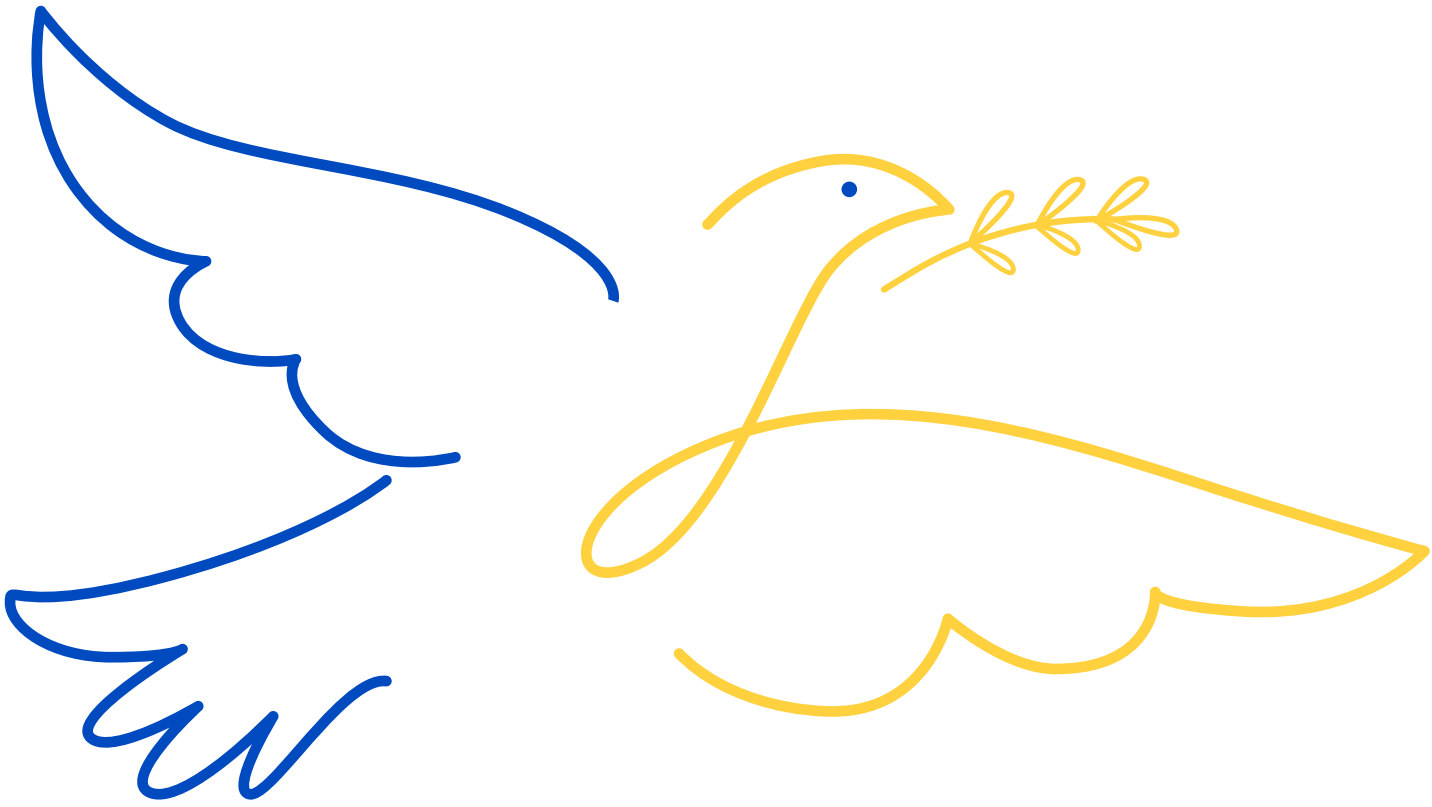
STRN Newsletter



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Sustainability Transitions Research Network.

Newsletter 44 – June 2022

Content

About

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

Cover picture: Shutterstock

Editorial

by Jochen Markard
(with suggestions from Danny Rosenbloom)

The Ukraine war has now been waging for four months, with no end in sight. How can we, as a global community of sustainability transitions scholars, come to terms with the relentless killing, destruction and suffering? At times, I find it hard to keep up my hopes in the midst of this. How can we address looming sustainability crises, in the context of geopolitical conflict? The world's economies are refocusing their resources on fueling and retooling their military apparatuses, spending billions on weapons – money that is direly needed elsewhere.

I also acknowledge that my initial feelings of outrage are increasingly numbed over time, which, while being a normal psychological response, strikes me as incredibly wrong. Perhaps this is the same effect people have when it comes to climate change and the other mounting sustainability crises. Once the heat waves, flooding and fires subside, we go back to normal. Or worse yet, we become desensitized to these events altogether due to their commonality.

The war has also made clear what it means to depend on fossil fuels. We have known for years that we need to reduce energy consumption and to ramp up renewables much more rapidly – both to address climate change and to become more energy independent. But all too often we squandered time wringing our hands over the near-term costs of the transition or complaining about how wind turbines change our landscapes. Now the implications of those delays are being borne out in global price surges riding on an overreliance on hydrocarbons.

But in the midst of all this, there may yet be cause for hope. Transition theory suggests that shocks can destabilize established socio-technical systems, potentially creating windows of opportunity for major transformation. And indeed, there are some indications that climate change and energy security concerns are converging to accelerate the ongoing energy transition: EU institutions plan to raise the renewable energy targets for 2030 (from 32% to 40%), to introduce a 100% CO_2 emissions reduction target by 2035 for new cars and vans, or to integrate intra-European aviation into the emissions trading scheme, among other measures.

At the same time though, we observe political reflexes of the past. Now that the prices for fossils are on the rise, policy makers have begun to subsidize gasoline and return to massive investments into new fossil fuel infrastructures. New gas deals are made with the next autocratic regime, while people continue to buy new SUVs or install new gas heating systems, which will last for another 20 years or so. Why not ban such practices as a mid-term response strategy?

Overall, my impression is that we need to work harder when it comes to serious demand side changes. Mobility and air travel are almost back to pre-Covid levels, there are ideological conflicts about every bit of city space taken away from cars (e.g., in favor of public transit and bike lanes), German policy makers still fear the introduction of a general speed limit, and it is very much unclear whether people are ready to heat less next Winter. Changing consumption practices and lifestyles is not easy and there is quite a risk of political backlash because it involves questioning the basic principles our current systems are built on. But these changes will be essential, and through our research and action we can be part of this transformation.

EIST Journal

We are happy to introduce the most recent issue of EIST with 25 excellent papers published in Volume 43. The full list of papers is also featured in the publication section of this newsletter.

Particularly worth mentioning are two recent *Perspectives* articles, one by Paula Kivimaa on the role of geopolitics in transition studies and one by Xiao-Shan Yap and myself on the challenges of earth-space sustainability. These two contributions may be considered templates for the kind of articles, we would like to see under the new perspectives rubric.

Bernhard Truffer
Editor-in-Chief EIST
EIST

NEST webinar series

The NEST webinar series had two further sessions this term.

- **June 14** – Rob Raven: Strategic Niche Management
- **June 30** – Tim Schwanen: Low-carbon Mobility Transitions

Missed these or any of the previous sessions? The recordings are / will be available on our Youtube Channel

In the webinar series, we aim to give early career researchers the opportunity to learn about core concepts in the field, and facilitate the dialogue between them and established researchers.

For questions don't hesitate to reach out to Abe Hendriks.

STRN Events

13th IST Conference, November 21-25, 2022 Stellenbosch, Melbourne, Washington D.C.

IST 2022 conference preparation is in full swing. We received almost 350 submissions across all formats and are now in the final stages of the review process.

At the same time, we are also working hard on inviting keynote speakers and setting up plenary discussions on both the online event and in-person days.

For more information visit the IST 2022 website
https://consultus.eventsair.com/ist2022-conference
or contact
ist2022global@gmail.com

New projects & networks

LAMARTRA Bridging decarbonization and labour market in sustainability transitions

This project addresses the interlinkages between transition processes of decarbonisation and work & employment. The national-level project (2021-2025) is funded by BELSPO (Belgian Science Policy Office).

Featuring 5 research institutes from Brussels, Liège, Namur, Louvain-la-Neuve and Leuven, it combines cutting-edge expertise on sustainability transitions, foresight/ future-of-work studies, labour economics and sociology of work.

Our main research question:
How to understand the ongoing and future developments of the low-carbon and labour transitions, and which governance strategies are available in Belgium to ensure the joint pursuit of climate targets and 'just' work and employment?

The scientific starting point for the project is the as yet still fragmented analysis - and also the governance - of these interlinked 'labour'/'decarbonisation' transitions.

Lead partner: Université Libre de Bruxelles, Socio-Environmental Dynamics Research Group (contact: dr. Bonno Pel, Bonno.Pel@ulb.be)
Project website Info on Researchgate

Transformative Realism for effective climate action

TRANSREAL explores innovative ways to combine radical with incremental and feasible action to achieve climate-friendly and climate-resilient practices and policies. Such transformative climate action (TCA), contributing to a desired social-ecological transformation, links short-term objectives to improve immediate living conditions with long-term concerns to stay within planetary boundaries. The project will co-design such TCAs in two Austrian rural micro-regions in the field of land use and socio-econ. aspects of housing, like countering splintered development, providing affordable housing, contributing to village regeneration and local job creation, and sustaining provisioning. The overarching research question of TRANSREAL is how transformative realism can improve climate action.

Our specific research questions are: 1. How can climate actions be designed to effectively contribute to socio-ecological transformation? 2. What are concrete TCAs in the socioeconomics of climate-friendly landuse in two rural case study regions in Austria? 3. How (in which organizational setting and by means of which forms of knowledge) can relevant knowledge for TCAs be produced?

Information and Contact: ulrike.stroissnig@wu.ac.at

Transitions in Latin America and the Caribbean

A group of researchers from Colombia (Prof. Dr. Mónica Ramos Mejía and Diego Florez Ayala) and Brazil (Dr. Rebeca Roysen and Rafael Machado) are joining forces to build a network of scholars interested in transitions in Latin America and the Caribbean within STRN and Transitions in the Global South networks.

Their first activity was to start mapping the researchers engaged in the topic, their thematic interests and countries, and to organise a series of events for scholars to present their investigations and to network. The fist two events are already available (in Spanish) on the YouTube channel Transitions in the Global South.

Two more events are planned to happen this year, one in August and one in October 2022. If you are interested in joining this network, please send an e-mail to diego.ayala@univali.br describing your research and interests. We look forward to your participation!

Report of Latin America HUB of TIPC conference May 17-20, 2022

The Latin America HUB of the Transformative Innovation Policy Consortium (TIPC) was established in May 2020 to undertake experiments that advance transformative innovation policy in the region.
The first presential conference took place between May 17-20 in Medellin Colombia over four days with visitors from all over Colombia, Chile and Mexico. One of the main aims of the conference was to cement a bridge with policy makers and in this highly successful event, that included both plenary presentations and parallel sessions, over one hundred policy makers, academics, students and consultants participated.

The topics of the paper presentations included some of the most salient issues to do with transformations in the global south and Latin America. This included inclusive rural development and inclusive agriculture, health service provision, education and inclusive circular economy and urban development. Analysis of the turnout from Colombia was particularly important. There was representation form the big cities of Bogota, Medellin and Cali, but also from predominantly rural regions, including the Amazon.

For further information on the activities of the Latin American HUB of TIPC please see link and sign up to the contact list and follow us on @hublayctip

STAGS - Sustainable Transition in Agriculture in the Global South

Just a few weeks ago a new network was launched with the name STAGS. It stands for Sustainable Transition in Agriculture in the Global South.

Focus is on support, co-create, network, discuss, ideate, design, find solutions, collaborate on challenges, when it comes to sustainable agricultural practices, agroforestry, symbiosis, nature-based solutions, agroecosystems, finance, renewable energy, resilience building, niche management, sustainable transition in the global south and the agricultural sector.

Emphasis will be on farmers, local-communities, ngos, start-ups, businnesses and grassroots. In this group, we will showcase the development of projects, organise events and workshops as well as interactive design games which serve as ways to create opportunities and impact. As STAGS we would like to organise different opportunities to engage with projects already happening on the ground and facilitate possible collaboration between STAGS and Stakeholders and NGOs working on sustainable agricultural practices in the global south.

Contact us through our LinkedIN group or by email
Geoffrey Kwala

Impressions NEST 2022

After two years of online editions, the global situation allowed for in-person participation again, and École normale supérieure de Lyon hosted the 7th NEST conference. Nevertheless, a hybrid format ensured accessibility for early career transition researchers that could not travel to Lyon. Over the course of two days, more than 100 participants from 26 countries presented their ongoing research on a wide range of topics, including mobility & energy transitions, circular economy, geographies of transition, governing transitions, and urban transitions. In line with the conference theme that called for a global view on sustainability transitions, a conscious decision was made to not hold individual sessions on transitions in the global south but rather integrate contributions from the global north & south. This helped to make a first step towards shaping a common perspective and offered an opportunity to learn from each other's work but also highlighted differences as well as research gaps that demand more attention.

Three online keynotes by Dr. Bipashyee Ghosh (University of Sussex), by Assoc. Prof. Dr. Adriana Marotti (University of São Paulo), and by Dr. Ruya Perincek (OECD) further provided much food for thought on how present structural inequalities and uneven distribution of resources across geographies and among populations could be overcome. The program was completed by an online “book session” that allowed participants to mingle with senior scholars from the transition community, five workshops tackling issues such as North-South collaboration, and of course a conference dinner.

Short impressions from selected conference participants follow:

“The hybrid model of organisation of NEST 2022 was very inclusive and has helped me to be part of the conference while sitting in another part of the world,

without having to worry about the expenses. The Gather Town platform was an excellent choice that facilitated smooth networking with others while giving a sense of fun in using the customisable avatars.

The conference gave an enriching experience with the diversity of the topics presented by young researchers and the keynote speeches. I was also happy to see the relatively higher number of presentations on agri-food system transitions compared to the previous year, which indicates increased attention given to this field by the ECRs. It would be really nice to see if institutions from different parts of the globe can be part of organising NEST conferences in the future.”
Anita Pinheiro, Ambedkar University, Delhi.

“NESTing in Lyon – what a blast! I’ve been to many scientific conferences over the past years, but this gathering in Lyon was special: First, the organizers did a great job facilitating a hybrid event for participants from all over the world during extremely turbulent times. Second, it was my first time at a NEST conference, which felt a bit like a family reunion; but the good sort, that is, without the old auntie or uncle telling you that your choice of career (or method/approach/literature) was stupid and wrong :-). Third, I can’t recall ever having more “fear of missing out” at a conference, given the

choice between so many relevant and interesting presentations. All the great discussions with inspiring people from both the global south and the global north definitely fueled me with much-needed energy." Dr. Michael P. Schlaile, Cusanus Hochschule für Gesellschaftsgestaltung & University of Hohenheim.

"As a Ph.D. candidate who is fairly early on in my research, I thought NEST was a great platform to get a lot of food for thought- from theory to framing and methods- that I am applying in my research, as well as an excellent networking opportunity. It felt good to have others give feedback on my work and to have them offer getting connected with other researchers who are working in similar fields. The feedback on post-its is one of those tools that I hope to use, too! But mostly, it was nice to be able to meet, in person, other PhDs and learn how their experiences have been and how they've coped with the impact of COVID on their research. I'm already looking forward to the NEST 2023." Subina Shrestha, Centre for Climate and Energy Transformation, University of Bergen.

NEST is a rapidly growing community, which is evident from the increasing number of participants at the NEST conferences. It is essential to find ways to make future NEST events even more engaging but in an inclusive way. Further, it is crucial to critically reflect on the agency and role of ERCs in the transitions community.

With this year's iteration behind us, we would like to thank STRN for the ongoing support & the NEST community for making this event such a great success!

Publications

PhD theses

Adriaan van der Loos (2022)
On Sustainability transitions and industrial development – the case of offshore wind.
Copernicus Institute of Sustainable Development, Utrecht University
link

This thesis makes a major contribution to sustainability transitions by delving into the coupling dynamics of industrial development and innovation systems. Innovation systems are widely used to grasp the mechanisms of technological emergence, but generally presume that industrial development is the *de facto* outcome of such activities rather than a concerted effort. Three theoretical gaps serve as the central pillars of this thesis:

- Influence: Innovation systems neglect to reflect on what is within and beyond the influence of a nation to facilitate industry formation.
- Missions: The effect of mission-oriented innovation policy on innovation systems and industry building remains underexplored, particularly regarding lock-in and resilience.
- Governance addresses guiding human behavior towards certain ends and is dependent on who gets to make decisions, how and for what purpose. This determines the formation and trajectory of innovation systems and industries.

Offshore wind serves as our empirical case and is the cornerstone of many costal countries' energy transition programs, such as the Netherlands. We conducted 65 interviews, statistically analyzed an industry database and assessed a government sponsored R&D project database.
It is possible to achieve the double-dividend effect, thereby benefiting sustainability transitions and industrial growth. The rapid diffusion of new technologies is feasible, particularly when there is strong relatedness between existing sectors and the emerging technology. However, it may also lead to technological lock-in and weaken resilience. Openness to a multitude of actors that engage in decision-making processes leads to a high degree of legitimacy, common expectations and shared purpose.

Losacker, S. (2022)
The diffusion of environmental innovations: a geographical perspective on lead markets and technology licensing in China.
Gottfried Wilhelm Leibniz Universität, Hannover
link

In this dissertation, I shed light on the diffusion of environmental innovations from a spatial perspective, i.e. the process from invention to adoption and the geography thereof. My research focuses on diffusion processes taking place in China, which is a particularly important case. The pace of China's sustainability transition will have a decisive impact on global futures given its current environmentally adverse modes of production and consumption. At the same time, China ranks as the largest market for green technologies and leads the technological frontier in many domains. From an economic geography point of view, many Chinese regions therefore enjoy great prospects for green regional path development, which might lead to a win-win situation for the environment and the local economy. Against this background, I analyze the diffusion of environmental innovations in Chinese regions using a regional case study and quantitative analyses of patent licensing data. Drawing on the case study, I develop a conceptual framework that provides a rationale for the spatial diffusion of environmental innovations: the regional lead market framework. The quantitative analyses provide statistical evidence for how spatial patterns of green technology diffusion might evolve into lead market structures. The findings reveal, inter alia, that geographic proximity between innovators and adopters not only increases the likelihood of innovation diffusion processes, but also their speed. The results of this dissertation yield important lessons for regional eco-innovation policy.

Books

Geels, F. W. and Turnheim, B. (2022)
The Great Reconfiguration: A Socio-Technical Analysis of Low-Carbon Transitions in UK Electricity, Heat, and Mobility Systems.
Cambridge University Press
link

This book is intended for researchers, policymakers, and practitioners interested in the dynamics and governance of low-carbon transitions. Drawing on the Multi-Level Perspective, it develops a whole system reconfiguration approach that explains how the incorporation of multiple innovations can cumulatively reconfigure existing systems. The book focuses on UK electricity, heat, and mobility systems, and it systematically analyses interactions between radical niche-innovations and existing (sub)systems across techno-economic, policy, and actor dimensions in the past three decades. Comparative analysis explains why the unfolding low-carbon transitions in these three systems vary in speed, scope, and depth. It evaluates to what degree these transitions qualify as Great Reconfigurations and assesses the future potential for, and barriers to, deeper low-carbon system transitions.

Generalising across these systems, broader lessons are developed about the roles of incumbent firms, governance and politics, user engagement, wider public, and civil society organisations.

EIST Volume 42

Darcy Parks
Directionality in transformative innovation policy: who is giving directions?
link

Carolina R. Haddad, Valentina Nakić, Anna Bergek, Hans Hellsmark
Transformative innovation policy: A systematic review
link

Sushil Rajagopalan, Hanna L. Breetz
Niches, narratives, and national policy: How India developed off-grid solar for rural electrification
link

Paula Kivimaa
Transforming innovation policy in the context of global security
link

Ionara Costa, Sibylle Bui, Olivier De Schutter, Tom Dedeurwaerdere
A network perspective to niche-regime interactions and learning at the regime level
link

Jakub Sokołowski, Jan Frankowski, Joanna Mazurkiewicz, Piotr Lewandowski
Hard coal phase-out and the labour market transition pathways: The case of Poland
link

Gavin McCrory, Johan Holmén, Niko Schäpke, John Holmberg
Sustainability-oriented labs in transitions: An empirically grounded typology
link

Robert MacNeil, Madeleine Beauman
Understanding resistance to just transition ideas in Australian coal communities
link

Leonardo Augusto de Vasconcelos Gomes, Lidyane Stephane da Silva Barros
The role of governments in uncertainty orchestration in market formation for sustainability transitions
link

Caitriona McLeish, Phil Johnstone, Johan Schot
The changing landscape of deep transitions: Sociotechnical imprinting and chemical warfare
link

Rachel Friedman, Gillad Rosen
Policy entrepreneurs in green building transitions: The role of interurban coalitions
link

Maria Luisa Lode, Thierry Coosemans, Luis Ramirez Camargo
Is social cohesion decisive for energy cooperatives existence? A quantitative analysis
link

Andres de Jesus Fernandez, Jim Watson
Mexico's renewable energy innovation system: Geothermal and solar photovoltaics case study
link

Eeva-Lotta Apajalahti, Gregor Kungl
Path dependence and path break-out in the electricity sector
link

Piotr Żuk, Paweł Żuk
Energy ageism: The framework of the problem and the challenges of a just energy transition
link

Theresa Tribaldos, Teea Kortetmäki
Just transition principles and criteria for food systems and beyond
link

Ram Kamath, Zhanli Sun, Frans Hermans
Policy instruments for green-growth of clusters: Implications from an agent-based model
link

Jonas Heiberg, Bernhard Truffer
The emergence of a global innovation system – A case study from the urban water sector
link

Daniel Weiss, Fabian Nemeczek
A Media-based Innovation Indicator: Examining declining Technological Innovation Systems
link

Dwarkeshwar Dutt
How power and politics shape niche-regime interactions: A view from the Global South
link

Christopher D. O'Connor, Kaitlin Fredericks, Kaylee Kosoralo

People's perceptions of energy technologies in an era of rapid transformation
link

Irene Kuhmonen, Marjo Siltaoja
Farming on the margins: Just transition and the resilience of peripheral farms
link

Julia Tschersich, Kristiaan P.W. Kok
Deepening democracy for the governance toward just transitions in agri-food systems
link

Guilherme Raj, Giuseppe Feola, Maarten Hajer, Hens Runhaar
Power and empowerment of grassroots innovations for sustainability transitions: A review
link

Kristiaan P.W. Kok, Evelien de Hoop, Frans Sengers, Jacqueline E.W. Broerse, ... Anne M.C. Loeber
Governing translocal experimentation in multi-sited transition programs: Dynamics and challenges
link

Papers

AbdulRafiu, A., Sovacool, B. K. and Daniels, C. (2022)
The dynamics of global public research funding on climate change, energy, transport, and industrial decarbonization.
Renewable & Sustainable Energy Reviews, 162, 112420, 1-17
link

This paper explores the funding trends, topical themes, and notable gaps in global public research funding across the areas of energy, climate change, transport, and industrial decarbonisation from 1990 to 2020. The paper organizes its analysis along the themes of financial and spatial patterns of funding, patterns of disciplinary funding, and the temporality (and shifting research priorities) within funding patterns. It finds that funding for energy and climate research remains concentrated within the European Commission, United Kingdom and United States. Climate change adaptation research is the most funded general area, and the specific topics of energy efficiency, climate resilience, and climate information systems, managing climate risks, energy storage, carbon dioxide removal and solar energy are the most funded technologies. There is significant diversity in the disciplines funded, with the social sciences supported almost as much as the engineering and physical sciences and meaningful amounts of funding disbursed to the arts and humanities and the life sciences. A large majority of projects identify themselves as transdisciplinary. The paper, lastly, discusses research gaps and future research questions.

Bankel, A., and Mignon, I. (2022)
Solar business models from a firm perspective–an empirical study of the Swedish market.
Energy Policy, 166, 113013
link

A worldwide transition towards sustainable energy systems requires the diffusion of renewable electricity technologies. To achieve this, recent research has put emphasis on the role of business models as catalysts for sustainability transitions, particularly in the case of solar photovoltaics. Authors have identified a variety of solar business models that can be characterized based on roles, activities, and applications. In contrast, on the market, solar firms use business models to communicate their offer to clients, focusing on customers' needs, how they organize their resources and activities to meet these needs and, in return, create value for themselves. The aim of this paper is to bridge the gap between the way the energy policy literature describes solar business models, and the way solar firms use them to communicate with their clients. The business models of 241 solar firms in Sweden were mapped and analyzed using a framework developed by Richardson (2008) as well as the roles, activities, and applications highlighted in solar business model literature. This led us to identify six types of solar business models. We found that there are some gaps and overlaps between theoretical and empirical solar business models which, in turn, have implications for theory and policy.

Corais, F., Bandeira, M., Silva, C. and Bragança, L. (2022)
Between the Unstoppable and the Feasible: The Lucid Pragmatism of Transition Processes for Sustainable Urban Mobility: A Literature Review.
Future Transportation, 2:1
link

This article presents a literature review of Transition Experiments applied to the Sustainable Urban Mobility context from a critical and operative point of view. The moment of transformation that we are living through determines concerns about the decarbonization and compliance with the 2050 Targets and imposes a paradigm shift towards sustainable urban mobility. In this regard, the necessary physical change will have to be accompanied by a socio–cultural transition, of which the challenge implies the construction of a collective

ideal, shared by the population and the main stakeholders, leading to the opening of new political spaces and a change, also in terms of governance.

Dijk, M., Hommels, A. and Stoffers, M. (2021)
The Transformation of Urban Mobility Practices in Maastricht (1950–1980).
Coevolution of Cycling and Car Mobility, Transfers, Volume 11, Issue 3, Winter 2021: 22–61.
link

This article reconstructs the historical transformation of mobility in the city of Maastricht in the period 1950–1980, from cycling as the most popular mode of traveling in the 1950s to car driving by the end of the 1970s. Based on an analysis of written sources and oral history interviews with Maastricht travelers and other practitioners who experienced this shift themselves, this article sheds light on this historical transformation, its key actors, and its main drivers. Combining insights from studies of social practice-based perspectives on mobility, historical sociotechnical transitions, and the model of urban obduracy, this study seeks to contribute to understanding why and how cities may transform toward being unsustainable places. Furthermore, it aims to show how social practice approaches can give more context-sensitive insights into processes of transformation and transition compared to established MLP-based transition approaches, by giving more attention to local meanings.

Drews, S., I. Savin, J. van den Bergh, S. and Villamayor-Tomás, S. (2022)
Climate concern and policy acceptance before and after COVID-19.
Ecological Economics 199, 107507
link

It remains unclear how COVID-19 has affected public engagement with the climate crisis. According to the finite-pool-of-worry hypothesis, concern about climate change should have decreased after the pandemic, in turn reducing climate-policy acceptance. Here we test these and several other conjectures by using survey data from 1172 Spanish participants who responded before and after the first wave of COVID-19, allowing for both aggregate and within-person analyses. We find that on average climate concern has decreased, while acceptance of most climate policies has increased. At the individual-level, adverse health experiences are unrelated to these changes. The same holds for negative economic experiences, with the exception that unemployment is associated with reduced acceptance of some policies. Complementary to the finite-pool-of-worry test, we examine three additional pandemic-related issues. As we find, (1) higher climate concern and policy acceptance are associated with a belief that climate change contributed to the COVID-19 outbreak; (2) higher policy acceptance is associated with a positive opinion about how the government addressed the COVID-19 crisis; (3) citizens show favorable attitudes to a carbon tax with revenues used to compensate COVID-19-related expenditures. Overall, we conclude there is support for addressing the global climate crisis even during a global health crisis.

Edomah, N. (2022)
Can a shift to electric vehicles fast track Africa's energy transition?
Joule. 6 (4), 715–717
link

Recently in *iScience*, Dioha et al. used a bottom-up energy modeling framework to generate insights on future electric vehicle penetration and their potential contribution to Africa's energy transition. In this preview, we discuss electric vehicles within the African context and what it means for Africa's future energy in the midst of a prevailing energy access crisis.

Ehnert, F. (2022)
Review of research into urban experimentation in the fields of sustainability transitions and environmental governance.
European Planning Studies, 1–27
link

In recent years, scholars from diverse research communities have become greatly interested in the experimental turn within the social sciences and economics. A rapidly emerging field within the literature on experimentation is investigating urban experimentation to promote sustainability transitions. Emphasising the situatedness of experiments, such publications are shedding light on the particularities of places and spaces. Experimentation conducted in real-world settings seeks to combine purposeful intervention with observation and reflection. In the study of urban experimentation, various disciplinary lenses and conceptual frameworks have emerged, especially in the two literatures on sustainability transitions and environmental governance. This has fostered a more complex, differentiated understanding of experimentation. The literature review presented here seeks to elaborate current lines of inquiry on urban experimentation in order to gain insight into how experimentation shapes urban sustainability transitions. By outlining the complementary and contrasting nature of different academic perspectives, it is possible to identify avenues of future research and encourage dialogue between the different research communities.

Fahimi, A., Upham, P. and Münch, S. (2022)
Afghanistan's energy sociotechnical imaginaries: Alternative visions in a conflict

zone.
Political Geography, 98, 102657
link

Imaginaries are understood to be both discursive and cognitive constructs that shape behaviour, policies, and institutions – but how do longstanding imaginaries evolve in new circumstances, and how do they interact with existing power structures in changed circumstances? Drawing on conceptions of discursive power, this paper investigates the interplay of power with both new and old imaginaries in the case of Afghanistan, specifically regarding alternative energy futures. Employing an interpretive approach, we draw on document analysis and semi-structured interviews with elite stakeholders and policy observers, to provide an account of the relations between alternative energy futures imaginaries and political power. We demonstrate, how certain discursive practices are made possible, authorised and articulated through imaginative geographies. Critically, the government-advocated imaginary of Afghanistan as an energy corridor and hence an energy importer both represents the views of several powerful interests and concurs with the long-held idea of Afghanistan as a buffer state. In this way, political path dependencies are reinforced through a supportive imaginary, just as the dominant imaginary is itself reinforced by the main stakeholders. While in line with our interpretive epistemology we do not make claims for the specific configuration of imaginaries being generalisable elsewhere, we do find the general theoretical approach useful for understanding discursive aspects of conflict zone politics, particularly vis-à-vis energy system trajectories.

Friedrich, J., Najork, K., Keck, M. and Zscheischler, J. (2022)
Bioeconomic fiction between narrative dynamics and a fixed imaginary: Evidence from India and Germany
Sustainable Production and Consumption, Volume 30, 584-595
link

Bioeconomic ideas and visions have received increasing attention from scientists and policy makers to address socioecological challenges. However, the role of imagined futures in the design of bioeconomic innovations and transitions has hitherto been widely neglected. In this study, we therefore explore the role of imaginaries of the future to understand how they shape bioeconomic innovations and transitions. We thereby build on insights from economic sociology and compare two distinct case studies from Germany and India. Based on our results, we inductively develop an analytic model that describes the co-constitution of imaginaries, fictional expectations, narratives, and innovation dynamics. Our results show that narrative dynamics are caused by irritations in the political and discursive landscape; these irritations prompt economic actors to stabilize, adapt, or reject their own bioeconomic conceptions, while the underlying imaginary of a technological fix remains fixed. We discuss this reductionist imaginary and instead plead for an imaginary of a socioecological fix that reintertwines technologies with their underlying societal, cultural, and ecological factors. We conclude that this will support sustainability scholars and policy makers in remaining vigilant against premature mental and institutional lock-ins that could lead to a colonization of the future with severe negative implications for society's ability to mitigate and adapt to global environmental change in the future.

Friedrich, J., Zscheischler, J. and Faust, H. (2022)
Preservation, modernization, and transformation: contesting bioeconomic imaginations of "manure futures" and trajectories toward a sustainable livestock system.
Sustainability Science
link

In discourses on sustainability, its underlying conceptualizations and meanings, the role of imaginations and their influence on concrete social practices and mutually dependent sociomaterial structures have been overlooked. Therefore, our article uses Adloff and Neckel's (Sustain Sci 14(4):1015-1025, 2019) conceptual framework to explore the role of imaginations in generating different trajectories from a concrete environmental problem, namely issues attributed to manure surpluses in Germany, to assess the hurdles and conflicting goals of a transformation toward a sustainable livestock system. Our study builds on qualitative, semistructured, and problem-centered interviews with both new innovation actors and incumbent actors in the current system. Our results show that different trajectories of "manure futures" exist, as we identify "preservation", "modernization" and "transformation" as trajectories representing ideal types of change. We discuss the results in light of the theory of imaginations and reflect on the usefulness of the concept of imaginations for analyzing environmental discourses and practices. Furthermore, we find that normative framings of problems rather than factual knowledge describe contesting imaginations as barriers to sustainability transformations, a point that must be acknowledged when developing a sustainable livestock system. We conclude that contesting imaginations could result in conflicts that must be moderated as drivers for change yet could also point to transformations that are already underway.

Geels, F. W. (2022)
Causality and explanation in socio-technical

transitions research: Mobilising epistemological insights from the wider social sciences.
Research Policy, 51(6), 104537
link

In response to criticisms about the status of causal explanation in socio-technical transitions research, this article elaborates the epistemological underpinnings of this emerging research field, mobilising insights from the wider social sciences where foundational debates have started to transform the understanding of causality and explanation. The article shows that socio-technical transitions are a special kind of research topic with phenomenological characteristics that pose challenges for mainstream explanatory formats and therefore warrant particular approaches to causality and explanation. It first discusses three philosophical positions on causality and explanation (positivism, pragmatism, critical realism), and concludes that critical realism is most suited to address phenomenological characteristics of socio-technical transitions. Elaborating the critical realist approach, the article then discusses the relevance of complex causalities (especially conjunctural, configurational, and event-chain causality) for explaining transitions and how existing transition frameworks (MLP, TIS, SNM) can improve their use of these causalities. The article subsequently discusses the role of theories in explanations (including heuristic roles), and the relevance of conceptual frameworks, causal mechanisms, process tracing and narrative explanation in socio-technical transitions research. Theoretical and methodological suggestions for improving transition research are provided throughout.

Goggins, G., Rau, H., Moran, P., Fahy, F., and Goggins, J. (2022)
The role of culture in advancing sustainable energy policy and practice.
Energy Policy, 167, 113055
link

This paper offers a culturally sensitive analysis of measures to improve the energy performance of households. Comparing and combining insights from two recent sustainable energy initiatives in Ireland, we show how integrated approaches that work with participants' everyday practices and their links with people and place can yield substantial and sustained reductions in household energy use. Recognizing the centrality of culturally rooted meanings related to domestic energy use and the services it provides, our analysis challenges approaches to energy saving that overemphasize technology use and individual-level behavior change. Instead, it treats domestic energy use as an inherently social phenomenon that reflects place-specific cultural practices and material conditions. The paper also provides important lessons for upscaling and diffusion of good practice that recognize the centrality of formal and informal community networks and related aspects of trust in local social relations. Involving local advocates with strong social awareness and (inter-)cultural competences can increase engagement in community-based initiatives and deliver more sustainable results. Overall, the paper addresses a major energy policy challenge that has generated intense public debate, namely how to design and implement sustainable energy initiatives that meet the needs of participants and deliver lasting reductions in domestic energy use.

Gothár, E., and Schanz, H. (2022)
Bringing a governance perspective to plastic litter: A structural analysis of the German PET industry.
Sustainable Production and Consumption, 31, 630-641
link

The challenge for a circular plastics economy transition is to focus policies on key leverage points that initiate actual system transitions. This requires a systemic perspective on the plastics industries. This study takes such a systemic perspective by employing a network approach to examine the often-underestimated complexity of interrelating markets in a circular plastics economy, and their structural sensitivity to governance interventions. Based on the case of polyethylene terephthalate (PET) markets in Germany, we investigate the structures and underlying dynamics of increasing circularity in the PET industry. Concerns about plastic litter accumulating in the natural environment have facilitated the development of niche markets for the recycling of plastic litter recovered from the environment. We systematically reveal that recycling markets connecting diverse waste sources with a broad range of new applications are key areas of intervention in the structural transitions towards circular industries. By connecting otherwise disconnected parts of the system, the recycling of recovered plastic litter is a key leverage point for the circular economy transition. We recommend to focus governance efforts on such key leverage markets as powerful venues to initiate systemic change.

Griego, D., Mehta, P. and Nuñez-Jimenez, A. (2022)
Solar Energy Communities in the Urban Environment.
The Palgrave Encyclopedia of Urban and Regional Futures, 1-8
link

Decarbonizing energy consumption in urban environments is key to mitigating climate change

and reducing local air pollution. Over two-thirds of global primary energy consumption and an even greater share of energy-related CO2 emissions are derived from energy use in cities. Increasing the adoption of solar photovoltaics is a promising route to decarbonizing urban energy systems. Still, competing uses in already limited available space pose a barrier to PV diffusion in urban centers. Solar energy communities in urban environments (SECUE) can help overcome this challenge. This chapter presents a taxonomy of PV installations based on who owns them and uses their electricity, making it easier to identify SECUEs and map their economic, environmental and social benefits. After a brief overview of existing classifications of renewable energy communities, the chapter introduces the new taxonomy, reviews examples of SECUEs, and discusses their opportunities and challenges. The new taxonomy helps researchers investigating renewable energy communities and has implications for practitioners and policymakers.

Groot-Kormelinck, A., Bijman, J., Trienekens, J. and Klerkx, L. (2022)
Producer organizations as transition intermediaries? Insights from organic and conventional vegetable systems in Uruguay.
Agriculture and Human Values
link

Increased pressures on agri-food systems have indicated the importance of intermediaries to facilitate sustainability transitions. While producer organizations are acknowledged as intermediaries between individual producers and other food system actors, their role as sustainability transition intermediaries remains understudied. This paper explores the potential of producer organizations as transition intermediaries to support producers in their needs to adopt sustainable production practices. Ten cases of producer organizations in conventional (regime) and organic (niche) vegetable systems in Uruguay were studied qualitatively. Findings show that the classic intermediary roles that producer organizations fulfil in food systems also address the needs of producers in their transition to sustainable food systems. By providing organic inputs, organizing access to output markets, sharing knowledge, and facilitating sustainable production practices, producer organizations support producers within and across regime and niche. Producer organizations mostly function as implicit transition intermediaries, facilitated by their legitimacy among producers, their embeddedness in rural networks, and by refraining from taking a strong normative position. Producer organizations have the potential to be more explicit transition intermediaries, however this position comes with limitations. We provide policy recommendations to optimize the transition intermediary potential of producer organizations in their facilitation towards sustainable food systems.

Haarstad, H., Sareen, S., Kandt, J., Coenen, L. and Cook, M. (2022)
Beyond automobility? Lock-in of past failures in low-carbon urban mobility innovations.
Energy Policy 166, 113002
link

Automobility, including the infrastructures, technologies and institutions that created high dependence on private car use, has led to significant environmental and climate problems and notably high carbon emissions. Now cities are attempting to move beyond this failed regime by experimenting with a range of different mobility innovations. In this paper, we examine whether emergent policy-led experiments and innovation processes in low-carbon mobility are learning from the past, or whether they are reproducing key elements of past policy failures. Through four case studies – Birmingham, Stavanger, Milton Keynes and Melbourne – we assess attempts to break out of high-carbon automobility through three key factors, namely diversification of travel options, a shift from individual to shared forms of mobility, and whether these aspects are implemented at scale. We find that while all cities show potential for diversification and sharing at scale, current modes of innovation exhibit features that may reproduce rather than reduce high-carbon automobility. Our analysis attributes this risk of continued failure to how policy-led experimentation and innovation are structured and themselves become locked in, thereby upholding the obdurate automobility regime.

Heiskanen, E., Happonen, J., Matschoss, K., and Mikkonen, I. (2022)
Learning from failures-Encouraging lesson-sharing in the Finnish energy transition.
Energy Research & Social Science, 90, 102676
link

Learning from experiments has been seen as important in developing climate and energy solutions, but less attention has been paid to learning from the inevitable failures associated with experiments. Learning from failures is challenging because sharing such experiences is difficult. This study examines a novel intervention developed to support the creation of a failure-tolerant culture related to renewable energy experiments. A series of after-work events for pioneers in energy experimentation was held in several locations in Finland during 2018–2019, engaging 139 participants from various backgrounds. The aim of the Energy

Pioneers' After Work event series was to encourage participants to openly share their failures in a relaxed atmosphere, thus promoting the adoption of an experimental culture and the local dissemination of experimental lessons. The events were successful in terms of cultural change, as the participants openly and comprehensively shared their failures. The focus being on social and peer learning, the events revealed a need to improve the flow of information, help adapt new technology to the context of its application and pay more attention to the design architecture. The underdevelopment of the market for new solutions and the problems of co-development were identified as challenges in promoting the energy transition. The events brought together actors from varied backgrounds, which was considered important and enabled the creation of an energy experimenter's network. In the future, more systematic learning could be facilitated by building on the concept and engaging more practitioners and transition community researchers in the events.

Hoop, E. de, Boon, W., Oers, L. van, Smith, A., Späth, P. and Raven, R. P. J. M. (2022)
Deliberating the knowledge politics of smart urbanism.
Urban Transformations. 4(6), 1-15
link

This Frontiers paper develops a synthesis on deliberating smart knowledge politics for urban transformations, based on a 3-year collaborative research project conducting case studies in cities in the UK, France, the Netherlands, Germany and Spain. The paper presents a set of observations about existing deliberations on smart city knowledge politics that emerged from our case studies in terms of the who, what, where, when and how of smart knowledge politics. Based thereon, we *propose* a set of research questions about deliberative spaces for smart knowledge politics that may foster inclusive and sustainable urban transformation.

Kivimaa, P., Brisbois, M. C., Jayaram, D., Hakala, E. and Siddi, M. (2022)
A socio-technical lens on security in sustainability transitions: Future expectations for positive and negative security.
Futures, Volume 141, 102971.
link

A transition to net-zero carbon energy systems, imperative to combat climate change, is unfolding around the world. Other socio-technical systems also face the need to transition to become more environmentally and socially sustainable. We argue that such transitions will have both positive and negative security implications on numerous issues which deserve attention but have been little addressed in transition studies. We take a socio-technical lens and propose that these security implications can be ex-ante analysed via three elements of socio-technical systems: technology, actors, and institutions. We provide an illustration of such analysis in the energy transition context and use this to create a categorisation framework for expectations analysis. Regarding the technology dimension, expectations concerning, e.g., resource and technology dependencies, risk for technical system disruptions, and effects on interconnected systems can be analysed as relevant security issues. For the actor dimension, issues such as geopolitical uncertainties, regional (in)stability, internal tensions, and diffusion of power are identified. For institutions, e.g., influence on democratic institutions, peace building and structural violence can be assessed. We argue there is a need for improved and forward-looking policy coordination across domains and for academic studies that utilise foresight approaches to assess different security expectations more concretely.

Klitkou, A., Bolwig, S., Huber, A., Ingeborgrud, L., Pluciński, P., Rohracher, H., Schartinger, D., Thiene, M. and Żuk, P. (2022)
The interconnected dynamics of social practices and their implications for transformative change: A review.
Sustainable Production and Consumption, 31, 603-614
link

This review article analyses the interconnectedness of different fields of social practice. Our aim is to understand if and how the literature using social practice theory addresses these interrelations and how this is linked to questions of sustainability transformations. Based on our review, we suggest a framework that conceives everyday-life practices of working, dwelling, mobility, eating, and recreation as closely intertwined and not changing independently of each other. As our analysis demonstrates, such a framing also contributes to better understanding the dynamics of (un)sustainable transformative change. Greater sustainability cannot be achieved by technological fixes or changes in individual behaviour alone but requires comprehensive interventions that address the interactions between practices, as these often co-evolve and co-locate, and changes need to be aligned between different practice fields. This has high relevance for understanding the development of public policy interventions that aim to increase the sustainability of everyday life. Our review shows a significant value of social practice research on the interconnectedness of different practice fields, although certain areas still appear to be somewhat neglected, such as the interconnectedness of work-related

practices with other practices of everyday life. It furthermore points to the potential contribution of studies of interconnected practices to the literature on sustainability transitions, a perspective otherwise neglected in transition studies focusing on organisational actors and institutional dimensions of socio-technical change.

Klitkou, A., Capasso, M. and Hansen, T. (2021)
Understanding conditions for path development after path exhaustion.
European Planning Studies, 1-18
link

This paper focuses on path development processes after a sudden path exhaustion. We analyse the decline, the closure and the attempts at the re-orientation of a forestry-based industry agglomeration in Southern Norway, located around the municipality of Hønefoss. In particular, this paper focuses on the Treklyngen holding company in Hønefoss. This paper explores how policy may be influenced by and built upon regional capabilities to support new path development in the aftermath of path exhaustion. It also shows how natural resources and institutional endowments could contribute to path development, under such difficult circumstances in a peripheral region.

Konc, T., Drews, S., Savin, I. and van den Bergh, J. (2022)
Co-dynamics of climate policy stringency and public support.
Global Environmental Change, 74, 102528
link

Public support for stringent climate policies is currently weak. We develop a model to study the dynamics of public support for climate policies. It comprises three interconnected modules: one calculates policy impacts; a second translates these into policy support mediated by social influence; and a third represents the regulator adapting policy stringency depending on public support. The model combines general-equilibrium and agent-based elements and is empirically grounded in a household survey, which allows quantifying policy support as a function of effectiveness, personal wellbeing and distributional effects. We apply our approach to compare two policy instruments, namely carbon taxation and performance standards, and identify intertemporal trajectories that meet the climate target and count on sufficient public support. Our results highlight the importance of social influence, opinion stability and income inequality for public support of climate policies. Our model predicts that carbon taxation consistently generates more public support than standards. Finally, we show that under moderate social influence and income inequality, an increasing carbon tax trajectory combined with progressive revenue redistribution receives the highest average public support over time.

Loewen, B. (2022)
Revitalizing varieties of capitalism for sustainability transitions research: Review, critique and way forward.
Renewable and Sustainable Energy Reviews, 162, 112432
link

Despite recent calls for more critical views of capitalism in sustainability transitions research, a starting point for transitions researchers is lacking. Recognizing the potential of the varieties of capitalism (VoC) approach to bring capitalism deeper into transitions research, this paper constitutes a review of VoC in the sustainability transitions literature, returning to its theoretical foundations in coordination and strategic interactions and their relations to innovation and socio-technical system transformation. The review finds the most common application of VoC to be in the energy dimension of transition, nevertheless revealing a shallow engagement with the approach that reinforces the need for conceptual development for sustainability transitions purposes. Potential areas for development relate to the enrichment of core VoC concepts – coordination, strategic interaction and comparative institutional advantage – and to competing growth and sustainability objectives of existing (and beyond) capitalist systems. There is a further need to expand the scope of VoC application beyond ideal-form national archetypes to infiltrate across scales and levels, as well as to go beyond the traditional range of sectors to shed light on understudied actors, roles and power relations for transitions. Despite typical delegation to political economy, VoC is highly interdisciplinary, applicable to common frameworks used in transition studies and amenable to social scientists interested in power and agency in transitions. As a strategy for moving VoC forward in transitions research, it is recommended to place it at the core of studies taking institutions, stakeholder interactions and sector coordination in their contextual situations seriously.

Low, S. J., Baum, C. and Sovacool, B. K. (2022)
Rethinking Net-Zero systems, spaces, and societies: "Hard" versus "soft" alternatives for nature-based and engineered carbon removal.
Global Environmental Change, 75, 102530, 1-15
link

Carbon removal – also known as negative emissions technologies, or greenhouse gas removal – represents a core pillar of post-Paris climate policy, signaling for enhancing and constructing carbon sinks to balance

emissions sources on route to ambitious temperature targets. We build on Amory Lovins' "hard" and "soft" alternatives for energy pathways to illuminate how foundational experts, technologists, and policy entrepreneurs think about different modes of resource inputs, infrastructure and livelihoods, and decision-making, regarding ten nature-based and engineered carbon removal approaches. Based on 90 original interviews, we show that hard and soft paths reflect different conceptions of systems, spaces, and societal involvement. We highlight that pathways depend on diverging concepts of economies-of-scale (capturing carbon at the largest possible scale, versus catalyzing systemic co-benefits) and carbon management (a waste product within conventional climate governance, versus diverse end-uses and values to be diversely governed). Our analysis further emphasizes two key uncertainties: whether renewables can be upscaled to allow synergies rather than tradeoffs between carbon removal and more widespread energy demands, and whether carbon certification can expand spatially to navigate long supply chains, and conceptually to incentivize diverse co-benefits. Experts remain motivated by antecedent concerns over land-use management and extractive industries, and that exploitative systems will – without guardrails – be replicated by inertia.

Low, S., Baum, C., and Sovacool, B. K. (2022)
Taking it outside: Exploring social opposition to 21 early-stage experiments in radical climate interventions.
Energy Research & Social Science, 90, 102594, 1-21
link

Large-scale and highly experimental interventions are being considered as strategies to address climate change. These include carbon dioxide removal approaches that are becoming a key pillar of post-Paris assessment and governance, as well as the more controversial suite of solar geoengineering methods. In this paper, we ask: Who defends and opposes these experiments, and why? After screening 44 early-stage experiments, we conduct a qualitative comparative analysis of 21 of them in five areas: ocean fertilization, marine cloud brightening, stratospheric aerosol injection, ice protection, and enhanced weathering. We develop a common framework of analysis, treating experiments as sites in which the risks and appropriate governance of early-stage science and technology are envisioned and disputed among scientists and other social groups. Our contribution is to map and explain the key issues of contention (why), actors (who), and tactics (how) that have shaped opposition across these linked fields of experimentation and technological development, from the 1990s till today. In doing so, we build upon and connect past studies on particular climate experiments and develop insights relevant to governance outlooks perceptions, discourses, and intents surrounding immature but potentially crucial climate technologies.

Lukkarinen, J. P., Nieminen, H., and Lazarevic, D. (2022)
Transitions in planning: transformative policy visions of the circular economy and blue bioeconomy meet planning practice.
European Planning Studies, 0(0), 1–21
link

Ongoing sustainability challenges create pressure on planning practices and institutional arrangements. Transformative policy visions, such as the circular economy and bioeconomy, create promises for designing and planning sustainable pathways in society. Moreover, research agendas on sustainability transitions, such as transition management, are developing toolkits and attempting to shift planning practice by applying evidence-based policy-making processes. In this paper, we ask what happens when sustainability visions are exposed to planning practices, and vice versa, by developing an analytical framework to discuss processes of territorialization and mobilization. We draw lessons from two contextually differing case studies in Finland; on the evaluation of spatial planning processes for the circular economy and a strategic planning intervention for the blue bioeconomy. The disparate cases show that the planning process act as a bidirectional intermediary space, refining both the general transition visions and established planning practices.

Marcon Nora, G. A., Alberton, A., and Ayala, D. H. F. (2022)
Stakeholder theory and actor-network theory: The stakeholder engagement in energy transitions.
Wiley Online Library
link

The idea of sustainable development highlights the need to address economic, social, and environmental aspects to preserve the rights and needs of future generations. This paper proposes an association between stakeholder theory (ST) and Actor-Network Theory (ANT) that can better explain the dynamics of actors in the energy sector, in the context of sociotechnical transitions to sustainability. By selectively examining the way in which different researchers perceive this subject, we intend to address how the engagement of the stakeholders can promote sociotechnical transitions in the energy sector trough the connection between ST and ANT. We aim to characterize the dynamics of stakeholder's engagement in sociotechnical transitions in the context of

sustainability in the energy sector, trough the connection of the two theories. A narrative literature review was performed on scientific databases. The results showed that sociotechnical transitions in the energy sector require the involvement of multiple actors with different interests and that ST associated with ANT provides a good basis for research on this theme. The association of both theories highlights the importance of ST to enhance cooperation in the areas of clean energy research and technology, providing a theoretical tool for understanding the dynamics of transitions and its different pathways. For future studies, it is recommended to deepen the relationship between human and non-human actors and their role as stakeholders.

Mathur, S., Gosnell, G., Sovacool, B. K., Furszyfer Del Rio, D. D., Griffiths, S., Bazilian, M. and Kim, J. (2022)
Industrial decarbonization via natural gas: A critical and systematic review of developments, socio-technical systems and policy options.
Energy Research & Social Science, 90, 102638, 1-23
link

Natural gas is an important and highly flexible fuel across the industry sector globally. It provides fuel and energy services for both heat and power, and is also as a key feedstock in many industrial processes. Natural gas-based industrial technologies typically have lower capital costs, operating costs, and electricity consumption than coal-based technologies. These features make natural gas preferable for industrial use as compared to other fossil fuels. However, the future of natural gas remains uncertain, especially for industry planning to be net-zero or carbon neutral by mid-century. This review addresses the role that natural gas might play in global industrial decarbonization, and how it can help decarbonize industrial processes. We undertake a comprehensive and critical review of more than 400 studies on the topic of industrial decarbonization via natural gas. The review also provides evidence of critical barriers that range from financial and infrastructural to geopolitical and governance issues along with promising avenues for future research.

Mäkitie, T., Hanson, J., Stehen, M., Hansen, T., Andersen, A. D. (2022)
Complementarity formation mechanisms in technology value chains.
Research Policy, Volume 51, Issue 7, 104559,
link

Recent literature has begun to discuss complementarities between sectors and technologies in the context of sustainability transitions. This paper contributes to this literature by theorizing complementarity formation mechanisms underlying such positive interactions within and across technology value chains. It pursues empirically founded theory building based on a case study of innovation in battery-electric, hydrogen and liquefied biogas technologies in Norwegian coastal shipping. Three complementarity formation mechanisms in technology value chains are identified: synchronization, amplification, and integration. Synchronization points to the need for co-development between the input and user sectors of a technology value chain. Amplification refers to the necessary expansion of input sectors to match the growing demand in user sectors. Finally, integration highlights the potential of convergence between different technology value chains in one or more user sectors. The paper concludes with a discussion of how policy may leverage such complementarity formation mechanisms to foster innovation in zero-carbon technologies.

Mäkitie, T., Stehen, M., Saether, E. A., Bjørgum, Ø., Poulsen, R. T. (2022)
Norwegian ship-owners' adoption of alternative fuels.
Energy Policy, Volume 163, 112869
link

The shipping sector's rising greenhouse gas emissions are often considered “hard-to-abate”. Some ship-owners have recently adopted or started to consider the adoption of alternative fuels, but systematic studies of this are still lacking. We address this gap by studying how ship-owners differ in both actual and intended adoption of alternative fuels. We analyze data from a unique survey with 281 ship-owners in Norway, a major ship-owning country and center for maritime technology development, with descriptive statistics and analysis of variance. We find early adopters among large and established ship-owners in offshore, international cargo and domestic passenger shipping segments, which are often subjected to specific contractual demands for alternative fuel adoption. Laggards were typically small and young ship-owners operating in shipping segments where demands for alternative fuel adoption are weak. Our findings also suggest that firms' business strategy and financial and knowledge resources may have relevance for ship-owner's adoption of alternative fuels. Our study has implications for national and international policymaking, highlighting for example how contracting mechanisms can be an effective tool in incentivizing the adoption of alternative fuels.

McDowall, W. (2022)
The political economy of actively phasing out harmful industries: Lessons from resource-based sectors beyond fossil fuels.

Energy Research and Social Science, 90, 102647
link

The growing urgency of reducing fossil fuel consumption has spurred interest in the political economy dimensions of policies that aim to phase out existing industries. Much of this growing literature has focused on previous energy transitions and phase-outs. In this perspective article, I highlight the value of looking at cases beyond energy and fossil fuels to understand the dynamics of industry phase-out. To illustrate the point, I provide three short empirical case studies of industries in which policymakers have taken active steps to phase out or reduce specific industries. The cases are asbestos mining, tobacco cultivation, and cod fisheries in the UK's Humber region.
The cases highlight the potential for economic diversification policies to both soften the blow faced by communities that are dependent on industries at the heart of phase-out policies, and to undermine the advocacy coalitions opposing phase-out policy. All three also suggest that cultural identity issues can play an important role in the politics of industry decline. The paper concludes by highlighting four avenues for future research into the political economy of actively phasing out harmful industries.

Morseletto, P., Mooren, C. E. and Munaretto, S. (2022)
Circular Economy of Water: Definition, Strategies and Challenges.
Circular Economy and Sustainability, 1-15
link

The circular economy has attracted considerable attention also in relation to water, an indispensable element to the sustainment of life and a critical input resource for the world economy. Despite a growing body of research on the circular economy of water (CEW), a consistent terminology and a clear conceptualisation of CEW strategies are lacking. Without such aspects, decision-makers, scientists and professionals may be hindered in developing a shared understanding of problems and solutions and exploiting new opportunities in the domain of the CEW. Furthermore, we argue that water is a unique element in the circular economy because it is a resource, a product and a service with no equivalent in the economic system and should be considered and valued as such in the CEW. Accordingly, we provide the definition of the CEW as an economic framework for reducing, preserving and optimising the use of water through waste avoidance, efficient utilisation and quality retention while ensuring environmental protection and conservation. Building on an analysis of academic literature and cases studies, we outline and illustrate a set of nine CEW strategies, including Rethink, Avoid, Reduce, Replace, Reuse, Recycle, Cascade, Store and Recover. Finally, we identify normative (legislation), governance (roles and responsibilities) and implementation (barriers and opportunities for application) challenges that need to be addressed to facilitate the transition to a comprehensive CEW.

Naims, H. and Eppinger, E. (2022)
Transformation strategies connected to carbon capture and utilization: A cross-sectoral configurational study.
Journal of Cleaner Production, 351, 131391
link

Firms from various industries are investing in carbon capture and utilization (CCU) technologies as part of their circular economy efforts. Hence, managers and policy makers need to develop strategies to create value and “win” sustainability transformations. This study investigates how CCU innovations are connected to economic progress at the firm and industry levels. First, we characterize economic progress from sustainability innovations as a spectrum of combinations of transformation and growth targets, and derive a configurational perspective for such innovations. Consequently, through an empirical study based on 25 in-depth expert interviews with corporate innovation managers, triangulated via additional quantitative and qualitative data, we investigate the causal configurations of R&D activities in CCU that are expected to lead to economic progress, using a fuzzy set qualitative comparative analysis. Our results show a hierarchy of transformation strategies based on investments and value creation which may support policy makers in deciding on appropriate support mechanisms. To enable the emergence of more profitable CCU solutions and facilitate their commercialization, regulators should adapt existing policies to accommodate CCU and consider developing an integrated policy framework. Moreover, managers across industry should develop adaptive strategies for achieving value creation and progress from CCU within changing environments.

Novalia, W., McGrail, S., Rogers, B., Raven, R., Brown, R. and Loorbach, D. (2022)
Exploring the interplay between technological decline and deinstitutionalisation in sustainability transitions.
Technological Forecasting & Social Change, 180, 121703
link

The decline side of transitions is an emerging study, which advances thinking on regime destabilisation, technology decline and phase-out policies. Previous research has predominantly focused on the complete phase out of specific unsustainable technologies as

desirable or possible, but it has given less attention to how these technological aspects interweave with institutional elements in ways that may constrain or enable system transformations. Our research develops a framework that clarifies the nuanced relationships between technological decline and the dissipation of institutional elements as distinct but interrelated processes. Through a longitudinal case study, we used the framework to examine the decline of unsustainable drainage technologies in Melbourne, Australia. These technologies are embedded within existing institutional elements, i.e. routines, rules, roles, and meanings that govern how stormwater should be managed. The near-full decline of one type of the drainage technologies is enabled by mixing old and new institutional elements. We found that the dissipation of multiple elements using combined mechanisms is important to achieve this partial decline outcome, and more attention needs to be paid to the effects of institutional remnants in constraining systems transformations.

Oates, L. (2021)
Sustainability transitions in the Global South: A multi-level perspective on urban service delivery.
Regional Studies, Regional Science, 8(1), 426–433
link

Urban sustainability in low and middle income countries is rarely studied from a sustainability transitions perspective, though 90% of projected population growth between 2018 and 2050 will be in cities of the Global South. Using principles from grounded theory, this paper explores the relevance of the multi-level perspective (MLP) – a prevalent analytical framework in sustainability transitions theory that has primarily been applied in the Global North – for the study of infrastructure in the Global South. It draws on empirical data collected through case study research in the cities of Ahmedabad, India, and Jinja, Uganda, which have adopted innovative socio-technical approaches to service delivery that respond to the challenges presented by urbanization, climate change and inequality. Applying the MLP to these cases shows how niche innovations by non-state actors in waste management (Ahmedabad) and solar energy (Jinja) can increase access to services, reduce ecological footprints and empower socially excluded groups, in spite (or because) of landscape pressures such as poverty, informality and limited institutional capacity. The observed benefits are attributable not only to technological but also to organizational innovation. These findings may help to develop a more flexible understanding of the types of urban transitions needed and the ways in which those transitions could be achieved. Lessons from alternative socio-technical configurations in the South could be informative for any city looking for service delivery models that better serve contemporary environmental and societal needs.

Radley, B. and Lehmann-Grube, P. (2022)
Off-grid solar expansion and economic development in the global South: A critical review and research agenda.
Energy Research & Social Science 89, 1-15
link

In this paper, we seek to understand how the rapid expansion of off-grid solar energy across the global South since the turn of the century is influencing local and national processes of economic development. We do so through a systematic review of 125 papers published between 2001 and 2020 that provide much evidence and understanding on the topic. Ninety-six of the reviewed papers claim off-grid solar expansion has positively influenced economic development. However, among other issues, much of this positivity is based upon a narrow conceptualisation of economic development as increased income, often achieved by individuals and firms working longer. To what extent these income gains are likely to be sustained and strengthened over time remains unclear. Based on the findings, we call for future research in this area to adopt a more transformative conceptualisation of economic development, as well as a broader analytical framework that: pays greater attention to the role of the state; adopts a more critical position in relation to the foreign firm; and more fully embraces the contested, contingent, and uneven nature of the process of economic development under observation. We close the paper by identifying several fruitful avenues for future research. It is hoped that these suggested paths might help build on the rich insights generated to date, to further deepen and develop our understanding of to what extent, how, and where off-grid solar expansion is promoting (or undermining) transformative and emancipatory processes of economic development in the global South.

Rommetveit, K., Sareen, S. and Ballo, I. (2022)
Extracting users: Regimes of engagement in Norwegian smart electricity transition.
Science, Technology, & Human Values (in press)
link

Recent efforts to involve digital technologies and renewables in the electricity grid have placed users at center stage in the legitimation of energy transitions. This move has been paralleled by an emphasis on users and energy practices in social studies of energy related to science and technology studies. This article builds on an eighteen-month Living Lab exploration of energy practices with smart electricity users in Bergen, Norway. We make two interrelated arguments. First, energy production and distribution in Norway and elsewhere is

shifting toward greater automation of tasks, possibly bypassing the "active user" concept. Energy sector practices are evolving from simply extracting natural resources (Extraction 1.0) toward extraction of users' behavioral data (Extraction 2.0), and privacy thus emerges as a key component in the stabilization of energy systems. Second, we reflect on displacements of the roles and possibilities of users (or "energy citizens") thereby enabled, especially their normative (political and regulatory) aspects. We propose that conceptualization of energy practices be supported by the concept of regimes of engagement from pragmatist sociology. Relatedly, we argue that market, civic, ecological, and industrial regimes are being actively merged through digital innovation and what we call the techno-epistemic network of smart electricity.

Sareen, S. (2022)
Drivers of scalar biases in energy transitions: Solar photovoltaic roll-out in Portugal, 2017-2020.
Environmental Justice 15 (2), 98-107
link

Studying the dynamics of solar photovoltaic (PV) rollout can generate insights on how policies enable and constrain energy transitions. This energy source has low carbon emissions, and has rapidly become economically competitive. This combination makes it one of the fastest growing energy technologies globally. Yet its rollout is spatially uneven, and slowed down by drivers other than cost and environmental impact, namely energy infrastructure, regulatory inertia, and political dynamics. These drivers of scalar biases make the rollout of solar energy along environmentally just lines challenging. This article analyzes the solar PV rollout in solar-rich Portugal during 2017–2020 to illustrate these drivers. The way solar PV layers on top of existing electric grid infrastructure determines the spatiality of its rollout. The path dependence of sectoral regulations modulates which actors are able to drive this technological diffusion. The particular political moment, unfolding contestation, and orchestrated consensus are decisive for both the rate and manner of growth of solar PV energy. The three drivers promote large-scale solar PV, whereas small-scale projects for households and communities remain limited. Empirical study of these drivers and how they combine in a specific context are key to understand the scalar environmental justice effects of policies for energy transitions.

Sareen, S. (2021)
Legitimating power: Solar energy rollout, sustainability metrics and transition politics.
Environment and Planning E: Nature and Space (in press)
link

Increasing recognition of the irrefutable urgency to address the global climate challenge is driving mitigation efforts to decarbonise. This article takes its point of departure in ambitious sustainability metrics for solar rollout that Portugal embraced in the late 2010s. This southwestern European country leads on hydro and wind power, and recently emerged from austerity politics after the 2008–2015 recession. Despite Europe's best solar irradiation, its big solar push only kicked off in late 2018. In explaining how this arose and unfolded until mid-2020 and why, the article investigates what key issues ambitious rapid decarbonisation plans must address to enhance social equity.

Sareen, S., Albert-Seifried, V. *et al.* (13 authors) (2022)
Ten questions concerning positive energy districts.
Building and Environment 216, 109017
link

Positive Energy Districts (PEDs) constitute an emerging energy transition paradigm, with an ambitious timeline for rapid upscaling to match the urgency of climate mitigation and adaptation. In this timely contribution, thirteen researchers from nine European countries flag ten questions concerning PEDs, and offer preliminary responses in line with cutting-edge insights informed by science and practice. This contribution draws on multidisciplinary competence in steering the Positive Energy Districts European Network, and aims to make emerging knowledge widely available, while also inviting constructive critique and engagement within the PED arena which features a broad range of diverse stakeholders. Authors highlight key pathways forward for a rapid, far-reaching translation of the ambitious PEDs agenda into multi-sited, district-scale beacons of sustainable energy transition.

Sareen, S., Grandin, J. and Haarstad, H. (2022)
Multi-scalar practices of fossil fuel displacement.
Annals of the American Association of Geographers, 112 (3), 808-818
link

As renewable energy sources increasingly outcompete fossil fuels on cost and efficiency, novel questions arise around how, when, and where renewables can displace fossil energy. We need to understand fossil fuel displacement as a sociopolitical and spatial process. In this article, we focus particularly on the scales and practices of legitimation through which fossil fuel displacement occurs. We advance an understanding of

how such displacement is conditioned by incumbent multiscalar arrangements and of how these can be overcome. We suggest that there are different practices of displacement that operate across multiple scales—here conceptualized as discursive, financial, institutional, and infrastructural—and use them to develop an analysis of solar rollout and fossil phase-out in Portugal. Our analysis shows that although renewables have partially displaced fossil fuels both discursively and financially, they have not yet displaced the historically large-scale nature of energy generation. Rather, the persistence of fossil fuel geographies and sectoral institutional arrangements keeps the displacements of energy transition at a spatial remove from citizens.

Sareen, S., Robinson, C., Thomson, H. and Ochoa, R. (2021)
Editorial: Urban energy poverty and positive energy districts.
Frontiers in Sustainable Cities 3: 775705
link

Cities are important actors in low-carbon energy transitions. They matter as front-runners, trend-setters and decision-makers. They matter as daily settings for over half of humanity. As cities continue to evolve, urban form is changing and the effects on consumption and climate change are the focus of political debate, governance and urban transformation research. Yet, without careful planning and thought, changing cities can have profound negative impacts on social inclusion. These impacts are felt most acutely by disadvantaged groups such as the urban energy poor. Shifts to positive energy districts (PEDs) and low-carbon urban forms can lead to green gentrification and exacerbate intersecting inequalities, or they can be drivers of inclusive cities that become low-carbon and socially sustainable. This thematic collection focuses on the contested, varied and dynamic relationship between urban energy poverty and PEDs. We feature contributions from a wide range of urban contexts, social science disciplines and novel interdisciplinary methodological approaches that address three cross-cutting thematic domains and suggest a need to include a focus on equity and justice in policy on PEDs.

Sareen, S., Waage, M., Smirnova, P., Boakye-Botah, J. and Loe, M. (2022)
Double energy vulnerability in the Norwegian low-carbon urban transport transition.
People, Place and Policy (in press)
link

Household energy poverty and transport energy poverty are increasingly recognised as entangled in energy social science. The intersection of these related phenomena is growing due to twin transitions of decarbonisation and digitalisation, whereby transport modes are increasingly electrified, and household electricity use is digitalised. Sectoral coupling enables energy flexibility, which is crucial for enabling greater renewable energy penetration in the electricity mix to advance decarbonisation agendas. Yet there are potential negative outcomes of this cross-sectoral hyper-integration, in terms of exacerbating existing inequalities and creating new ones. Digitalised systems can exclude marginalised groups, constitute intrusion on privacy, reallocate resources such as public space and electricity to certain transport modes at the expense of others, and drive dynamic electricity tariffs that penalise those with inflexible usage patterns, who typically include energy-poorer households. This paper examines how these issues play out in the under-privileged neighbourhood Østre Bydel in affluent Stavanger, Norway – a city targeting low-carbon urban transport transitions where energy poverty is an under-studied concern. Based on 45 structured interviews with households in the neighbourhood conducted during autumn 2021 complemented by desk study, the paper analyses double energy vulnerability in the city's systemic transition to low-carbon transport coterminous with rapidly digitalised electric infrastructure.

Scholl, C., de Kraker, J. and Dijk, M. (2022)
Enhancing the contribution of urban living labs to sustainability transformations: towards a meta-lab approach.
Urban Transformation, 4, 7.
link

The contribution of the first generation of urban living labs (ULLs) to system-wide sustainability transformations is thus far less than expected. A possible explanation for this can be found in the focus of most ULLs on local, highly contextualized knowledge, and a missing link to system-wide transformations through diffusion and upscaling beyond the geographic boundaries of the lab. Meta-learning, i.e., learning across multiple, distributed experiments, through networked ULLs seems to offer a way forward. However, the literature on city networks shows that meta-learning cannot be effectively facilitated in horizontal networks without a learning infrastructure. To address this shortcoming and inspire a second generation of ULLs, this Perspective paper outlines a meta-lab approach actively facilitating the contribution of local living labs to wider sustainability transformations. We see a meta-lab as a transurban multi-actor network to connect and, where possible, align the learning processes across thematically related ULLs in different urban contexts through a central learning agenda. The meta-lab approach respects and supports local learning agendas and their focus on local solutions for local problems, while acknowledging and

utilizing the potential of local experiments to contribute to a central learning agenda. Our paper argues that a meta-lab approach can act as a catalyst of learning in two important ways: (1) by accelerating local experimentation and learning processes by feeding them with lessons from other locations; and (2) by facilitating a more focused – local and transurban – learning process through a shared learning agenda. The meta-lab approach thus stimulates urban sustainability transformations by supporting faster, more focused and wider learning about effective innovations. We conclude this paper by outlining how common pitfalls in transurban learning can be avoided by a careful design of the meta-lab, or by meeting certain conditions when implementing this design.

Setyowati, A. and Quist, J. (2022)
Contested transition? Exploring the politics and process of regional energy planning in Indonesia.
Energy Policy 165, 112980
link

Transitioning to low carbon energy involves policies, institutions, and actors across different scales of governance. Indonesia's aspiration for a transition to low carbon energy is occurring in the dynamics of the re-scaling of environmental governance through decentralization processes. This article examines the interplays of actors at the national and provincial levels in negotiating energy futures as the energy planning processes unfold on the ground and identifies context specific factors that shape the outcomes. Further, it investigates how the regulatory framework and institutional arrangements for energy transition planning could not only generate obstacles for renewable energy transition but also open opportunities for actions. It is based on interviews with stakeholders at national and subnational levels, combined with the analysis of policy documents, studies, and relevant reports. The findings reveal emerging spaces for local actions amid constraining regulatory and institutional fields through the process of regional energy plan development. However, the ability of sub-national actors to seize these spaces is influenced by several factors, most notably political leadership, civil society engagement, political economic structure and power relations. These in-depth insights from Indonesia have wider implications for understanding the multi-scalar dynamics of energy transitions and provide useful policy recommendations for engaging subnational actors in the transition process.

Stalmokaitė, I., Larsson Segerlind, T., and Yliskylä-Peuralahti, J. (2022)
Revival of wind-powered shipping: Comparing the early-stage innovation process of an incumbent and a newcomer firm.
Business Strategy and the Environment, 1-18
link

Despite the urgency of decarbonising, the shipping sector has demonstrated a slow-paced response to climate change challenges. Some frontrunner firms are engaged in sustainability-oriented innovation processes. However, there is limited knowledge of how such processes emerge and contribute to societal sustainability transitions and what the role of technology is in companies' (re)orientation towards sustainable business models. This study contributes to filling these gaps through a comparative case study of the ongoing innovation process within an incumbent and a newcomer firm developing wind-powered energy solutions for deep-sea transportation. The study's findings bear implications for theory and practice. This paper's combination of a dynamic capabilities approach and a multi-level perspective from sustainability transitions research is a conceptual novelty, enabling an understanding of the activities involved in the (re)orientation process towards sustainable business from a company's perspective, as well as broader societal and sustainability needs.

van Summeren, L. F. M., Breukers, S. and Wieczorek, A. J. (2022)
Together we're smart! Flemish and Dutch energy communities' replication strategies in smart grid experiments.
Energy Res. Soc. Sci. 89, 102643
link

Increasingly, energy communities engage in smart grid experiments to explore new ways to collectively generate, consume, store, manage, and trade energy. Transition literature puts forward that replication of such experi- ments is essential for socio-technical transformation. However, in practice many experiments remain rather isolated events that fail to contribute to sustainability transitions. Moreover, while the literature points to the importance of replication, there is little attention to how replication occurs in practice and on the perspectives of actors involved. This paper reports on action research done to explore together with Dutch and Flemish energy communities what replication of community-based Virtual Power Plant (cVPP) experiments means in practice and how this can be achieved. In line with literature, the energy communities considered replication of cVPP as an iterative and multi-dimensional process that includes collective exploration of meaning, searching for necessary resources, building competencies, and implementation of the necessary technological building blocks. In light of identified challenges, the energy communities articulated two strategies, both aimed at collaboration with similar initiatives to pool resources (including shared digital

technology). This was considered a viable strategy to confront the current context that is characterized by (institutional) uncertainty and ambiguity. Although the literature distinguishes between growth and replication of experiments, the identified strategies show that this distinction is less clear in practice. 'Pure' replication was not considered as the way forward. Rather, it appears that combining replication and growth processes provides opportunities for wider diffusion of the cVPP concept beyond the few resourceful frontrunner energy communities.

Swennenhuis, F., de Gooyert, V. and de Coninck, H. (2022)
Towards a CO2-neutral steel industry: Justice aspects of CO2 capture and storage, biomass- and green hydrogen-based emission reductions.
Energy Research & Social Science, 88, 102598
link

A rapid transition towards a CO_2-neutral steel industry is required to limit climate change. Such a transition raises questions of justice, as it entails positive and negative impacts unevenly distributed across societal stakeholders. To enable stakeholders to address such concerns, this paper assesses the justice implications of three options that reduce emissions: CO_2 capture and storage (CCS) on steel (up to 70%), bio-based steelmaking (up to 50%), and green hydrogen-based steel production (up to 100%). We select justice indicators from the energy, climate, labour and environmental justice literature and assess these indicators qualitatively for each of the technological routes based on literature and desk research. We find context-dependent differences in justness between the different technological routes. The impact on stakeholders varies across regions. There are justice concerns for local communities because of economic dependence on, and environmental impact of the industry. Communities elsewhere are impacted through the siting of infrastructure and feedstock production. CCS and bio-based steelmaking routes can help retain industry and associated economic benefits on location, while hydrogen-based steelmaking may deal better with environmental concerns. We conclude that, besides techno-economic and environmental information, transparency on sector-specific justice implications of transforming steel industries is essential for decision-making on technological routes.

Wågsæther, K., Remme, D., Haarstad, H. and Sareen, S. (2022)
The justice pitfalls of a sustainable transport transition.
Environment and Planning F 1-20 (in press)
link

This article examines the potential adverse effects of sustainable transport transitions on justice. It is important for policy debates to consider how pro-environment policies may adversely impact social justice. We apply a broad conception of justice as comprising redistribution, representation and recognition to the transport transition in Bergen, Norway, with ambitious climate mitigation policies to be met primarily by reshaping transport. Through primary data collection and critical literature review, we identify several potential injustice effects of green transport transitions. These particularly relate to the redistributive effects of selective allocation of benefits and to less tangible processes of representation and recognition.

Wesseling, J. H., Kieft, A., Fuenfschilling, L. and Hekkert, M. P. (2022)
How socio-technical regimes affect low-carbon innovation: Global pressures inhibiting industrial heat pumps in the Netherlands.
Energy Research & Social Science, 89
link

This paper shows that the socio-technical barriers that sustainable innovations face, may stem from global regimes. Existing transitions approaches like the Technological Innovation System (TIS), overlook the impact of global regimes on radical innovation. Building on institutional theory, we therefore develop a theoretical framework that captures TIS-regime interaction, allowing us to analyze the impact of globalized industries on the development and diffusion of promising radical low-carbon innovations. This is applied to a qualitative case study of how the global industrial processing regime influenced the Dutch industrial heat pump (IHP) TIS over the past 30 years. We identify several mechanisms through which the regime's coercive, normative and mimetic institutional pressures inhibit TIS development. Takeovers by multinational owners for example translated into corporate strategies focused on short-term economic valuation with no priority to sustainability. TIS actors respond to and strategically deal with these pressures. We show that the institutionalization of a new logic in the global regime can outpace the rate of technological development of the radical innovation, causing it to become less attractive over time despite technological performance increases. The impact of global regimes limits the effectiveness of national policy support for a TIS.