsletter 37 – September 2020

Content

Special

About

The STRN newsletter is published four times a year in March, June, September & December

Cover: Impressions from IST 2020

Editorial

by Klaus Kubeczko
(Austrian Institute of Technology)
& Verena Madner
(Vienna University of Business)

First of all, a big thank you to all of you who have joined the IST2020! It was a great pleasure for us to see so many familiar and new faces. That we could not see much more than your faces was an odd feeling – we would have really enjoyed meeting you in person in Vienna. In the end, however, we learned that big events such as this also work online and can become more climate friendly.

Preparing IST2020, we have seen that we are indeed living in a time of big changes and challenges, so "Governance in an Era of Change" proved to be the right topic. The COVID19 pandemic showed that, when visions for transitions are at hand, times of crisis might also trigger changes.

Who would have ever believed that the Green New Deal or the European Green Deal would be considered as a way out of a global economic crisis by many? The STRN research agenda and the contributions of our field will be highly relevant in making these transitions happen.

We believe that with around 400 individual contributions spread over four days and 23 hours of intensive conference time, the impact of the conference will endure. We are particularly proud that researchers from our community organized 43 dialogue sessions, which – next to transition scholars – attracted participation of more than 100 experts, policy professionals and activists.

We also believe that we have to widen our research agenda. Looking back, we see at least two topics that should receive more attention at future IST conferences. Mainstreaming transitions will lead to a massive increase in investments. This and the climate crisis will affect private and public spending. Therefore, a better understanding of the role of the state and of financial institutions (both public and private), will be needed to maintain the relevance of transition research. Transitions research should also be extended to include law, as regime change is becoming more concrete and policy makers are increasingly aware of the need for setting up new legal frameworks.

We are happy that we received so much positive feedback and suggestions. To improve future online events, we will soon send out a questionnaire, which will help us and the organizers of IST2021 to better understand what needs to be improved.

In this newsletter you can already read some facts and figures and first reflections from us and some participants.

We are very optimistic and looking forward to meeting you all again virtually or in person at future IST conferences.

Best wishes

Klaus and Verena

EIST Journal

As you probably have seen, Elsevier now applies the so-called "article-based publishing" (ABP) format to EIST. Hence, EIST volumes 36 and 37 also follow this format.

Volume 36 can be found here.
It includes a policy brief on "China's post-COVID-19 stimulus: No Green New Deal in sight", a survey on "The study of institutional entrepreneurship and its implications for transition studies", 12 regular articles, a book review, and a special issue/section on "Zooming in and out: On local transition governance".

Volume 37 is still in progress, and includes seven regular articles so far. It can be found here.

For a complete list of special issues see this link.

Since 1 September we have a new associated editor, namely Prof. Rob Raven from Australia. He replaces Prof. Maurie Cohen who decided to step down after accepting new responsibilities at his university. We are grateful for Maurie's commitment to EIST during the past years. He has proved to be a very reliable, thoughtful and constructive companion in the editorial team.

As always, we look forward to receive your submissions and comments. Please don't forget to read, and if relevant cite, EIST.

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

STRN Events

Upcoming Events

12th IST conference, October 5-8, 2021

The 12th International Sustainability Transitions Conference will take place in Karlsruhe, Germany.
It is planned as a hybrid event with people meeting in person and online.

The conference will be hosted by the Fraunhofer Institute for Systems and Innovation Research (ISI) in Karlsruhe.

Watch this video by Jakob Edler with some first impressions of what awaits.

The IST 2021 conference theme and the call for papers will be announced very soon, on October 15, 2020.

The local organizing committee is very much looking forward to welcoming you at IST 2021.

NEST Conference 2021, April 8-9

The 6th NEST Conference will be held from April 8-9, 2021 in Sofia, Bulgaria. The 6th NEST Conference will be held from April 8-9, 2021 in Sofia, Bulgaria. The current organizing team is in the initial stages of preparation with more info to follow. Soon, we will issue a call for abstracts and the announcement of the conference theme!

For more information contact Abe Hendriks

NEST webinar series

This spring, the NEST webinar series launched with successful sessions by Jochen Markard, Marko Hekkert, Frank Geels and Karoline Rogge. And just the other day, Flor Avelino talked about transformative social innovation.

In our webinars, we aim to give early career researchers the opportunity to learn about core concepts in the field, and facilitate the dialogue between them and senior researchers. We also work towards creating a curated resource of our webinar recordings and other recorded lectures or presentations, which will be made available on the NEST blog as well as through our YouTube channel. If you have recordings of lectures or talks on transition studies you would be willing to share, we would very much appreciate you getting in touch with Abe Hendriks.

Invitations for future webinars will be sent through the STRN mailing list. Over the next months we have sessions scheduled with:

Niki Frantzeskaki (October 27th)
Lars Coenen (November 24th)
Lea Fünfschilling (December 10th)

We are looking forward to the upcoming sessions and invite interested researchers to join us!

New webinar series on the Geography of Transitions (GeoST)

This November, a new webinar series on the geography of sustainability transitions will be launched. The webinar series aims at exploring the current state of the art in GeoST theorizing and identifying promising future research themes that go beyond the issues commonly discussed in the STRN community. It brings together scholars from transition studies and human geography that are working on salient conceptual interfaces and empirical cases, which taken together may build the backbone of a future overarching research agenda. The webinars are set up as a series of 'mini-keynote' lectures, followed by a discussant and open Q&A, and intend to initiate an open and inclusive debate about what the GeoST field is all about and where it may be heading in the future. The event will also be used to launch a new STRN thematic group on the geography of transitions. Detailed information about the webinars will be provided soon through the STRN mailing list.

For any inquiries, please get in touch with Christian Binz

Other Events

Upcoming events

APEEN 2021: Energy Transition and Sustainability, January 20-21

The 5th Annual Conference of the Portuguese Association of Energy Economics (APEEN) is fully dedicated to all aspects of the Energy Transition and Sustainability. Climate change and sustainability are challenging energy systems to new levels of innovation, in terms of technology, regulation and social values, among others.
The 5th APEEN conference aims to join leading academic scientists, researchers, innovators and business and social stakeholders, through an interdisciplinary context to present, share and discuss the most recent experiences, research results, innovations and ideas around the multiple topics on Energy Transition and Sustainability.

GET-together seminar series

On September 24th, the University of Stavanger has launched the Governing Energy Transitions together (GET-together) seminar series with an opening seminar featuring Professor James Meadowcroft.

Further dates and speakers:
Oct. 1, Jennie Stephens, Energy democracy
Oct. 22, Per Espen Stoknes, Green growth
Oct. 29, Zora Kovacic, Complexity, uncertainty and ambiguity
Nov. 5, Jessica Verheij, Justice and power relations
Nov. 19, Harriet Thomson, Energy poverty
Nov. 26, Mari Martiskanen, Energy justice activism
Dec. 3, Kjetil Rommetveit, Make way for the robots!

Seminars are geared towards online participation and run 16-17 CET on Thursdays. To register, visit this link.

EURAM 2021, June 16-18, Call for Papers

We invite you to submit your research to explore the theme of Reshaping capitalism for a sustainable world for a special track on *Organizational Coevolution and Ecosystems* at next year's European Academy of Management (EURAM) conference.

Deadline: 12th January 2021 – 2 pm CET.

Author's guidelines for full papers can be found here.

For more information contact Johan Kask.

New Projects

Transactional investigations of learning in view of sustainability transitions (LESTRA)

Katrien Van Poeck, senior researcher at Ghent University's Centre for Sustainable Development, has been awarded an ERC Starting Grant to build e new research team on the above topic.

The LESTRA project's key question is how can learning fruitfully contribute to sustainability transitions (STs). This project's objectives are 1) to develop a new analytical and conceptual framework for investigating the connections between learning processes, the transformation of habits and customs, and (potential) STs; 2) to identify the key conditions for learning to contribute to STs; and 3) to develop a roadmap for

future research in diverse settings and contexts.

Follow updates on the project here.

The project will start in Spring 2021. A full-time post-doctoral researcher (5 years) and two PhD students (4 years) will be employed for the project team.

Contact Katrien van Poek for further information.

Other News

Award for cVPP project

The cVPP project has been awarded a EU Citizens Award for Sustainable Energy Innovation. cVPP is a community-based Virtual Power Plant that is made possible by an ICT platform which facilitates aggregation of distributed generation and flexible asset. The platform can schedule the operation the assets in a way that not only helps grid operators deal with the congestion and balance issues. It predominantly operates based on motivations and goals of the communities. It is thus a true radical and socio-technical innovation that empowers citizens. We had a privilege to develop and test this concept in the context of the Interreg NWE project. More information: Anna J. Wieczorek.

Looking back @ IST 2020

Conference organization in times of crisis – experimenting with new opportunities

by Gudrun Haindlmaier

As you all know, due to COVID-19 we had to switch the conference from a great place in Vienna to a virtual event. Finding an adequate conference tool was no easy task. Our ambition was to allow for dialogue between academics, experts and activists and to also provide space for social networking. Therefore, we did not want to merely copy the analog format to the digital world but experimented with new conference modes, in addition to "traditional" session formats such as Full Paper Sessions, Speed Talks and Dialogue Sessions. With the IST2020 Gallery, we intended to combine flexible access to contributions and a slot for live discussions with the authors. Many of these contributions were pre-recorded and accessible during the whole conference, thus providing the opportunity to get an overview of the research for those who could not attend live sessions.

Some key facts about IST2020

672	Registered participants (incl. conference ambassadors und support staff)
30	Average participants online in every session during up to 9 parallel sessions
147	Full paper presentations
95	Speed talks
43	Dialogue sessions (some with more than 90 participants)
133	Gallery contributions including 14 posters
3	Keynotes (330 viewers online during keynote by Ann Pettifor)

Given the tight program, we were a little nervous, if the opportunities for networking and relaxation would be enough, and if side events like Speed-dating, Vienna-says-Hi!, the Dinner-session with live music, the Ganymed performances and the Yoga Breaks would create enough space for that. We hope we could achieve some of it.

What we learned:

A first learning was that participants in an online event need time to get accustomed to move around in a virtual world. New routines had to be established on the fly. Given the intensive live program, the opportunity to meet authors during a specific time slot in the Gallery was not used as much as we had hoped. Nevertheless, with some finetuning, we'd expect a potential in this new format, due to the possibility to make those contributions available in a conference repository.

Second, it turned out that the chat function was intensively used to enrich the academic discourse and to provide and document information otherwise lost. That way, also those comments or questions for which there was not enough time in the live format could be heard. This is a great feature we might also want to work with in future events.

Third and unfortunately, the conference tool did not allow us to keep the material online for a longer time. So, as many of you have asked to make the contributions accessible, we will provide conference participants with a password protected download-link in the coming days. This will give you access to the Gallery contributions, to the full papers and some chats and YouTube videos of selected sessions.

Finally, to learn more about your experiences and to help the IST2021 organizing team, we will send out a feedback questionnaire soon.

Personal impressions

Last month, I attended my first IST conference. I am new to the discipline of sustainability transitions having started as a research fellow at SPRU, University of Sussex just 6 months ago. I work on the Transformative Innovation Policy Consortium (TIPC) and its sister project, Deep Transitions, which are inspired by the theory of sustainability transitions.

I was excited to attend IST as I had heard it is the biggest (or one of the largest!) annual meeting places for researchers working on sustainable transitions across the globe. I felt that the conference would be a great chance to get a 'big picture' view of the discipline overall and what the emerging areas in sustainable transitions are. I was very much looking forward to the sessions about the geographies of transition as this is an area I am working on.

I most liked the range of sessions from the big keynote lectures to the small poster sessions. I was inspired by Ann Pettifor's keynote on the green new deal – I had not previously made the link between the institution of credit and rent-seeking, for example. The live streamed yoga sessions were a great reminder of the importance of stretching and the musical concert on the Thursday evening was great.

The online format was great because it meant I didn't have to travel away from my family but it was very tiring to stare at a screen for hours over 4 days. Sometimes the schedule of the sessions clashed with my childcare responsibilities. The high number of parallel sessions made it hard to pick which to 'attend'! Recording more of the sessions and making the recordings available after the conference (if not to everyone then at least to conference attendees) could be a way to address the dilemmas of which sessions to listen to.

My highlights were in hearing and learning from so many inspiring researchers located across the world. The keynote speakers were all fantastic. I had not fully grasped before the conference just how big the discipline of sustainability transitions is – about 4000 papers have been published in 5 key journals since the year 2000, according to Karoline Rogge in her keynote! I also reached out to researchers working on subaltern and uneven spaces as the 'dark side' of transformation and to researchers studying regional experiences of transformation in the Nordic countries.

Imogen Wade
Research Fellow in Transformative Innovation, SPRU, University of Sussex

The IST2020 conference was one of the most productive and enjoyable events that I have attended in over ten years of my academic career. Receiving expertly feedback on my work and networking with the experts and peers were among the main reasons I attended the IST2020. This year's theme could not have been timelier, as the theme and three keynote speakers focused on the importance of governance in accelerating sustainability transitions not only in the face of resource scarcity and climate change, but also in the current COVID-19 pandemic.

Even though the conference was online, I found it fantastically adaptable and scalable. It provided me with the flexibility of gaining access to any of the sessions including full paper, speed talk, dialogue, cultural and yoga. Additionally, it provided me with amazing networking opportunities as I attended multiple sessions simultaneously and instantly interacted with a bigger and more diverse audience from around the world including speakers, specialists, and peers. I was able to present my paper very comfortably and effectively to the audience and received questions and feedback in a number of ways - including messaging and dialogue in the session or even hours or days after my presentation.

I learned how to break my comfort zone and reach out with an elevator pitch to the prominent experts and peers. To me personally, the IST2020 conference was more of a 'comference' as I could more comfortably attend the entire conference in my pajamas, living far away in the land down under (Australia). I left the conference with more scientific gains and footprint, and yet no carbon footprint. While I highly recommend the organisers keep on delivering the online version next to the default face-to-face, I also would like to suggest a live polling capability for presenters to keep their audience involved and engaged in their presentation. I am looking forward to attending the next IST conferences.

Amir Mirzadeh Phirouzabadi
Ph.D. candidate in management, The University of Newcastle, Australia, amir.mirzadeh@uon.edu.au

First off, I was eager to attend the IST conference as soon as it was suggested to me by my peers at our department, as it is a great opportunity to connect with other PhD students from the field and also with the senior researchers.

During the conference, I enjoyed the interdisciplinary foundation of the sustainability transition research network. As I come from an economics background, where I felt that interdisciplinary theoretical and empirical work was not appreciated or even considered, I was pleased about the diversity in the network. For instance, I was really impressed by the approaches that included

discourse analyses of hype cycles and discussions of technological bottlenecks and trade-offs from an engineering perspective.

The technical execution and organisation of the conference was exceptional and made the conference a wonderful experience during these difficult times! I enjoyed the possibility of switching between different sessions dynamically, which allowed me to experience as much as possible from the conference. Moreover, the gallery format was great to read upon research during the not so busy times and provided the opportunity for in-depth discussions during the spotlight sessions. However, as some sessions did not have as much visitors, it might be a good idea to assign a reviewer to each gallery presentation in order to be sure to receive some feedback.

Overall, my first IST conference was a great experience. I had many exchanges with other scholars, which were not only helpful to my own research on technological innovation systems, but also inspired me to look deeper into other approaches like the multi-level perspective and input-output analysis in order refine my understanding of technological development. Finally, I really hope that we can all meet in person at next year's conference.

Daniel Weiss
Phd Student, Chair of Innovation Management, Freie Universität Berlin, Germany

Publications

PhD theses

Andersson, J. (2020)
Chalmers University of Technology, Gothenburg, Sweden
Shape it until you make it: A conceptual foundation for efforts to analyze and shape technological innovation.
link

Although grand challenges call for new products, processes and practices, the answer is not found in the blind expansion of new technologies. Our success in accomplishing social and environmental objectives rather depends on how, where and when innovation influences patterns of production and consumption. This calls into question the focus of academics and policymakers on stimulating technological innovation. And it highlights the need for analytical tools that can be used to explore how policymakers and other actors may shape the direction of change.

The research presented in this thesis therefore aims to develop a conceptual foundation for analyzing and shaping technological innovation. This effort draws on three qualitative case studies that investigate emerging renewable energy technologies from a Swedish perspective. The thesis is situated in the sustainability transitions research community and takes the literature on technological innovation systems as a theoretical point of departure. However, the research adopts a critical perspective and gradually departs from the core concepts used in this literature, over the course of a learning process that unfolds in five appended research papers.

In the end, the thesis proposes the technological systems framework as a set of concepts that offers a multidimensional perspective on the dynamics and outcomes of technological innovation. It also presents empirical findings that demonstrate different development trajectories, reveal some of their underlying dynamics and highlight policy implications. This will hopefully contribute to an ongoing shift in academia and politics – from stimulating the expansion of new technologies, to shaping the direction of change.

Manders, T. N. (2020)
Technische Universiteit Eindhoven
The transformative potential of smart mobility experiments: an analysis of the role of experiments in a Dutch mobility transition.
link

The mobility system faces several problems, which are especially caused by automobility. Facing these challenges, the mobility system is under great pressure and a fundamental change is needed. Currently, Information and Communication Technologies (ICTs) evoke high expectations. Captured in the concept of 'smart mobility', the ICT-related mobility innovations are expected to address automobility issues and possibly also trigger fundamental change.

In the Netherlands, the concept triggered the emergence of many experiments. These experiments unfolded into two distinctive niches. One is an organized technological automated mobility niche that contains experiments for immediate transport problems and is driven by a few large incumbent actors. The other is a less organized but more diverse and sustainability-oriented mobility services niche, involving outsiders and containing experiments on shared and multi-modal forms of mobility.

While the automated mobility niche is mostly concerned with technological optimizations in line with the existing automobility system and has greater chances to be adopted, the mobility services niche is possibly more disruptive in nature and has a greater potential to address sustainability challenges. To generate a greater transformative potential in total, the combination of both niches is promising, especially with electric mobility as well.

Mäkitie, T. (2019)
University of Oslo
Sustainability transitions in oil economies: Resource redeployment from an established industry to a clean technology industry.
link

The energy transition poses a challenge for an ´oil economy´ like Norway, where the extraction of oil and gas (O&G), and the related service and supply industry, constitute a significant part of the nation´s economy. Sustainability transition field has recently argued that instead of merely opposing transition, established industries may also actively drive environmental innovation e.g. through the redeployment of their vast resources. Nevertheless, the field has not yet elaborated in detail why and how industries like the O&G would transfer their resources in e.g. renewable energy, and how this in turn may influence sustainable innovation.

My dissertation contributes to this need by studying the diversification of the Norwegian O&G industry in offshore wind power (OWP) through an empirical analysis based on mostly document and interview data. I analyze why and how this industry has redeployed its resources (e.g. technological competences, managerial

capabilities, human and financial resources etc.) in the OWP industry. Theoretically I bridge concepts from the literature in strategic management, organizational sciences and innovation systems.

My findings suggest that the types of firm resources affect if, when and where established firms redeploy resources. Moreover, external factors and especially market conditions had influenced how O&G industry firms had engaged in OWP. My analysis therefore shows that resource redeployment is a highly complex process with multiple explaining factors at the firm, industry and environment levels. I argue that a deeper insight on resource redeployment may help to explain the behavior of established industries in sustainability transitions.

Books

Hölscher, K. and Frantzeskaki, N. (eds.) (2020)
Transformative climate governance. A capacities perspective to systematize, evaluate and guide climate action.
Palgrave Macmillan.
link

How to progress climate science to be policy-relevant and actionable? This book presents a novel framework to give a positive vision and structuring approach to guide research and practice on transformative climate governance, to shift the narrative from apathy and stalemate to action and transformation. Our vision contrasts existing climate governance and associated lock-ins that signify the institutional resistance to change. To effectively address climate change, climate governance itself needs to be transformed to foster sustainability transitions under climate change.

The book brings together a collection of case studies to investigate how capacities for transformative climate governance are developing at multiple scales and how they can be strengthened vis-à-vis existing governance regimes. Specifically, it sheds light on the following questions: What are key overarching conditions, actors and activities that facilitate governance for transformation under climate change? Given persistent climate governance lock-ins, what needs to happen in research and policy to build-up the capacities that transform climate governance and ensure effective climate action?

Stephens, J. C. (2020)
Diversifying Power: Why We Need Antiracist, Feminist Leadership on Climate and Energy.
Island Press.
link

The climate crisis is a crisis of leadership. For too long too many leaders have prioritized corporate profits over the public good, exacerbating climate vulnerabilities while reinforcing economic and racial injustice. Transformation to a just, sustainable renewable-based society requires leaders who connect social justice and antiracist, feminist principles to climate and energy. During the Trump era, connections among white supremacy; environmental destruction; and fossil fuel dependence have become more conspicuous. The inadequate and ineffective male-dominated framing of climate change as a narrow, isolated, discrete problem to be “solved” by technical solutions has inhibited investments in social change and social innovations. But inspiring leaders who are connecting climate and energy with job creation and economic justice, health and nutrition, housing and transportation, are advancing exciting transformative change. Bold diverse leaders are resisting the “the polluter elite” to restructure society by catalyzing a shift to a just, sustainable, regenerative, and healthy future.

Policy reports

Geels, F.W. (2020)
Transformative innovation and socio-technical transitions to address grand challenges.
In: Science, Research and Innovation Performance of the EU 2020: A Fair, Green and Digital Europe. DG Research and Innovation, European Commission, Brussels, p. 572-607
link

The aim of the chapter is to present the role of transformative innovation as a new paradigm to address many of the most pressing societal challenges we are facing, notably transition to sustainability and combatting climate change. It elaborates on what it means for research and innovation R&I policy and attempts to ‘operationalise’ these transitions. This chapter presents a broader conceptual model to benefit policies for transformative innovation and grand challenges that goes beyond the linear model and innovation system approaches. The new role for R&I is to support socio-economic transformations, but it needs to be complemented with other policies to have a stronger impact. After introducing the socio-technical transitions framework and potential barriers for the uptake of radical niche innovations, the chapter provides three illustrative case studies (German electricity transition, Austrian biomass district heating systems, French tram systems). The chapter closes with an extensive overview of policy conclusions.

Wolff, F., Heyen, D. A., Brohmann, B., Grießhammer, R., Jacob, K. and Graaf, L. (2020)

Transformative environmental policy. Consistently promote and shape sustainable development. A guide for the BMU's area of responsibility.
Umweltbundesamt: Sustainability, Strategies, International Matters
link

Many environmental problems have been successfully resolved in recent decades. However some are persistent and prove difficult to solve, and new ones have been added. Environmental problems can be particularly persistent if their causes are closely linked to the way we do business, to central aspects of our society or to lifestyles that are perceived as attractive. This guide can help staff in the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) to tackle such environmental problems. For this purpose, approaches to "transformative environmental policy" are presented.

Papers

Alkon, M. and Wong, A. (2020)
Authoritarian energy transitions undermined? Environmental governance cycles in China's power sector.
Energy Research & Social Science, 68(101531), ISSN 2214-6296
link

We develop a theory to explain the persistence of tensions between decentralized delegation and centralized control of environmental governance in authoritarian regimes. Economic benefits from decentralization – information, competition, and efficiency – conflict with environmental goals of centralized policy harmonization and management of inter-jurisdictional externalities. Decentralization to local government actors can facilitate economic growth but also empower them in ways that undermine environmental governance. Persistent tensions between decentralized and centralized imperatives generate cycles in environmental and energy systems governance. We test our theory of authoritarian environmental governance cycles using the case of China's power sector, drawing on evidence from primary source documents, field interviews, and multiple data sources on the development and distribution of energy generating capacity. We focus on two policy areas – coal-fired power and wind energy – that are integral to central government efforts to improve the quality of environmental governance. This research explains the puzzling alternations in the locus of governance, and contributes to understanding inter-governmental relations and environmental politics in authoritarian regimes.

Arthur, J. L. and Fianu, J. (2019)
Drivers to energy efficiency development in lighting and air-conditioning systems in manufacturing industries in Ghana for 2018.
J. Geogr. Reg. Plann., 12(3), pp. 34-42
link

The increase in electricity demand, coupled with drastic deficit in energy generation and depleting conventional energy resources continues to create complex challenges for the energy market in Ghana. But Energy Efficiency (EE) in lighting and air-conditioning has been considered as a green area for reducing energy consumption. The manufacturing sector has been considered as a key area for the implementation of energy efficiency practices. This paper presents a survey to assess the drivers to energy efficiency in lighting and air-conditioning systems from the perspective of two manufacturing industries. Questionnaires were distributed to 260 employees in two manufacturing industries in Ghana. Key informant interviews were carried with four respondents. The impact of employee gender, department of work and job position in mediating the drivers of EE was also assessed using correlation analysis. The results showed that the staff of manufacturing industries sees the availability of information on energy efficiency measures, staff awareness and knowledge and the availability of funds as leading driversto energy efficiency development. Also providing incentives in the form of awards to employees for energy efficiency participation was shown to be effective in the implementation of EE measures. The inferential statistics showed that employees' gender, department and job position predict the barriers to energy efficiency in the manufacturing industries. However, few of the drivers of energy efficiency are not dependent on gender, department of work and job position.

Arthur, J. L. and Fianu, J. (2020)
Knowledge and understanding of energy efficiency in air-conditioning: Exploring perceptions from the manufacturing sector in Ghana.
Sci. Res. Essays, 15(2), pp. 33-40
link

The study investigated Energy Efficiency (EE) measures and practices from the perspectives of Ghana's manufacturing sector. A mixed methods approach that applied both qualitative and quantitative methodologies guided the study. The quantitative approach was relevant to establish statistical inferences and the qualitative methods used to provide further in-depth understanding to statistic(s) provided by the quantitative analysis. A total of 774 respondents (636- food processing Industry, 138- Cement Industry) provided the population for the study. A sample size of 260 informed the study. Various sampling frames including purposive, cluster and simple random were adopted to

select respondents. The study concluded that knowledge on EE awareness and practices occurring at the departmental levels was mixed but clear on servicing and cleaning of air-conditioning since the manufacturing industries placed premium on regularity of servicing ACs in their places of work. Also, the findings identified that failure to clean the heating, ventilating and air-conditioning systems, failure to close doors and windows while ACs were on and avoidance of the use of efficient refrigerants and new ACs as key factors that negatively impacted EE for the manufacturing industries. The contribution of single speed ACs to energy efficiency was minimal compared to the other energy wasting activities associated with the use of air-conditioning.

Arthur, J. L., Murray, G., Rollins, R. and Stahl, A. (2020)
Differential impacts of dam construction on livelihoods in Ghana.
African Geographical Review, 39(3)
link

Debates about the benefits and costs of hydro-electric dams have provoked this study, which examines how the Bui Dam in Ghana impacts on 13 nearby communities. Impacts were assessed using the capital assets framework, embracing seven types of capital assets: social, natural, human, physical, financial, cultural, and political. Data was collected through a quantitative questionnaire administered to 339 households, and qualitative interviews with 22 key informants. Findings indicated that dam impacts on each capital asset were generally negative, but varied somewhat. Relocation and type of livelihood were important explanatory factors, while age, ethnicity, education and gender were lesser factors.

Bach, H., Bergek, A., Bjørgum, Ø., Hansen, T., Kenzhegaliyeva, A., and Steen, M. (2020)
Implementing maritime battery-electric and hydrogen solutions: A technological innovation systems analysis.
Transportation Research Part D: Transport and Environment, 87(102492)
link

Maritime transport faces increasing pressure to reduce its greenhouse gas emissions to be in accordance with the Paris Agreement. For this to happen, low-and zero-carbon energy solutions need to be developed. In this paper we draw on sustainability transition literature and introduce the technological innovation system (TIS) framework to the field of maritime transportation research. The TIS approach analytically distinguishes between different innovation system functions that are important for new technologies to develop and diffuse beyond an early phase of experimentation. This provides a basis for technology-specific policy recommendations. We apply the TIS framework to the case of battery-electric and hydrogen energy solutions for coastal maritime transport in Norway. Whereas both battery-electric and hydrogen solutions have developed rapidly, the former is more mature and has a strong momentum. Public procurement and other policy instruments have been crucial for developments to date and will be important for these technologies to become viable options for shipping more generally.

Batel, S. (2020)
Research on the social acceptance of renewable energy technologies: Past, present and future.
Energy Research & Social Science, 68(101544), ISSN 2214-6296
link

Social sciences have been very prolific in the last decades in publishing research that attempts to better understand the social acceptance of renewable energy technologies and associated infrastructures (RET) – such as high voltage power lines – and processes – such as communities' participation in related decision-making processes. This Perspective proposes that this might be a good point in time, roughly 30 years after social sciences begun looking at the social side of RET, to offer a (over)view on that research, if and how it has changed over time and where it leaves us currently or, in other words, which directions we should follow in the future. I first provide an overview of research on the social acceptance of RET, suggesting that it can be roughly organized around three waves - normative, criticism and critical -; for then identifying and discussing some avenues for future research.

Baxter, J., Walker, C., Ellis, G., Devine-Wright, P., Adams, M. and Smith Fullerton, R. (2020)
Scale, history and justice in community wind energy: An empirical review.
Energy Research & Social Science, 68(101532), ISSN 2214-6296
link

Although there is a clear positive link between community wind energy (CWE) projects and social acceptance, there is still empirical and conceptual ambiguity concerning the details of why. To fill this gap, we revisit foundational papers in this field and then, focusing on empirical case studies between 2010 and 2018 (n = 15), trace how recent research has engaged with existing conceptual frameworks. Most empirical researchers verify the importance of the two key dimensions defined by Walker & Devine-Wright [1]: process and outcome, and then relate this to procedural justice and distributive justice. Meanwhile, the core concept of "community" has been deployed, in both practice and research, in so many different and sometimes ambiguous ways that it remains difficult to assert if, and how, community-based renewable energy policy and siting practice produces high levels of local

community acceptance. We suggest that parsing out the scale of investment in wind energy projects and the local historical context of energy transitions add clarity to the Walker & Devine-Wright framework as it relates to CWE; providing important conceptual nuance for guiding policy, developer practices and future empirical research.

Bell, S. E., Daggett, C. and Labuski, C. (2020)
Toward feminist energy systems: Why adding women and solar panels is not enough.
Energy Research & Social Science, 68(101557), ISSN 2214-6296
link

Growth in renewable energy does not displace fossil fuel use on a one-to-one basis, but rather increases the total amount of energy that is produced. As numerous scholars have argued, an energy transition away from – rather than in addition to – fossil fuels will require more than technology and financial capital. Here we argue that a feminist perspective on energy provides an important framework for understanding what keeps us stuck in unsustainable energy cultures, as well as a paradigm for designing truly just energy systems. Feminist approaches have been widely taken up in environmental and ecofeminist work, as well as in climate change research. In energy studies, however, gender-related research has tended to focus more narrowly on women's issues. Although this is crucial work, the focus on women represents just one dimension of what feminism can bring to the study of energy. Feminist theory also offers expertise in the study of power more broadly, which is widely applicable to the full spectrum of energy research. This article outlines a feminist energy research agenda that addresses many aspects of energy system design, planning, exchange, and use. We analyze energy along four intersecting coordinates: the political (democratic, decentralized and pluralist); economic (prioritizing human well-being and biodiversity over profit and unlimited growth); socio-ecological (preferring relationality over individualism); and technological (privileging distributed and decentralized fuel power and people power). In doing so, we show that feminism is well-suited for navigating the tangled web of power, profit, and technological innovation that comprises human fuel use.

Bettin, S. S. (2020)
Electricity infrastructure and innovation in the next phase of energy transition—amendments to the technology innovation system framework.
Rev. Evol. Polit. Econ.
link

A new phase of energy transition makes auxiliary technologies such as energy storage and other flexibility options more important. Economic policy that aims to steer this transition needs to grasp the complex system dynamics underlying energy and society. This conceptual article gives an overview of energy technology innovation theories that exemplify the growing importance of flexibility for electricity usage. First, the article presents different conceptualizations of technology innovation and diffusion. Second, how energy systems are embedded in physical infrastructures and social power relations is shown with a brief history of electricity in contemporary industrialized societies. Third, energy innovation is discussed in context of challenges of the upcoming energy transition. Fourth, energy technology innovations are further contextualized in light of insights from political economy and energy social sciences. Finally, the discussed approaches are synthesized to amend the holistic technology innovation system approach for studying energy technology innovations such as energy storage.

Bloomfield, J. and Steward, F. (2020)
The Politics of the Green New Deal.
The Political Quarterly
link

Covid-19 has highlighted our fragile relationship with the planet. But it represents a minor challenge compared to the permanent havoc that runaway climate change threatens. Politicians and governments-some at least-are beginning to recognise the scale of the danger.
In this article we assess the evolution of policy thinking on how to make climate transitions happen; the potential of the European Green Deal; and how progressives need to shape it and any UK counterpart to meet the challenges of modern society. The European initiative arises from a broad coalition spanning the political spectrum. Yet, its central thrust of active government offers the prospect of reviving a battered social democracy. We indicate the openings here for a pluralist, ecological left. The run-up to the next global climate conference-COP26-will be a vital period which will show whether parties and governments across the world are prepared to meet the climate change challenge.

Drews, S., F. Exadaktylos and van den Bergh, J. (2020)
Assessing synergy of incentives and nudges in the energy policy mix.
Energy Policy, 144(111605)
link

Should policy-makers combine price incentives with behavioural nudges to encourage sustainable energy behaviour? Available evidence from various behavioural sciences is scarce and inconclusive about synergy of the two instruments. This is partly due to methodological limitations. We offer a framework to overcome such limitations in future research and to

guide policy-making. It includes four cases: no synergy, positive synergy, weak negative synergy, and strong negative synergy or backfire. The adoption of a policy mix is recommended in the first two cases, and may be pursued in the third case. To clarify the underlying mechanisms of the synergy, a distinction is made between crowding (in/out) of intrinsic motivations by incentives and crowding (in/out) of extrinsic motivations by nudges. This distinction turns out to be especially relevant in the case of weakly negative synergy, as here behavioural and temporal spillover effects require consideration from the policy-maker as well. We end with broader reflections regarding other policy criteria for the design of an adequate energy policy mix.

Edomah, N. and Ndulue, G. (2020)
Energy Transition in a lockdown: An analysis of the impact of COVID-19 on changes in electricity demand in Lagos Nigeria.
Global Transitions, 2, pp. 127-137 (Special issue on COVID-19)
link

In this study, we analyse the role of forced lockdowns on electricity consumption behaviour and its effect on momentary transition in electricity use. Electricity consumption data for residential, commercial and industrial consumers within the Lagos metropolis representing 259 electrical feeder locations were collected and analysed under three scenarios: first, we analyse a business-*as*-usual scenario without a lockdown; secondly, we analyse the case of a partial lockdown; and finally, we analyse the case of a total lockdown. The study revealed that aside from government announcement of the lockdown, certain social practices triggered changes in electricity consumption and use leading to momentary energy transition. Within the residential sector, increased cooking, home laundry, showering, and some professional practices that moved to the homes impacted on higher electricity consumption. Reduced manufacturing practices limited to those involved in food, personal care and pharmaceutical products led to a reduction in electricity use within the industrial sector, while reduced electricity use in the commercial sector was triggered mainly by a scaling down of trading services to essentials. The study concludes by highlighting the impact of changes in electricity demand and consumption under these scenarios and its implications for energy transition and electricity planning.

Frank, L., Jacob, K. and Quitzow, R. (2020)
Transforming or tinkering at the margins? Assessing policy strategies for heating decarbonisaton in Germany and the United Kingdom.
Energy Research & Social Science, 67(101513)
link

Decarbonising heating supply is an important part of the global energy transition, and a vital step towards mitigating climate change. We analyse the transformative potential of German and UK heating sector decarbonisation policies. We deploy Transformative Environmental Policy [TEP], originally developed to guide policy development, as an analytical framework to discuss how and to what extent both countries' heating sector policy strategies promote the necessary radical reconfiguration of the socio-technical system of heating supply. TEP suggests a systemic approach for such reconfigurations, addressing technologies, social practices, institutions and infrastructures as well as combining experimental support of innovation with governance approaches for the phase-out of unsustainable technologies and practices. Our comparative analysis of German and UK decarbonisation strategies concludes that such elements can be identified in both strategies, although to different degrees. The analysis points to considerable deficiencies, such as a lack of phase-out policies, insufficient low-carbon building standards and a neglect of non-technical system elements.

Frenken, K. and Pelzer, P. (2020)
Reverse Technology Assessment in the Age of the Platform Economy.
Built Environment, 46(1), pp. 22-27
link

The rise of what is often referred to as the sharing economy is among the most daring challenges for cities around the world. Sharing platforms create opportunities for efficient market exchange, but also cause negative externalities for city dwellers. A challenge for city authorities is that platforms can be launched without ex ante assessment of externalities and public interests, leaving public debate and political deliberation ex post affairs. We call the platform innovation logic 'reverse technology assessment', which obstructs participatory planning and constructive technology assessment. We discuss the potential of an alternative policy framework known as 'right to challenge'. We end with a broader reflection on public policy regarding sharing platforms at different scalar levels, emphasizing local initiatives to develop alternative sharing platforms.

Fritz, B., Aichele, C. and Schmidt, M. (2020)
Environmental impact of high-value gold scrap recycling.
The International Journal of Life Cycle Assessment, 25(1930-1941)
link

The gold routes satisfying the global gold supply are mining (74%), recycling of high-value gold (23%), and electronic scraps (3%). The gold production in industrial as well as artisanal and small-scale mines creates

negative impacts such as resource depletion, extensive chemical use, toxic emissions, high energy consumption, and social concerns that are of great importance. On the other hand, almost all gold is recycled and has historically always been. In common life cycle assessment (LCA) databases, there is no data on recycling of high-value gold available. This article attempts to answer the question what the ecological benefits of this recycling are.
In this study, we were able to collect process data on the most commonly used high-value gold scrap recycling process, the aqua regia method, from several state-of-the-art German refineries.
High-value gold scrap recycling has a considerably lower environmental impact than electronic gold scrap recycling and mining. For example, high-value gold scrap recycling in Germany results in a cumulative energy demand (CED) of 820 MJ and a global warming potential (GWP) of 53 kg-CO2-Eq. per kg gold. In comparison, common datasets indicate CED and GWP levels of nearly 8 GJ and 1 t-CO2-Eq. per kg gold, respectively, for electronic scrap recycling and levels of 240 GJ and 16 t-CO2-Eq. per kg gold, respectively, for mining. The results show that buying gold from precious metal recycling facilities with high technological standards and a reliable origin of the recycling material is about 300 times better than primary production.

Galbraith, E. and van den Bergh, J. (2020)
Carbon tax to aid economic recovery.
Nature, 581, p. 262
link

The fall in fossil-fuel prices offers governments a chance to offset the potentially massive public debt incurred by the COVID-19 pandemic. If world leaders act fast, using the same decisive and coordinated approach they have applied to combat the spread of the virus, they can help to protect both the economy and the climate through a single simple instrument.

Hellsmark, H. & Hansen, T. (2020)
A new dawn for (oil) incumbents within the bioeconomy? Trade-offs and lessons for policy.
Energy Policy, 145(111763)
link

This paper develops a more detailed understanding of when incumbent actors may become the main locomotive driving energy transitions. It also illustrates the trade-offs between policy approaches that actively seek to involve the incumbents in transitions, and policy approaches that pursue transitions without their active involvement. The paper examines state support for the bioeconomy in Sweden and concludes that public investments have been geared towards large-scale, complex and integrated biorefineries that are dependent on the active participation of the forest industry. Incumbents in the forest industry have, however, both lacked motivation and the abilities required to take the necessary steps for commercialisation of the demonstrated concepts. Instead, a rather small investment in a joint venture between actors from the forestry and oil refinery industry in Sweden has spurred learning and revenues; and it has placed an oil refinery at the centre of the future development of what we here term distributed biorefining. The main trade-off is that while this shift has opened up for cross-industrial collaborations and the production of advanced biofuels and materials, it has also paved the way for further investments in existing fossil-fuel infrastructure.

Jacob, K., and Ekins, P. (2020)
Environmental policy, innovation and transformation: affirmative or disruptive?
Journal of Environmental Policy & Planning, pp. 1-15
link

The paper firstly summarizes the approach and findings to evaluate the effectiveness of environmental policies around the globe as it was undertaken in the Sixth Global Environment Outlook (GEO-6; 2019). The data gathered in GEO-6 reveals (1) a high level of institutional innovation, increasingly from the global south, (2) a lack of environmental policy integration (3) spatial and temporal dynamics and (4) the importance of the policy design. Current environmental policies are, however, not sufficient to effectively preserve natural resources and limit emissions to a sustainable level. This has led to a general recognition of the need for a transformative change that goes beyond mere improvements of efficiency. The second part of the paper analyses how environmental policies could contribute in shaping such transformations to sustainability. Transformative policies can be built on social innovations and experimentation with institutional innovation. This is compatible with incremental and sectoral policy making. However, given the complexity and stability of social systems, the outcomes of such policies are uncertain. This is why we argue for strengthening conventional, strategic environmental policies and complementing rather than replacing them with transformative policies.

Johnstone, P. and McLeish, C. (2020)
World wars and the age of oil: Exploring directionality in deep energy transitions.
Energy Research & Social Science, 69(101732)
link

This paper explores the role of the world wars in 20th century energy transitions, focusing on the growth of oil as a major energy source which accelerated after the Second World War in North America and Europe. We utilise the recently developed Deep Transitions framework which combines Techno-Economic Paradigms and sociotechnical transitions approaches. The first deep transition entails the long running emergence of industrial modernity since the late 18th

century which culminated in the post-Second World War economic 'golden age' underpinned by rapid and stable growth and prosperity in North America and Western Europe. The Deep Transitions framework draws attention to the increasing role of fossil fuels over this long period, and how fossil fuel consumption accelerated in the 20th century taking on a particular direction where energy, mobility, and food systems became increasingly reliant on oil while the share of coal as a proportion of the energy mix decreased. This paper integrates sociotechnical, historical and geopolitical literatures to examine how the development of the age of oil was shaped by wartime demand pressures and logistical challenges and the search for new solutions to these challenges in the United States of America and the United Kingdom.

Kanda, W. and Kivimaa, P. (2020)
What opportunities could the COVID-19 outbreak offer for sustainability transitions research on electricity and mobility?
Energy Research & Social Science, 68
link

The COVID-19 pandemic is a major landscape shock that is having pervasive effects across socio-technical systems. Due to its recentness, sustainability scientists and other researchers have only started to investigate the implications of this crisis. The COVID-19 outbreak presents a unique opportunity to analyze in real time the effects of a protracted landscape-scale perturbation on the trajectories of sustainability transitions. In this perspective, we explore the ramifications for sustainability transition research on electricity and mobility, drawing from selected examples in Finland and Sweden. The long-term consequences of the COVID-19 pandemic are likely to trigger more permanent changes connected to the digitalization of work and other daily activities, thus reducing mobility needs and overall fossil-energy consumption. The crisis may encourage governance systems to be better prepared for different types of shocks in the future, while it also contains a threat of increasingly populist or undemocratic political responses and increased securitization. These developments can guide research by addressing the reproduction of new practices arising from the COVID-19 outbreak to accelerate sustainability transitions, enhancing understanding of the role of governance in transitions, and bringing to attention the ethical and political implications of landscape shocks.

Kanger, L., Sovacool, B. K., Noorkõiv, M. (2020)
Six policy intervention points for sustainability transitions: A conceptual framework and a systematic literature review.
Research Policy, 49(7, 104072)
link

Recent literature has turned considerable attention to the role of policy mixes in shaping socio-technical systems towards sustainability. However, the identification of relevant policy intervention points has remained a relatively neglected topic. This is a potentially significant oversight given that such intervention points constitute a mid-step between means (particular policy instruments) and overall goals (change in the directionality of socio-technical systems). By complementing existing work on policy mixes with additional insights from transitions literature, this paper formulates a conceptual framework of six policy intervention points for transformative systems change. The coding scheme developed on the basis of this framework is used to review current literature on policy mixes in sustainability transitions. It is shown that the latter has so far primarily focused on niche-regime dynamics while largely neglecting the broader context of these interactions. We argue that adopting a wider perspective on intervention points can aid future work on policy mixes by enabling the identification of root causes and critical problems of ongoing transitions, and to spot gaps in existing policy activities. The case of the Estonian energy system is used to briefly illustrate these possibilities. Methodologically, we demonstrate the value of combining theory-based concept-formation with a systematic literature review, enabling not only a provision of a summary of existing literature but also highlighting systematic gaps in that literature.

Klerkx, L. and Begemann, S. (2020)
Supporting food systems transformation: The what, why, who, where and how of mission-oriented agricultural innovation systems.
Agricultural Systems, 184(102901)
link

Agricultural innovation systems has become a popular approach to understand and facilitate agricultural innovation. However, there is often no explicit reflection on the role of agricultural innovation systems in food systems transformation and how they relate to transformative concepts and visions (e.g. agroecology, digital agriculture, Agriculture 4.0, AgTech and FoodTech, vertical agriculture, protein transitions). To support such reflection we elaborate on the importance of a mission-oriented perspective on agricultural innovation systems. We review pertinent literature from innovation, transition and policy sciences, and argue that a mission-oriented agricultural innovation systems (MAIS) approach can help understand how agricultural innovation systems at different geographical scales develop to enable food systems transformation, in terms of forces, catalysts, and barriers in transformative food systems change. Focus points can be in the mapping of missions and sub-missions of MAIS within and across countries, or understanding the drivers, networks, governance, theories of change, evolution and impacts of MAIS. Future work is needed on further conceptual and empirical development of MAIS and its

connections with existing food systems transformation frameworks. Also, we argue that agricultural systems scholars and practitioners need to reflect on how the technologies and concepts they work on relate to MAIS, how these represent a particular directionality in innovation, and whether these also may support exnovation.

Liefner, I., Losacker, S. and Rao, B.C. (2020)
Scale up advanced frugal design principles.
Nature Sustainability
link

A sustainable economy for a growing population must be climate-neutral but also frugal in resource consumption — raw materials, water and physical space. In this context, frugality means applying science and technology to design 'simplified' products that minimize the use of resources throughout their entire life cycle. A widespread diffusion of the principle of frugality in the design and redesign of products will help to reduce environmental degradation and safeguard the basic functions of the world's ecosystems. We argue that transition costs must be overcome in order to widely implement frugality as a design principle. In this regard, two essential measures must be taken. Firstly, financial policy support for companies will be necessary to adjust production processes. Secondly, it will be important to teach engineers, technicians and managers how to produce and sell frugal products.

Lieu, J., Sorman, A. H., Johnson, O. W., Virla, L. D. and Resurrección, B. P. (2020)
Three sides to every story: Gender perspectives in energy transition pathways in Canada, Kenya and Spain.
Energy Research & Social Science, 68(101550), ISSN 2214-6296
link

Transitions toward a low-carbon future are not only technical and economical, but also deeply social and gendered. The gendered nature of energy transitions is often implicit and unexplored. As a corrective, this paper explores energy pathways by applying concepts from innovations and gender studies. We examine gender perspectives and niche energy innovations which could disrupt the regime. The regime represents the mainstream pathway that includes the dominant gender perspective and energy system. We explore different gender perspectives of energy transition pathways by applying an Alternative Pathways framework that includes: (1) on-stream pathways that exist within the mainstream pathway to promote equal opportunities for women and men, as well as niches for energy innovations without challenging the high-carbon energy regime; (2) off-stream pathways that depart from the mainstream and promote differences across different genders while creating niches outside the energy regime; and (3) transformative pathways that are fundamentally different from the previous mainstream and includes all gender perspectives in a new energy regime. Applying this framing, in Canada, we explored Indigenous perspectives in the oil sands sector; in Kenya, we studied largescale renewable energy impacting Indigneous communities; in Spain, we evaluate the movement away from fossil fuels and towards renewable technologies. The framework helped to identify that mainstream pathways represented the dominant male perspective while woman's perspective were largely left out. Such absence generate energy pathways that are disconnected from local realities, lack public buy-in and slow-down a sustainable energy transition.

Linzenich, A., Zaunbrecher, B. S., Ziefle, M. (2020)
"Risky transitions?" Risk perceptions, public concerns, and energy infrastructure in Germany.
Energy Research & Social Science, 68(101554), ISSN 2214-6296
link

Citizen protests against large-scale energy infrastructure technologies underline the vital role of public acceptance for energy planning. Research has found risk and benefit perceptions to affect energy technology acceptance considerably. Comparing risk and benefit perceptions of wind turbines, electricity pylons, and mobile phone masts, an empirical study was undertaken in Germany. The study examined whether there are types of risks perceived as particularly relevant, regardless of the technology, or whether each technology (wind, electricity transmission, mobile technology) has a specific "risk pattern." Benefit perceptions and trust did not differ between energy infrastructure technologies (wind turbines and electricity pylons), though perceived risks were significantly higher in the pylon context compared to wind turbines. Energy infrastructure was perceived as significantly less hazardous than mobile phone infrastructure. Beyond the impact of different mast types, also person-specific effects influenced risk perceptions: The higher the perceived knowledge about large-scale infrastructure technologies, the lower was the overall risk perception associated with the respective technology. Persons with less perceived knowledge showed lower levels of technical self-efficacy and, in case of wind turbines, a lower environmental awareness. Findings can be used for tailoring future information and public communication concepts to the user-specific requirements regarding energy infrastructure planning.

Manders, T., Cox, R., Wieczorek, A. J. and Verbong, G. P. J. (2020)
The ultimate smart mobility combination for sustainable transport? A case study on shared electric automated mobility initiatives in the Netherlands.

Transportation Research Interdisciplinary Perspectives, 5, ISSN 2590-1982
link

The current mobility system faces severe sustainability challenges and requires a fundamental change. Enabled by smart mobility innovations, the previously separate fields of shared, electric, and automated mobility seem to converge into a promising alternative. As the ultimate combination, it is expected to have a major impact by transforming the current mobility system. This paper provides an empirical perspective by looking into the promises of the combination and the current state of development by conducting a case study in the Netherlands on shared electric automated mobility initiatives. The case study demonstrates that the initiators mobilized promises of reduced automobility and promises of increased sustainability to develop their shared electric automated mobility initiatives. The initiators, however, also experienced several difficulties, such as operational and technical issues and the difficulty of involving users. Automation was often regarded as an element to overcome these implementation challenges and is, therefore, also seen as an interesting business opportunity. Although promising in some regards, the combination might also result in the opposite effect, increasing car-dependency and diminishing any environmental benefits. Developments are still at an early stage, but the continuous involvement of a wide range of actors remains crucial to move beyond just vehicles and steer the developments into a direction of a shared electric automated mobility system, including the integration of multiple modes and alternative mobility developments

Minas, A.M., Mander, S., and McLachlan, C. (2020)
How can we engage farmers in bioenergy development? Building a social innovation strategy for rice straw bioenergy in the Philippines and Vietnam.
Energy Res. Soc. Sci., 70(17)
link

Involving farmers and local communities in bioenergy development is important for the deployment of sustainable bioenergy systems, especially if rural areas are to maximise potential co-benefits from energy provision. Focusing on rice straw bioenergy in the Philippines and Vietnam, our research explored how farmers' social networks can serve as a platform for social innovation – an emerging approach to energy transitions aimed at delivering solutions by empowering local people. Specifically, we used tools in social network analysis to map how farmers mobilise resources within their communities, who influences their decisions on the farm, and the stories embedded in their interactions. This allowed us to develop insights on how different actors in farmers' networks may be best connected to support collaborative partnerships and co-designing of solutions that meet their development needs. Our results showed potential windows of opportunity to engage farmers in bioenergy development. First, by connecting them to resource providers; and second, by developing capacities and network structures in rice farming communities to enable more resource sharing. Based on these, we propose a social innovation strategy useful for bioenergy project developers and local stakeholders to help ensure that farmers and other actors in the community can take active roles in the rice straw bioenergy development process.

Miremadi, T. (2020)
Coupling multilevel perspective with causal layered analysis on non-reflexive societies the case of socio-technical system of car fuel in Iran.
Technological Forecasting and Social Change, 155(120029)
link

This paper starts with a literature review that shows there is a clear difference between the literature of multilevel perspective with original focus in north Europe with reflexive governance and the new literature which documents the sustainability transition in non-reflexive societies. My argument is that the literature with emerging focus does not rely on the grand theories of social change in contrast to the literature with original focus. Based on this argument, I raise two questions: 1- what does MLP lack to study transitions in these societies. 2- What is the normative stand upon which the sustainability transition should be based. To address these questions, the paper used a post-structuralist tool box in the process of an action research workshop with a CLA structure. The case study was that of the car fuel socio-technical system in Iran. The paper concludes two points: 1- The coupling of Multilevel Perspective and Causal Layered Analysis can find facts which would have been hidden if the research were confined to the MLP framework. 2- Reflexiveness calls for societal platform to disclose and project discursive struggles and facilitate the inclusion of others. This is absent in vast part of developing countries.

Müller, F., Claar, S., Neumann, M., Elsner, C. (2020)
Is green a Pan-African colour? Mapping African renewable energy policies and transitions in 34 countries.
Energy Research & Social Science, 68(101551), ISSN 2214-6296
link

Renewable Energy (RE) is rapidly gaining relevance as a key technology to quench growing energy demand on the African continent. Many African states have introduced RE legislation, but the design of RE policy instruments, as well as their application and efficiency

vary considerably across African economies. This article presents an analysis of energy transition processes based on a comparative mapping of African renewable energy policies in 34 countries. We discuss these developments with respect to their justice dimension, following up on the recent debate on distributive, recognitional, and procedural energy justice. We not only provide evidence of African energy policies covering recognitional and distributive justice, but also identify potential trade-offs between strong market orientation and justice concerns. We embed our findings in the debates on a "just transition" and on "energy justice" that have emerged as recent outcomes of the transition management literature travelling to the Global South.

Münzel, K., Boon, W., Frenken, K., Blomme, J. and van der Linden, D. (2020)
Explaining carsharing supply across Western European cities.
International Journal of Sustainable Transportation, 14(4), pp. 243-254
link

Carsharing can partially replace private ownership of vehicles with a service that allows the use of a car temporarily on an on-demand basis. In this study, we analyze the supply of shared cars across 177 cities in five Western European countries (Belgium, France, Germany, The Netherlands, United Kingdom), while distinguishing between the traditional business-to-consumer (B2C) business model and the more recent peer-to-peer (P2P) business model. The data on carsharing supply is individually collected of all operators in the respective cities, while data of city characteristics is drawn from international or national statistical databases. We explain carsharing supply using comparable data of 14 explanatory variables. The results indicate that carsharing is popular in cities with a high educational level or university presence and, in the B2C case, with many green party votes. Furthermore, carsharing is less popular in cities with many car commuters. Particularly striking are the differences between countries, with peer-to-peer carsharing being especially popular in French cities and business-to-consumer carsharing in Germany. We reflect on the findings in the light of (sustainable) mobility policy options.

Oers, L., Hoop, E., Jolivet, E., Marvin, S., Späth, P. and Raven, R. P. J. M. (2020)
The politics of smart expectations: interrogating the knowledge claims of smart mobility.
Futures, 122(102604)
link

This paper studies the performativity of smart mobility expectations in envisioning urban futures. Smart mobility, or ICT-enabled transport services, are increasingly considered a necessary ingredient for sustainability transitions in cities. Expectations of smart mobility's contribution to such a transition are constituted by a strong belief in the transformative potential of data collection and use. These knowledge claims embedded in smart mobility expectations tend to be unchallenged, yet contribute to a particular future vision of urban mobility. Our empirical analysis, which draws on two empirical smart cycling case studies in Utrecht, the Netherlands, and Bordeaux, France, underlines the politics of such smart knowledge claims in two smart cycling projects and identifies distinct processes as to how such claims may shape and structure mobility futures. We observe intimate entanglements between what is being developed in terms of technologies and services; and the societal needs that the projects' expectations promise to fulfil. At the same time, we witness a disentanglement of these interconnected knowledge claims when projects unfold, leaving the promise of (un)achieved societal benefits out of view. Indeed, smart knowledge claims carried strong inherent legitimacy in the cases studied, thereby risking to exclude non-smart alternatives.

Pel, B., Raven, R.P.J.M. and van Est, Q. (2020)
Transitions Governance with a sense of Direction: Synchronization Challenges in the case of the Dutch 'Driverless Car' Transition.
Technological Forecasting and Social Change, 160(120244)
link

Current sustainability challenges call for transitions in locked-in socio-technical systems. The governance of transitions often remains limited to the cultivation of sustainable 'niche' innovations, however. This paper explores how to handle transitions directionality, i.e. the diversity of possible socio-technical development paths. It reaches beyond hitherto rather abstract and fragmented insights. STS, political-science and systems-evolutionary angles are combined into an integrative framework. Concrete directionality challenges are identified through the analysis of socio-technical multiplicity, divergent normative appraisals and process dynamics. The driverless car transition provides an exemplar case. As highlighted through qualitative evidence from the Dutch Intelligent Transportation Systems (ITS) sector, common innovation discourses of a 'race to automation' misrepresent the pace and direction of the nascent transition. The transition requires much more than the cultivation of driverless vehicles: Next to the commercial development of vehicle automation, it involves governmental traffic management ambitions and public-private collaboration towards 'cooperative systems'. Other insights on directionality-conscious transitions governance pertain to the sustained synchronization between institutionally diverse actors, and to the changing material conditions for steering. The overall

conclusion is that the framework provides a useful lens to explore the governance of directionality in socio-technical transitions. Future studies should explore its usefulness beyond the ITS domain.

Pel, B., Haxeltine, A., Avelino, F., Dumitru, A., Kemp, R., Bauler, T., Kunze, I., Dorland, J., Wittmayer, W. and Jørgensen, M. S. (2020)
Towards a theory of Transformative Social Innovation: a relational framework and 12 propositions.
Research Policy, 49(8)
link

This paper responds to the need in innovation research for conceptual clarity and solid theory on social innovation (SI). The paper conceptualizes SI as changing social relations, involving new ways of doing, knowing, framing and organizing, and theorizes *transformative* social innovation (TSI) as the process of SI challenging, altering, or replacing dominant institutions in a specific social-material context. Three advances towards TSI theory are proposed. First, we reflect epistemologically on the challenges of theory-building, and propose an appropriate research design and methodology. Middle-range theory is developed through iteration between theoretical insights and comparative empirical study of 20 transnational SI networks and about 100 associated initiatives. Second, we synthesize various innovation theories and social theories into a relational framework that articulates the distributed agency and institutional hybridization involved. Third, we formulate twelve propositions on the emergence of SI initiatives, on the development of SI ecosystems, on institutionalization processes, and on the historical shaping of SI. The paper ends with a critical assessment of the advances made, also identifying further challenges for TSI theory and practice.

Petzer, B., Wieczorek, A. J., Verbong,, G. P. J. (2020)
Dockless bikeshare in Amsterdam: a mobility justice perspective on niche framing struggles.
Applied Mobilities. In print.
link

This paper conceptually integrates socio-technical transitions with a Mobility Justice framework through the method of discourse analysis. A sample of media articles and secondary sources relating to the contested introduction of dockless bikeshare in the mature cycling city of Amsterdam was analysed using Rosenbloom's multi-dimensional discursive interactions framework, which emphasises actors' ability to succeed in framing struggles by persuasively combining content-related claims with relevant aspects of their context. Mobility Justice tenets were then applied to this framework, yielding a number of novel framings that correspond to a prescriptive logic rather than the descriptive, strategic focus of discursive transitions. These novel framings represent not only a new rhetorical resource for actors seeking to legitimate their innovations, but also enable transitions researchers to pay more explicit attention to groups and sets of interests who are affected by but excluded from innovation debates. This degree of attention may also bring to light inequalities, barriers and immobilities that as yet lie outside of the frames through which transitions research seeks to analyse innovation journeys. Mobility justice in its turn stands to benefit from closer engagement with the micro-dynamics of innovation journeys, which may yield more detailed insights into how normative frameworks can be embedded into specific contests.

Pons-Seres de Brauwer, C., and Cohen, J.J. (2020)
Analysing the potential of citizen-financed community renewable energy to drive Europe's low-carbon energy transition.
Renewable and Sustainable Energy Reviews, 133(110300)
link

In 2018, the real amount invested in the European Union's energy transition fell short of the funding level required to reach the 2030 climate and energy targets by €179 billion. Citizen-led finance in renewable energy development emerges as an innovative tool to bridge this investment gap. However, in spite of the European Union's ambition to involve local communities for co-driving the low-carbon energy transition, there is no comprehensive analysis quantifying citizens' potential to co-finance and participate in community renewable energy initiatives across Europe. We address this knowledge gap through a representative choice experiment survey that collected responses from 16,235 participants to different hypothetical investment options on renewable energy schemes across all European Union Member States, and estimate the 'social potential' of European citizens to participate and invest in community-administered wind farms. Results from a novel survey-based social simulation indicate that €176 billion could be obtained from citizen-led finance in community-administered wind farm developments, enough to halve the investment gap to achieve a 32% renewable energy share in final energy consumption by 2030. Our analysis substantiates the case for facilitating easily accessible, risk-insured community investment options across Europe to unlock citizens' social potential for investing in community renewable energy and, in doing so, broaden and expedite Europe's citizen-oriented sustainable energy transition towards carbon neutrality.

Quitzow, R. and Thielges, S. (2020)
The German energy transition as soft power.
Review of International Political Economy
link

Germany represents a new and unconventional actor in the field of energy foreign policy. Based on its reputation as an energy transition frontrunner, it is pursuing a soft power strategy aimed at promoting its *Energiewende* policy approach abroad. Germany's bilateral energy partnerships, this paper argues, represent the government's central policy instrument for this purpose. After a discussion of the German energy transition as a soft power resource, the paper provides an in-depth empirical analysis of Germany's bilateral energy partnerships. The paper argues that the partnerships have been deliberately designed as instruments for mobilizing the *Energiewende* narrative as soft power. Linking it to concepts in the soft power debate, it discusses the main channels through which the partnerships aim to boost the attractiveness of German policy solutions and persuade partners to consider their adoption. The paper concludes with a discussion of implications for further research on the international political economy of the energy transition.

Pel, B., Raven, R. P. J. M. and van Est, R. (2020)
Transitions governance with a sense of direction: synchronization challenges in the case of the Dutch 'Driverless Car' transition.
Technological Forecasting and Social Change, 160(12024)
link

Current sustainability challenges call for transitions in locked-in socio-technical systems. The governance of transitions often remains limited to the cultivation of sustainable 'niche' innovations, however. This paper explores how to handle transitions directionality, i.e. the diversity of possible socio-technical development paths. It reaches beyond hitherto rather abstract and fragmented insights. STS, political-science and systems-evolutionary angles are combined into an integrative framework. Concrete directionality challenges are identified through the analysis of socio-technical multiplicity, divergent normative appraisals and process dynamics. The driverless car transition provides an exemplar case. As highlighted through qualitative evidence from the Dutch Intelligent Transportation Systems (ITS) sector, common innovation discourses of a 'race to automation' misrepresent the pace and direction of the nascent transition. The transition requires much more than the cultivation of driverless vehicles: Next to the commercial development of vehicle automation, it involves governmental traffic management ambitions and public-private collaboration towards 'cooperative systems'. Other insights on directionality-conscious transitions governance pertain to the sustained synchronization between institutionally diverse actors, and to the changing material conditions for steering. The overall conclusion is that the framework provides a useful lens to explore the governance of directionality in socio-technical transitions. Future studies should explore its usefulness beyond the ITS domain.

Potts, S. and Walwyn, D. (2020)
An exploratory study of the South African concentrated solar power sector using the technological innovation systems framework.
Journal of Energy in Southern Africa, 31(2), pp 1-18
link

Concentrated solar power (CSP) could provide semi-dispatchable electricity at large scale. However, its deployment to date has been restricted by high capital costs and the limited geographical locations with optimal solar radiation to attain required efficiencies. South Africa, with its abundant solar resources, has the potential to develop an export-competitive CSP industry. This study applied the framework of technological innovation systems to understand the factors currently prohibiting the country from becoming a global leader. The assessment revealed a largely immature innovation system, characterised by a heavy reliance on imported technology and market support from the state-supported procurement programme. The advancement of CSP remains contingent on further allocation of CSP procurement targets and sufficient support to develop entrepreneurial activity. An integrated industrial policy strategy, which can ensure technology transfer and address the high cost of CSP, is recommended as a means of addressing the barriers to its development.

Rosenbloom, D. and Rinscheid, A. (2020)
Deliberate decline: An emerging frontier for the study and practice of decarbonization.
WIREs Clim Change.
link

Promoting low-carbon innovation has long been a central preoccupation within both the practice and theory of climate change mitigation. However, deep lock-ins indicate that existing carbon-intensive systems will not be displaced or reconfigured by innovation alone. A growing number of studies and practical initiatives suggest that mitigation efforts will need to engage with the deliberate decline of carbon-intensive systems and their components (e.g., technologies and practices). Yet, despite this realisation, the role of intentional decline in decarbonization remains poorly understood and the literature in this area continues to be dispersed among different bodies of research and disciplines. In response, this article structures the fragmented strands of research engaging with purposive decline, interrogating the role it may play in decarbonization. It does so by systematically surveying concepts with particular relevance for intentional decline, focusing on phase-out, divestment, and destabilization.

Rosenbloom, D., Markard, J., Geels, F.W., Fuenfschilling, L., 2020.
Reply to van den Bergh and Botzen: A clash of paradigms over the role of carbon pricing.
Proceedings of the National Academy of Sciences 117, 23221-23222.
link

We welcome van den Bergh and Botzen's comment on our paper as it reflects foundational differences between mainstream economics and sociotechnical transitions perspectives on the role of carbon pricing (CP) in climate policy. Emerging from in-depth empirical studies of transitions in societal systems such as energy, the latter perspective is part of an ongoing shift in climate policy toward "green industrial policy" and away from the market-based reasoning that has, to date, made little progress in solving the urgent sustainability issues at hand. Our reply centers on three core points that illuminate important differences between these paradigms.

Schlaile, M.P., Urmetzer, S., Ehrenberger, M.B. and Brewer, J. (2020)
Systems entrepreneurship: a conceptual substantiation of a novel entrepreneurial "species".
Sustainability Science (Special Feature: Leverage Points for Sustainability Transformations)
link

In this paper, we explore the notion of systems entrepreneurship in the context of innovation systems (IS) dedicated to transformations towards sustainability. To this end, our paper draws primarily but not exclusively on the *leverage points* concept, which was originally proposed by Donella H. Meadows and recently refined by sustainability scientists. More precisely, we flesh out four general propositions about the systems entrepreneurial process that serve as a starting point for illuminating how systems entrepreneurs can intervene at deep leverage points to introduce a dedication to sustainability in IS. The paper touches the important issues of directionality, formal institutions, as well as information flows and network structure that have received insufficient attention from researchers, policymakers, and practitioners aiming at transformations towards sustainability (e.g., funders and other support organizations). Taken as a whole, the paper serves as a conceptual basis for further theoretical and empirical work on systems entrepreneurs and *dedicated* IS. It should be read as a reminder that the fundamentally uncertain processes of systemic change call for collaborative efforts that transcend mental and organizational boundaries.

Shen, W. (2020)
China's role in Africa's energy transition: a critical review of its intensity, institutions, and impacts.
Energy Research & Social Science, 68(101578), ISSN 2214-6296
link

China is playing an ever important role in Africa's energy transition, mainly via its massive investment and loans on various energy infrastructure projects ranging from extractive activities in oil and gas industries, power generation facilities including both traditional and renewable energy sources, and transmission and distribution networks. These activities have generated profound economic, social and environmental impacts to the recipient countries and local communities, which has attracted tremendous academic interests in the past decade. In this critical review, the focus has been given to the power generation sector to understand implications of Chinese activities on African countries' energy development pathways. Three groups of studies are reviewed in specific, which focusing on the estimation of Chinese activities in the Sub-Sahara region, the governance structure of development finance and overseas energy activities in China, and the economic, social and environmental impacts of Chinese projects. I argue that a new research agenda is needed to further develop a precise estimation regarding the size and trend of Chinese activities in the power generation sector in the SSA region, and to unpack the complex actor network and power relations among Chinese actors and with recipient countries. Future researches should also establish more robust evidence regarding the impacts of Chinese activities on energy sector development, economic growth at national level, and local environmental and social benefits at the local level. A more standardised assessment criteria is also required to evaluate these impacts due to the unique characters of Chinese activities compared to traditional OECD practices.

Sinsel, S., Markard, J., Hoffmann, V.H., 2020.
How deployment policies affect innovation in complementary technologies - evidence from the power sector transition.
Technological Forecasting and Social Change 161, 120274.
link

The transition in the electricity sector has entered a new phase, in which the complementary interplay of different technologies is key for the future functioning of the sector. A key question in this regard is how deployment policies for clean technologies such as wind and solar PV affect innovation in complementary technologies such as battery storage. We present a qualitative study from the German power sector, in which we investigate the impact of the feed-in tariff for renewable energy generation, on two complementary technologies: consumer and grid connected battery systems. We find direct and indirect effects of the feed-in tariff. Indirect effects are primarily about positive expectations

regarding the future progression of the transition. As deployment policies drive this progression, providers of complementary technologies interpret these changes as promising signals for their business. Direct effects differ for consumer and grid connected batteries. We find that innovation in consumer battery systems is disincentivized by some deployment policy features, while there are no such effects for grid connected batteries. When re-designing deployment policies for the next stage of the energy transition, it is important to take their effects on complementary technologies into account, or to develop specific policies targeting complementary innovation.

Sintov, N. D., Abou-Ghalioum, V. and White, L. V. (2020)
The partisan politics of low-carbon transport: Why democrats are more likely to adopt electric vehicles than Republicans in the United States.
Energy Research & Social Science, 68(101576), ISSN 2214-6296
link

Electric vehicle (EV) acceptance varies across political ideologies. EV symbolic attributes, or the extent to which people perceive EVs to reinforce aspects of their identities, are among the strongest predictors of EV adoption intentions, and may contribute to this group difference. The primary objectives of this study are to better understand the role of social (in this case, political) identity in symbolic attribute perceptions, and how these variables work together to influence EV adoption intentions. Among 545 survey respondents from the state of Ohio in the United States, Democrats are more willing to adopt EVs than Republicans. This relationship is mediated by symbolic attribute perceptions. Specifically, Democrats have stronger EV symbolic attribute perceptions than Republicans, and these perceptions predict adoption intentions. Using an identity framework, this study advances our understanding of the psychological mechanisms that help explain differences in EV adoption intent amongst U.S. Democrats vs. Republicans, and offers guidance for targeted marketing efforts to enhance EV uptake.

Spector, S., Higham, J. E. S., Gössling, S. (2020)
Extraterrestrial transitions: Desirable transport futures on earth and in outer space.
Energy Research & Social Science, 68(101541), ISSN 2214-6296
link

Transport is frequently cited as one of the most expedient means by which humankind affects Earth's ecosystem. Indeed, as underscored by the Anthropocene proposition, transport-related impacts are significant to the point of resulting in alterations of the planet's geological structure. Rising awareness of such issues has led to increasing attention on the priority of achieving a radically decarbonised transport future. However, that vision stands in stark contrast to the aspirations of pro-space advocates who are in the process of initiating an alternate transport future facilitated by greatly increased – and highly carbon-intensive – access to outer space. This rapidly emerging 'beyond Earth' transport paradigm enormously expands the spatio-temporal boundaries of human transport and human impact. This article reviews prominent visions of desirable 'terrestrial' (Earth-bound) transport futures. We then critically consider the transport futures envisioned by advocates of space development. This enables us to construct a dialectics of two coexisting but sharply contrasting contemporary schools of thought. We identify a highly significant divide, with one set of discourses arguing for reigning in human influence while the other set seeks unfettered expansion. Our analysis indicates fundamental divergences in the assumptions and aims of terrestrial versus space-focussed transport discourses. We conclude that the largely unrecognised and unacknowledged tensions between these contrasting desirable transport futures will be difficult to resolve.

Surana, K., Doblinger, C., Anadon, L.D. and Hultman, N. (2020)
Effects of technology complexity on the emergence and evolution of wind industry manufacturing locations along global value chains.
Nature Energy
link

Wind energy can contribute to national climate, energy and economic goals by expanding clean energy and supporting economies through new manufacturing industries. However, the mechanisms for achieving these interlinked goals are not well understood. Here we analyse the wind energy manufacturing global value chain, using a dataset on 389 component supplier firms (2006–2016) that work with 13 original equipment manufacturers. We assess how technology complexity, that is, the knowledge intensity and difficulty of manufacturing components, shapes the location of suppliers. For countries without existing wind industries, we find evidence of the emergence of suppliers for only low-complexity components (for example, towers and generators). For countries with existing wind industries, we find that suppliers' evolution, that is, changes in their international supply relationships, is less likely for high-complexity components (for example, blades and gearboxes). Our findings show the importance of understanding technologies along with firms and countries within global value chains for achieving policy goals.

Trencher, G., Rinscheid, A., Duygan, M., Truong, N. and Asuka, J. (2020)
Revisiting carbon lock-in in energy systems: Explaining the perpetuation of coal power in Japan
Energy Research & Social Science, 69(101770)

link

Carbon lock-in hampers the realisation of sustainable energy systems. It occurs when carbon-intensive technologies, markets and institutions co-evolve and become wedded to historical trajectories despite environmentally superior technologies being available. Multiple material and non-material causes are discussed in literature on socio-technical or energy transitions and carbon lock-in. However, these are yet to be synthesised into a comprehensive framework to guide the empirical identification of lock-in factors. Also, empirical understanding into how various causes of lock-in can interact is limited. To deepen understanding into the various types of socio-technical lock-in affecting energy transitions, we develop an encompassing analytical framework accounting for material, human, non-material and exogenous factors. In addition to carbon lock-in and path dependency, we synthesise diverse literature encompassing sustainability transitions, energy policy, innovation and firm management, economics and political economy. The resultant framework provides a finer-grained and more comprehensive understanding of lock-in than previous studies. Using Japan as a case study, we then apply this framework with two questions in mind: (i) What factors are contributing to the perpetuation of coal power in Japan? and ii) What opportunities emerge to overcome these? The empirical analysis is informed by triangulated data involving 46 semi-structured interviews and diverse documents. Our findings reveal a wide array of interacting factors that contribute to the perpetuation of coal-power in Japan and several emerging opportunities to tackle these. They also demonstrate our framework's utility as a heuristic that scholars could apply to other cases to increase empirical understanding into the multiple causes of socio-technical lock-in.

Upham, P., Bögel, P., Dütschke, E., Schneider, U., Oltra, C., Sala, R., Lores, M. and Klapper, R. (2020)
"The revolution is conditional? The conditionality of hydrogen fuel cell expectations in five European countries ".
Energy Research and Social Science, 70(101722)
link

The sociology of technological expectations examines, amongst other questions, the way in which expectations of new technologies help to mobilise or hinder commitment and investment. In this and other regards, studies have referred to a 'sea' of informal, individual expectations, contrasting these with formal visions such as roadmaps. Here we first identify and document those less formal, individual expectations of static and mobile applications for hydrogen fuel cells (H2FCs), as held by innovation system actors. We then show that these typically involve conditionalities and uncertainties that relate as much to policy and society as to technology. In contrast, formal roadmaps set out bold possibilities premised on heroic policy assumptions that elide the social and policy uncertainties that informal expectations admit to. We argue that there is policy value in informal expectations: that they reveal issues that need to be addressed and conditions that need to be met. Moreover these are often social and political, as well as technological. We illustrate the variety of such issues with expectations-related data from interviews with 145 hydrogen fuel cell innovation system actors in Spain, Germany, Slovenia, France and the UK.

Upham, P, Eberhardt, L. and Klapper, R. (2020)
Rethinking the meaning of "landscape shocks" in energy transitions: German social representations of the Fukushima nuclear accident.
Energy Research and Social Science, 69(101710)
link

Sociotechnical sustainability transitions are understood to involve changes in cultural meaning, alongside a wide variety of other changes. One of the most popular conceptual models of such change, the multi-level perspective, exogenously locates slow-changing cultural factors in the 'sociotechnical landscape', viewing this landscape as periodically subject to 'shocks' that may support the break-through of niche innovations. Here we emphasise that shock to a sociotechnical system has social psychological dimensions, including meaning-related correlates. Accordingly, we apply social representations theory, as a theory of meaning, to provide a social psychological account of energy landscape shock and associated policy change. For illustration we take newspaper representations of the 2011 German social and policy response to the nuclear accident at the Fukushima Daiichi power plant in Japan. The study illustrates the inter-related role of affect, identity and symbolic meaning-making in the public response to a sociotechnical landscape shock.

Van den Bergh, J. (2020)
Six Policy Perspectives on the Future of a Semi-Circular Economy.
Resources, Conservation & Recycling 160(104898)
link

To examine the prospect of full closure of relevant material flows, and the policy mix and transition to achieve it, I critically approach the popular notion of a 'circular economy' (CE) from six complementary perspectives: (i) lessons from ecosystem recycling, (ii) limits posed by thermodynamics, (iii) material rebound and material-to-energy shifting, (iv) market processes, (v) consumer and firm behaviour, and (vi) geography and transport. The unprecedented ambition of the CE goal requires a permanent incentive structure to assure that all decisions by consumers, producers, investors

and innovators are in line with circularity. Rather than hoping to realise this at short notice, policy will likely have to go through subsequent stages of advancement. This is best guided by sub-aims such as balancing 'local and non-local recycling' and limiting material rebound and material-to-energy shifting. Due to complicated and inexact compromises between durability, product light-weighting, reparability, decomposability and recyclability, one cannot hope to formulate simple rules for optimal CE policy. In line with this, we should, at best, expect to achieve a 'semi-circular economy'.

Van den Bergh, J. (2020)
Systemic assessment of urban climate policies worldwide: Decomposing effectiveness into 3 factors.
Environmental Science and Policy, 114, pp. 35-42
link

Optimism about the contribution of city policies worldwide to reduce greenhouse gas emissions is widespread. It is based, though, on partial and anecdotal studies rather than comprehensive system-wide estimates. Popular empirical indicators to support the importance of cities, such as consumption-based emissions within city borders, lack a policy connection. Here I undertake an initial assessment of the effectiveness of emissions reduction through urban climate policies. It employs a novel decomposition of effectiveness into reach, capability and stringency. This results in a qualitative estimation of current and maximum contributions of city climate policies – divided into four types – to global emissions reduction. I formalize the framework to numerically illustrate additional policy aspects. Based on the insights obtained, I suggest policy and political strategies to make better use of cities' competences to mitigate climate change.

Van den Bergh, J., and Botzen, W. (2020)
Low-carbon transition is improbable without carbon pricing.
Proceedings of the National Academy of Sciences of the U.S.A. (PNAS), 117 (38) 23219-23220.
link

Rosenbloom et al. downplay the role of carbon pricing in climate policy. We counter their criticisms.

Van den Bergh. J. C. J. M., Angelsen, A., Baranzini, A., Botzen, W.J.W., Carattini, A., Drews, S., Dunlop, T., Galbraith, A., Gsottbauer, E., Howarth, R. B., Padilla, E., Roca, J. and Schmidt, R. C. (2020)
A dual-track transition to global carbon pricing.
Climate Policy
link

Unilateral climate policies have been unable to achieve intended emissions reductions. We argue that international harmonization of climate policy beyond the Paris Agreement is the only way forward and that global carbon pricing, either through a tax or market, is the best available instrument to manage this. A foundation has already been laid, as current carbon pricing initiatives cover about 20% of global CO2 emissions. Since it limits free-riding by countries/jurisdictions, global carbon pricing is, in principle, behaviourally easier to negotiate than other instruments, such as emission targets or technical standards. To overcome political resistance, we propose a dynamic strategy consisting of two parallel tracks and five transition phases. The first track entails assembly of a carbon-pricing coalition that expands over time and exerts moral and economic pressure on non-members to join. The second track involves refocusing UN intergovernmental climate change negotiations on carbon pricing, potentially involving initially heterogeneous prices reflecting distinct income levels of countries, which then gradually converge. The dual tracks are designed to reinforce one another, increasing the likelihood of a successful outcome. The proposal results in a transition trajectory consisting of two interactive tracks and five phases, with specific attention to inequity within and among countries. We illustrate how such an approach could function with either a carbon tax or market.

Van Ewijk, S. and McDowall, W. (2020).
Diffusion of flue gas desulfurization reveals barriers and opportunities for carbon capture and storage.
Nature Communications, 11
link
Addressing climate change may require rapid global diffusion of Carbon Capture and Storage (CCS). To understand its potential diffusion, we analysed a historical analogy: Flue Gas Desulfurization (FGD) in the global coal power market. Our findings challenge common patterns: diffusion of FGD is not described by a single S-curve but by multiple steps and does not slow down after materiality. The regulation-driven diffusion of FGD can be fast, especially for retrofit since it does not require new power plants. Owing to the mature size of coal power plants, the diffusion of FGD is driven by unit numbers instead of unit capacity growth. We find that the diffusion of CCS in climate change mitigation pathways, when normalised for economic growth, rarely exceeds the historical maximum diffusion rate of FGD. Our findings suggest that end-of-pipe abatement technology can diffuse fast and to a great extent provided deep, consistent long-term regulatory commitment.

Veldhuizen, C. (2020)
Smart Specialisation as a transition management framework: Driving sustainability-focused.
Research Policy, 49(6)
link

Intensifying debates regarding the capacity of innovation policy to contribute to addressing complex problems requires analysis of the relationship between different policy approaches and the concepts of sustainability and sustainable regional development. This paper makes an important contribution to this endeavour by considering the potential of the place based Smart Specialisation (S3) approach to be used as a vehicle for governing regional sustainability transitions. The potential for alignment between the Transitions Management (TM) framework and S3, predicated upon the central role of collaborative discourse in each, provides the analytical lens to explore this issue. Key factors which both promote and inhibit the potential of S3 to effectively pursue a sustainability agenda are identified. An exploratory case study of the first stages of implementation of S3 in Gippsland, Australia, suggests that the policy approach can be adapted to address some of the challenges. However, it also suggests that adaptation of the S3 process may act to conceal unacknowledged, systemic issues, with profound implications for its capacity to promote societal transition within constrained time frames.

Verbruggen, A. and Brauers, H. (2020)
Diversity disqualifies global uniform carbon pricing for effective climate policy.
Environmental Science and Policy, 112, pp. 282-292
link

Real economies and societies are diverse. Applied economics responds to diversity by a variety in technologies, institutions, products, policies, for meeting the demands of differentiated actors. Nevertheless, neoclassical economics states that climate change can be regulated most efficiently by installing a global uniform carbon price. This position is based on many assumptions, such as full substitutability, negligible transaction costs, and boundless scale economies. However, diversity is relevant for designing well functioning carbon pricing policies. Diversity is a gradual property for cataloging homogeneous and heterogeneous cases. When categories are incompatible, substitutability is problematic, and transaction costs are high, respecting diversity is beneficial, not costly. Negating heterogeneity (strong diversity) by applying uniform approaches triggers subsequent remedial ad-hoc policies to anyhow address relevant differences. Ex-ante consideration of diversity prevents the flaws of remedial policies. By opting for diverse, case specific financial incentives, economics would well partner with other social sciences in search for realistic, effective, efficient and just climate policies. The global uniform carbon price is a theoretical concept, unlikely to ever be realized, hence escaping decisive assessment of its actual performance. We suggest a substitute indicator for UNFCCC monitoring of countries' efforts to financially incentivize climate actions.

Vogl, V., Åhman, M. and Nilsson, L. J. (2020)
The making of green steel in the EU: a policy evaluation for the early commercialization phase.
Climate Policy
link

In the attempt to reduce greenhouse gas emissions from steel production, several large industry decarbonization projects have emerged in Europe. The commercialization of low-emission steel technology, however, faces systemic barriers such as a lack of infrastructure and unclear demand for greener steel. As part of its new commitment to climate-neutrality, the European Commission has announced plans to more actively create and reshape markets for green basic materials. The approach is inspired by the recent success story of renewable energy, where market interventionist policy has successfully led to cost reductions and supported the diffusion of wind and photovoltaics. However, the applicability of this type of policy to decarbonize basic materials has so far not been investigated. In this study, we evaluate the effectiveness, feasibility, efficiency and fairness of early commercialization policy support for the decarbonization transition of steel. We compare two approaches: demand side market creation and direct production subsidies through carbon contracts for difference. We find that the subsidy approach can more effectively enable the realization of primary green steel production. A complementary use of market creation policy instruments can reduce the production subsidy volumes needed and aid the global diffusion of new production methods. Although effective, we find that production subsidies will distribute the costs and benefits of the transition unequally. In order to improve effectiveness and fairness of the policy, parallel programmes such as electricity price guarantees and transitional assistance policies for disadvantaged regions are needed.

Wanzenböck, I., Wesseling, J. H., Frenken, K., Hekkert, M. P. and Weber, K. M. (2020)
A framework for mission-oriented innovation policy: Alternative pathways through the problem-solution space.
Science and Public Policy
link

We aim for a better conceptualization of mission-oriented innovation policy (MIP). Our starting point is an analytical decomposition of societal problems and innovative solutions based on three dimensions of wickedness: (1) contestation; (2) complexity; and (3) uncertainty. We argue that both problems and solutions can be divergent (contested, complex, and uncertain) or convergent (uncontested, well-defined, and informed).

Based on the resulting problem–solution typology, we suggest a process-oriented view on MIP and discuss three alternative pathways along which convergence between problems and solutions can be achieved to come from wicked problems to legitimate solutions. We illustrate these pathways using examples for different societal problems related to health (smoking bans), security (CCTV), and energy (wind turbines). For policy makers, locating a societal challenge in this problem–solution space, and implementing policy strategies to achieve problem and solution convergence, is expected to accelerate both the legitimacy of a mission and the resulting solutions.

Wanzenböck, I. & Frenken, K. (2020)
The subsidiarity principle in innovation policy for societal challenges.
Global Transitions, 2, pp. 51-59
link

While national governments are the main actors in innovation policy, we witness a proliferation of challenge-oriented innovation policies both at the subnational and the supranational level. This begs the question about subsidiarity: what innovation policies for societal challenges should be organized at subnational, national and supranational levels? We provide arguments that innovation policies aimed to solve societal challenges, such as climate change or aging, are best pursued at subnational levels given the contested nature of problem identification and the contextual nature of problem-solving. Regional innovation policy, then, should formulate concrete societal goals tailored to the local context, while the transnational context promotes inter-regional learning and provides the complementary policies in the realms of basic research, regulation and taxation. In addition, the supranational level can set overall goals that are made more concrete and operational at the subnational level.

Wittmayer, J.M., de Geus, T., Pel, B., Avelino, F., Hielscher, S., Hoppe, T., Mühlemeier, S., Stasik, A., Oxenaar, S., Rogge, K.S., Visser, V., Marín-González, E., Ooms, M., Buitelaar, S., Foulds, C., Petrick, K., Klarwein, S., Krupnik, S., de Vries, G., Wagner, A. and Hartwig, A. (2020)
Beyond instrumentalism: Broadening the understanding of social innovation in socio-technical energy systems.
Energy Research & Social Science, 70(101689)
link

Social innovation is an important dimension of current transformations in energy systems. It can refer to alternative business models, novel policy instruments, financing schemes, participatory governance approaches to energy questions, or new discourses. Its significance for energy systems is often considered in narrow instrumentalist terms, reducing it to a tool serving particular policy objectives. Grounding the concept in social science and humanities insights, this review essay proposes a broadened social innovation understanding. We propose 1) to open up the normative complexity of the concept; 2) to appreciate the multi-actor nature of social innovation; 3) to understand it as an analytical entry point for socio-material intertwinement; and, 4) to understand social innovation as premised on experimentalism-based intervention logics. The proposed social innovation understandings provide a broader imagination and strategizing of structural changes in energy systems.

Zeppini, P. and van den Bergh, J. (2020)
Global competition dynamics of fossil fuels and renewable energy under climate policies and peak-oil: A behavioural model.
Energy Policy, 136(110907)
link

We develop a stochastic decision model to analyse the global competitive dynamics of fossil fuels and renewable energy. It describes coal, oil/gas, solar and wind. These differ not only in pollution intensities but also in profitability and innovation potential. The model accounts for the effect of learning curves, path-dependence and climate policies. Adoption shares endogenously affect agents' utility through increasing returns to adoption, learning, and a 'peak oil' capacity constraint. We find that peak oil induces a transition to coal rather than renewable energy, which worsens climate change. By introducing climate policies - such as a carbon tax, market adoption or R&D subsidies for renewables, and eliminating existing subsidies for fossil fuels - we identify potential transition patterns to a low-carbon energy system. Model analysis clarifies two main features of climate policies: which ones solve the climate problem, i.e. do not surpass the critical carbon budget; and how uncertain or variable are final market shares of energy sources.