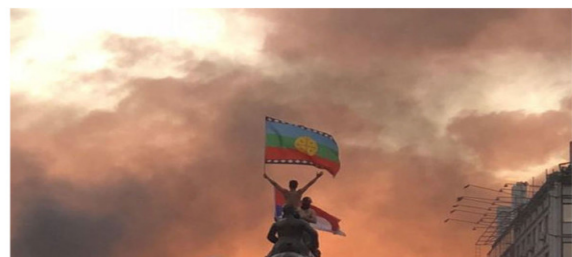
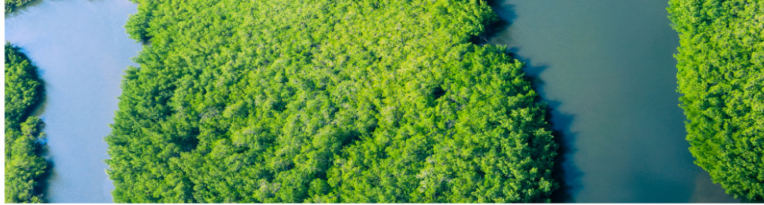
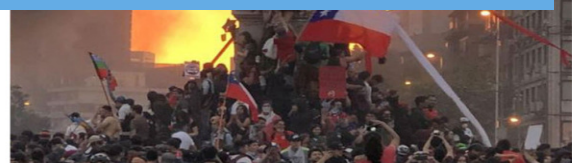


# STRN Newsletter



N°45 | September 2022





## Newsletter 45 – September 2022

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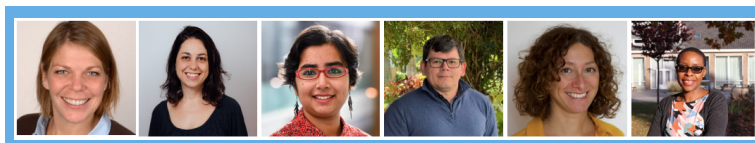
### About

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

Cover pictures: Shutterstock

## Editorial

by Katharina Schiller, Rebeca Roysen, Bipashyee Ghosh, Diego Florez Ayala, Giulia M. Mininni, Patience Mguni



We are living in unprecedented times. The war in Ukraine and the ensuing energy crisis are catalyzing efforts for rapid energy transitions in many countries, predominantly in the Global North.

However, transition studies in the Global South are already showing the limits of focusing simply on replacing technologies or energy sources without challenging extant power relations. Look at the recent floods in Pakistan - as much as it is a natural disaster, it is equally a governance fiasco where those in power failed to act rapidly and systematically in response to the crisis.

In such circumstances, questions around capacities of governments and institutions, roles of civil societies, and adaptation strategies come to the forefront. These issues push us to contest transition scholarship's continued focus on technological fixes: these often reinforce coloniality, toxic aspects of capitalism, and neoliberalist approaches, and hence may foster unjust transitions.

Given this context, dear readers, this editorial urges us to push the boundaries of sustainability transitions research in new and different directions that capture the realities, complexities, and nuances of transition dynamics in different parts of the world. What have we learned so far from transitions research and practice in the Global South?

(1) The diversity of contexts in which transitions occur needs to be considered more explicitly in transition theory. Solar panels and electric cars are critical to energy transitions - but batteries require mineral resources that are extracted by corporations in the territories of marginalized communities in the Global South, reinforcing patterns of violence, dispossession, economic dependence, and indefinite poverty traps. Hydroelectric, solar, and wind power production are significant sources of clean energy. However, in the South, they may also lead to a displacement of traditional communities in order to build these plants. Biofuels used in the Global North are often produced in monocultures owned by an elite few in the Global South and lead to environmental destruction and pollution affecting local communities. As transition scholars, we have to adapt our research and frameworks to better acknowledge sustainability conflicts across sectors and places.

(2) A pluriverse of social movements, indigenous and afro communities, and diverse urban and rural collectives are working from the base to transform territories in the Global South. Diversity may be key to new, more sustainable

socio-technical configurations and territorial trajectories. While One-World views tend to overlook local views for the sake of “development” trajectories inspired by Western/Northern experiences, some low-income countries are, in fact, ahead of the North in ecological resilience, social solidarity, and sustainable living. The various movements, communities and collectives offer new insights for diverse transition conceptualizations and pathways.

(3) Transition theory and practice should be decolonized. This means recognizing how the development of sustainable solutions, when entrenched by colonial practices and mindsets, might in fact be detrimental to people and communities in the Global South. Appreciation of local knowledge and practices is key here. Decolonizing research may begin with scientists reflecting on their positionality vis-a-vis research “subjects”; scrutinizing power issues within the research process; considering research participants as collaborators and co-designers; or integrating different ontological and epistemological perspectives and different disciplines that may challenge Northern perspectives and methodologies. Decolonizing transitions also means purposely creating spaces, within transition studies, that are welcoming to scientific/alternative knowledge from the Global South which may not be packaged in the “usual” way expected in our journal (e.g. non-English papers, new ways of writing, or new formats for articles).

The STRN Thematic group “Transitions in the Global South” is actively pushing these and other issues, thereby encouraging critical transitions research in Global South contexts. In the past 10 years, we have not only witnessed a rising number of publications, but also an increasing diversity of geographies, concepts, and approaches. The popularity of Transitions in the Global South research and action is reflected in the growing number of organizations and governments outside of Europe using transition concepts to guide their practices and policies.

Studying, practicing, and accompanying transitions in the Global South is not only about theoretical adaptations to better fit the realities of “developing” countries. It is also an opportunity to reflect on the consequences of Western lifestyles on communities and places elsewhere. It is an opportunity to learn that colonization is not a historical moment from the past, but actualized every day.

Principles of just governance and inclusion should permeate transition practice, including the choice of technology, to ensure fair processes at multiple levels. A key question is: how can we move away from technological fixes and really engage in a dialogue of knowledge with other cultures? Transition studies in the Global South offer a mirror that reflects the “other side” and the hidden effects of contemporary lifestyles, consumerist culture, and corporate capitalism. These “side effects” must be considered if we want to foster transitions that are just, regenerative, and plural.

## EIST Journal

We are happy to introduce the most recent issue of EIST with 15 excellent papers, a survey paper and a perspective published in [Volume 44](#).

The full list of papers is also featured in the publication section of this newsletter.

Bernhard Truffer  
Editor-in-Chief EIST

## STRN Events



### 13<sup>th</sup> IST Conference, November 21-25, 2022 Stellenbosch, Melbourne, Washington D.C.

With preparations for IST 2022 in full swing, we're excited to unveil some of our keynote speakers!

- Prof. Xuemai Bai, Distinguished Professor, Urban Environment and Human Ecology, Fenner School of Environment and Society
- Dr. Chantal Naidoo, Founder and Principal Associate of Rabia Greening Finance
- Prof. Flor Avelino, Professor of Organizations and Sustainability, Utrecht University
- Prof. Edgar Pieterse, Director of the African Centre for Cities and South African Research Chair in Urban Policy

This year Stellenbosch University, Monash University and Georgetown University will partner to create a week with a truly global experience that involves both online and in-person activities, in which conference participants will virtually travel through three different time zones and continents, culminating in regional hub gatherings in Stellenbosch, Melbourne and Washington DC.

**Online (Nov. 21<sup>st</sup>)**  
Keynote: [Chantal Naidoo](#)

**Online (Nov. 22<sup>nd</sup>)**  
Keynote: [Xuemai Bai](#)  
Panellists: Xuemai Bai, [Benjamin Sovacool](#), [Paula](#)

[Kivimaa](#) and [Bernhard Truffer](#)

### In-person (Stellenbosch, Nov. 25<sup>th</sup>)

Theme: The African energy transition

Keynote: [Edgar Pieterse](#)

Panellists: [Chantal Naidoo](#), [Guy Midgley](#) and [Sampson Mamphweli](#)

### In-person (Melbourne, Nov. 25<sup>th</sup>)

Keynote: [Flor Avelino](#) (online)

Panellists: [Paul Upham](#) (online), [Sarah Pink](#), [Liam Smith](#) and [Lauren Rickards](#)

Late registration (for non-presenters) is open until November 7. For more information visit the IST 2022 website

<https://consultus.eventsair.com/ist2022-conference>

or contact

[ist2022global@gmail.com](mailto:ist2022global@gmail.com)

### Save the date: 14<sup>th</sup> IST Conference, Utrecht, NL August 30 – September 1, 2023

While we eagerly await the IST 2022 edition, we are happy to announce that the 14<sup>th</sup> International Sustainability Transitions Conference (IST) will be hosted by the Copernicus Institute of Sustainable Development at Utrecht University from Wednesday, August 30<sup>th</sup> until Friday, September 1<sup>st</sup>, 2023.

On Tuesday, August 29<sup>th</sup>, the NEST community will organize an early career researcher and newcomer's session.

This conference will be the first fully in-person IST conference in three years, and we are very excited! We are exploring hybrid options to facilitate participation from abroad. More details will follow.

The location will allow for creative and innovative ways to interact and share knowledge and expertise.

We are already looking forward to meeting you!

Best wishes,

The Organizing Committee: Simona Negro, Adriaan van der Loos, Wouter Boon

## STRN News

### New and re-elected Steering Group Members

A warm welcome to **Kejia Yang** from TIK, University of Oslo and **Wisdom Kanda** from Linköping University as new members of the STRN Steering Group. We are also happy that **Florian Kern** (IÖW Berlin), **Bruno Turnheim** (LISIS, Paris) and **Bipashyee Gosh** (SPRU, Brighton) were re-elected.

We also welcome **Katharina Schiller** (Fraunhofer ISI Karlsruhe) and **Wouter Boon** (Utrecht University) as new STRN Board Members.

[Click here](#) to see all SG Members.

We thank Lea Fünfschilling and Karoline Rogge for their support of the Steering Group in the past.

Finally, we are happy to announce that **Adriaan van der Loos** will support STRN as the network manager.

This is a new, part-time position that Adriaan will hold in addition to his main position as Assistant Professor at Utrecht University. We are building a secretariat for STRN to support us in the coming years, which will be hosted by Utrecht University. This is part of the professionalization of STRN. We will share further updates in the next newsletters.

## Upcoming and Past Events



### Call for Abstracts: 2023 Conference on Sustainable Consumption and Production (#SCP23)

For the first time, the Sustainable Consumption Action and Research Initiative (SCORAI) and the European Roundtable on Sustainable Consumption and Production (ERSCP) join forces to host a major international conference. Hosted by Wageningen University (The Netherlands) from July 5 to 8, 2023, the #SCP23 conference will focus on the theme of

### Transforming consumption-production systems toward just and sustainable futures.

The inter- and transdisciplinary conference will provide a crucial opportunity to discuss recent advancements in sustainable consumption and production. It will provide a platform for building and enhancing connections between research, practice, and policy to increase understanding and action of how to move transformations to sustainable consumption and production forward.

Submit your abstract [here](#) by 30 November 2022.

## End of Summer University I - Sustainable Mobility: participation and governance for transition

September 20-22, 2022

During three days, Braga's municipality in partnership with researchers from the University of Minho organised the *End of Summer University I – Sustainable Mobility: participation and governance for transition*. As an interdisciplinary event it integrated a wide set of actions aiming at reflecting on several dimensions involving the transition to sustainable mobility. The program included lectures, round tables, and practical sessions aiming at raising up awareness of new mobility's challenges, in the context of preparing cities for the future impacts of climate change. Topics such as the future, geodesign, participation, funding opportunities, and international cooperation were also addressed.

More information at [universidadefimdeverao@gmail.com](mailto:universidadefimdeverao@gmail.com)

## Second Annual Carbon Dioxide Removal Law/Policy Conference, Sept. 27/28

The Second Annual Carbon Dioxide Removal Law/Policy Conference took place online, co-sponsored by the EPC Program at Northwestern, and the Institute for Carbon Removal Law & Policy at American University.

The conference brought together members of the academic, corporate, NGO and government sectors to discuss the potential of carbon dioxide removal options to help address climate change, as well as the risks and challenges attendant to this emerging climate response measure. The keynote speaker was Jennifer Wilcox, Principal Deputy Assistant Secretary for the U.S. Office of Fossil Energy and Carbon Management.

For further information reach out to [william.burns@northwestern.edu](mailto:william.burns@northwestern.edu)

## New projects & initiatives

### Call for Papers: Special Issue “Leveraging Culture to Cultivate Green Innovation in Organizations and Institutional Fields” in Industry & Innovation

Guest editors: Georg Reischauer, WU Vienna; Claudio Biscaro, Johannes Kepler University Linz; Lianne Lefsrud, University of Alberta

With this special issue, we aim to create a forum for research on how organizations cope with the challenges



of forms of innovation that reduce impact on the natural environment, i.e., green innovation, from a cultural perspective.

Deadline: 31st October 2022. More information [here](#).

## **Project FULFILL**

The project FULFILL takes up the concept of sufficiency to study the contribution of lifestyle changes in decarbonising Europe and fulfilling the goals of the Paris Agreement. FULFILL understands the application of the sufficiency principle as creating the social, infrastructural and regulatory conditions for changing individual and collective practices in a way that reduces energy demand, greenhouse gas emissions and that simultaneously contributes to societal wellbeing.

Its research concept engages in a dialogue between social science and humanities as well as technoeconomic energy and climate studies, i.e. modelling of scenarios. The project's core is empirical fieldwork in five EU and one non-EU countries combining qualitative and quantitative methods. Hereby FULFILL provides in-depth analysis of sufficiency lifestyles, their intended and unintended consequences (incl. rebound effects), enablers and barriers as well as impacts (incl. on health & gender) on the micro (individual & household) and meso (community & municipal) level. Building on this, FULFILL evaluates the potential for upscaling and develops a systemic impact assessment (macro level) which includes indicators beyond GDP. Findings will inform a co-creative process for developing policy recommendations (and suggestions for NECPs). Relevant project outputs will be available from the second half of 2022.

More information: [www. fulfill-sufficiency.eu](http://www. fulfill-sufficiency.eu)

## **hyBit project launched – a hydrogen hub for the transition towards sustainable industries**

Hydrogen is considered as the “energy carrier of tomorrow”, but the path to an efficient hydrogen economy is complex and requires excellent research. The hyBit consortium, coordinated by the University of Bremen and supported by 19 partners from science and industry, receives nearly 30 million euros in funding for this purpose.

The central starting point of the project in Bremen's industrial port is the steelworks of ArcelorMittal, which is the largest CO<sub>2</sub> emitter in the region. It will undergo a transformation towards sustainable process chains based on green hydrogen. hyBit will map and accelerate

the development of a hydrogen hub and a respective regional hydrogen economy in a monitoring framework by planning necessary measures prudently and avoiding undesirable developments or delays as far as possible. The findings of the model region in Bremen's industrial port shall be transferred to other locations in Germany and Europe and support similar structural changes.

Lead partner: University of Bremen, Department for Resilient Energy Systems.

More information: [Dr. Torben Stuehrmann](#).

5 open [job positions](#).

## **Political Economy of Solar Energy in the Middle East and North Africa**

The German Research Foundation (DFG) has approved Dr. Benjamin Schuetze's application for an Emmy Noether Junior Research Group (2022-2028). Benjamin will establish the group on “Renewable Energies, Renewed Authoritarianisms? The Political Economy of Solar Energy in the Middle East and North Africa” this autumn at the Arnold-Bergstraesser-Institute (ABI) in Freiburg, Germany.

The project looks at the relationship between solar energy and authoritarian practices in Morocco, Tunisia and Jordan and applies a (trans )regional approach that asks how different actors within and beyond the nation-state invest solar energy discourses and material realities with democratic and/or authoritarian meanings. The project's main interest lies in how politics is driving the expansion of solar energy, and how this (re-)shapes established authoritarian practices. While the distributed nature of solar energy offers a possibility for more democratic, inclusive and independent (energy) politics, transregionally connected authoritarian elites attempt to transform it into concentrated forms of political and economic power. This could replicate existing dependencies and authoritarian practices.

More information [here](#).

## **Closing the Loops: Major research project demonstrates the transformative potential of circular water technologies**

In the summer of 2022 with its heat waves and droughts, also the Global North increasingly felt the impact of the Climate Crisis on the availability of water. This highlights the relevance of the 6th SDG of “Ensuring availability and sustainable management of water and sanitation for all,” including farmers, citizens, and industries.

Also in summer of 2022, one of Europe's largest research projects on the circularity of water systems ("[Project Ö](#)") approached the end of its four-year funding period, in which it demonstrated in four countries, how innovative water treatment technologies can improve regional transitions towards sustaining crucial water supplies – from a textile factory in Croatia to olive orchards in Spain, fish farms in Israel, and contaminated ground water in Italy.

These new installations are now lowering costs, reducing energy and giving local regions access to alternative water sources. All solutions are technically scalable and replicable to other municipalities and industries. Beyond engineering the technological solutions, the project also developed decision support systems, and analysed stakeholder relations and regulation policies.

More information [here](#)

You may also contact: [ag@hsrw.eu](mailto:ag@hsrw.eu)

## Publications

### *PhD theses*

Geoff, I. (2022)

**Design for the environmental emergency: Plastic chairs and the transition to low-carbon product design**

University of Technology Sydney

[link](#)

Analysing the intersection between plastics, environmentally-conscious design, and consumption through a focussed study of plastic chairs, this dissertation casts new light on best practice for sustainable furniture design. Plastics are abundant in consumer goods. With reference to historical and contemporary developments, this dissertation examines the shifting cultural attitudes to plastics. Product designers are responding to mounting environmental concerns by experimenting with renewable carbon plastics (recycled plastic and bioplastics). Plastic chairs, although ubiquitous are objects of constant innovation and experimentation by designers, with many examples made from renewable carbon plastics already available. Using these designs as case studies a critical examination of their environmental performance is supplemented by interviews with leading international contemporary designers and representatives from industry. Findings from that research led to the development of an eco-audit tool to enable a quantitative comparison of these designs and demonstrate that the best outcomes for sustainable design incorporate existing materials (recycled plastics) and traditional moulding technologies.

By applying the multi-level perspective (MLP) transition framework strategies are identified to scale-up the use of renewable carbon plastics in design. This study provides a practical guide to accelerate the transition toward renewable carbon plastics. It provides a methodology for designers to embrace a more sustainable approach to the design of plastic product. This dissertation is also a call to arms for urgent action to mitigate the most devastating impacts of the environmental emergency.

Haugland, B. T. (2022)

**Innovation for preservation? Automated vehicles and the facilitating state.**

Norwegian University of Science and Technology (NTNU)

[link](#)

What roles are automated vehicles ascribed in the transition towards a more sustainable transport system?

To answer this question, the thesis analyses case studies from Norway using perspectives from sustainability transitions research and STS. The thesis is composed of three articles and an overarching essay. The first article concerns the translation of a set of generalised expectations into a more specific vision of how the development of automated vehicles might benefit the Norwegian state, and, by extension, what future automated vehicles might render possible. The second article concerns public expectations regarding automated vehicles in Norway as expressed through a public hearing, how these expectations are reflected in innovation practices, and how those practices shape further expectations. The third article focuses on the temporal aspect of innovation, contrasting technology experimentation with policy experimentation to explore how the two approaches might shape the future of transport. The overarching essay discusses the transformative role often ascribed to new technologies and shows how the Norwegian configuration of transport innovation tends to promote the preservation of both the transport system and society more generally. Future technologies are expected to ameliorate – or even solve – the problems of today's transport system, thus deferring present-day political action. However, such expectations are always associated with considerable uncertainty. Hence, the thesis concludes, it is crucial not only to ask what benefits new technologies might bring, and to assess any such claims critically, but also to plan for a future in which expectations for new technologies might not be realised.

Koretsky, Z. (2022)

**Unravelling: The dynamics of technological decline.**

Maastricht University

[link](#)

There is a growing recognition in the academic, policy and activist worlds of an urgency to navigate the current climate crisis by refusing to support production and use of certain technologies and infrastructures that are not environmentally sustainable (anymore). This research may be of relevance to scholars, policy-makers and anyone else curious of reading about why some technologies remain abandoned and do not return, while others do. This is a study of three historical cases of decline of technologies: the incandescent light bulb in the EU, cloud seeding in the US, and the Ural computer in Soviet Russia. The research presents an approach to trace, make sense and, possibly, act on technological decline. In the dissertation decline is conceptualised as “unravelling”, as related competences become less used, related materials are harder to come by, and related meanings turn outdated. Six ideal-type pathways for the outcome of unravelling are formulated.

Van Summeren, L. F. M. (2022)

**The rise and transformative impacts of community-driven smart grid experiments: The case of the community-based Virtual Power Plant.**

Eindhoven University of Technology

[link](#)

Recently, a few frontrunner energy communities started entering the field of smart grids to experiment with community-based models of energy generation, distribution, and management. An example is the community-based Virtual Power Plant (cVPP) project, in which Flemish, Dutch, and Irish energy communities set up their own cVPP. These emerging community-driven smart grid experiments faced severe challenges to survive, let alone play a significant role in the ongoing energy transition. This research drew on the field of Sustainability Transitions to better understand how such community-driven smart grid experiments can scale up from the niche to regime-level and contribute to the sustainable transformation of the energy system. Qualitative and action research approaches were used to simultaneously investigate and support energy communities involved in (the replication of) smart grid experiments. This research revealed promising niche hybridisation strategies that involve aggregation of multiple energy communities in an overarching cVPP, which can strengthen the community energy sector by enabling many energy communities to manage and trade energy. Aggregation requires an energy management system (EMS), the digital heart of a cVPP. An open-source EMS can function as a shared resource for the whole community energy sector, which can ease replication and growth of community-driven smart grid experiments. As such, aggregation and an open-source EMS can facilitate the upscaling of the cVPP experiments and contribute to the development of a promising cVPP niche.

*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. The book can be purchased for £39,99 or downloaded for free from the Cambridge University Press website.

#### *EIST Volume 44*

Elisabeth M.C. Svennevik

**Practices in transitions: Review, reflections, and research directions for a Practice Innovation System PIS approach**

[link](#)

Heikki Lehtonen, Ellen Huan-Niemi, Jyrki Niemi

**The transition of agriculture to low carbon pathways with regional distributive impacts**

[link](#)

Margit Keller, Marlyne Sahakian, Léon Francis Hirt

**Connecting the multi-level-perspective and social practice approach for sustainable transitions**

[link](#)

Johan Mörner, Jonas Heiberg, Christian Binz

**How global regimes diffuse in space – Explaining a missed transition in San Diego's water sector**

[link](#)

Dalia Mattioni, Paul Milbourne, Roberta Sonnino

**Destabilizing the food regime “from within”: Tools and strategies used by urban food policy actors**

[link](#)

Truzaar Dordi, Sebastian A. Gehricke, Alain Naef, Olaf Weber

**Ten financial actors can accelerate a transition away from fossil fuels**

[link](#)

Peter Karnøe, Julia Kirch Kirkegaard, Koray Caliskan

**Introducing the lens of markets-in-the-making to transition studies: The case of the Danish wind power market agencement**

[link](#)

Jasper van Dijk, Anna J. Wieczorek, Andreas Ligtvoet

**Regional capacity to govern the energy transition: The case of two Dutch energy regions**

[link](#)

René Kemp, Bonno Pel, Christian Scholl, Frank Boons

**Diversifying deep transitions: Accounting for socio-economic directionality**

[link](#)

Miguel Soberón, Teresa Sánchez-Chaparro, Adrian Smith, Jaime Moreno-Serna, ... Carlos Mataix

**Exploring the possibilities for deliberately cultivating more effective ecologies of intermediation**

[link](#)

Laur Kanger

**The spatial dynamics of deep transitions**

[link](#)

Minsi Liu, Kevin Lo, Linda Westman, Ping Huang

**Beyond the North-South divide: The political economy and multi-level governance of international low-carbon technology transfer in China**

[link](#)

Andrea Ferloni

**Transitions as a coevolutionary process: The urban emergence of electric vehicle inventions**

[link](#)

Xiao-Shan Yap, Bernhard Truffer, Deyu Li, Gaston Heimeriks

**Towards transformative leapfrogging**

[link](#)

Leonard Frank, Heiner Schanz

**Three perspectives on regime destabilisation governance: A metatheoretical analysis of German pesticide policy**

[link](#)

Mark J. Koetse, Jetske A. Bouma  
**Incentivizing a regime change in Dutch agriculture**  
[link](#)

Xiao-Shan Yap, Bernhard Truffer  
**Contouring 'earth-space sustainability'**  
[link](#)

## *Papers*

Al Kez, D., Foley, A., Lavery, D., Furszyfer Del Rio, D. and Sovacool, B. K. (2022)  
**Exploring the sustainability challenges facing digitalization and internet data centers.**  
Journal of Cleaner Production, 371, 133633, pp. 1-12  
[link](#)

Internet data centers have received significant scientific, public, and media attention due to the challenges associated with their greenhouse gas, water, and land footprint. This resource greedy data services sector continues to rapidly grow driven by data storage, data mining, and file sharing activities by a wide range of end-users. A fundamentally important question then arises; what impact does data storage have on the environment and is it sustainable? Water is used extensively in data centers, both directly for liquid cooling and indirectly to generate electricity. Data centers house a huge number of servers, which consume a vast amount of energy to respond to information requests and store files and large amounts of resulting data. Here we examine the environmental footprint of global data storage utilizing extensive datasets from the latest global electricity generation mix to throw light on this data sustainability issue. The analysis also provides a broad perspective of carbon, water, and land footprints due to worldwide data storage to through some light on the real impact of data centers globally. The findings indicate that if not properly handled, the annual global carbon, water and land footprints resulting from storing dark data might approach 5.26 million tons, 41.65 Gigaliters, and 59.45 square kilometers, respectively.

Breyer, C., Khalili, S., Bogdanov, D., Ram, M., Oyewo, A. S., Aghahosseini, A., Gulagi, A., Solomon, A. A., Keiner, D., Lopez, G., Østergaard, P. A., Lund, H., Mathiesen, B. V., Jacobson, M., Z., Victoria, M., Teske, S., Pregger, T., Fthenakis, V., Raugei, M., Holttinen, H., Bardi, U., Hoekstra, A., Sovacool, B. K. et al. (2022)

**On the history and future of 100% renewable energy systems research.**  
IEEE Access, 10, pp. 78176-78218  
[link](#)

Research on 100% renewable energy systems is a relatively recent phenomenon. It was initiated in the mid-1970s, catalyzed by skyrocketing oil prices. Since the mid-2000s, it has quickly evolved into a prominent research field encompassing an expansive and growing number of research groups and organizations across the world. The main conclusion of most of these studies is that 100% renewables is feasible worldwide at low cost. Advanced concepts and methods now enable the field to chart realistic as well as cost- or resource-optimized and efficient transition pathways to a future without the use of fossil fuels. Such proposed pathways in turn, have helped spur 100% renewable energy policy targets and actions, leading to more research. In most transition pathways, solar energy and wind power increasingly emerge as the central pillars of a sustainable energy system combined with energy efficiency measures. Cost-optimization modeling and greater resource availability tend to lead to higher solar photovoltaic shares, while emphasis on energy supply diversification tends to point to higher wind power contributions. Recent research has focused on the challenges and opportunities regarding grid congestion, energy storage, sector coupling, electrification of transport and industry implying power-to-X and hydrogen-to-X, and the inclusion of natural and technical carbon dioxide removal (CDR) approaches. The result is a holistic vision of the transition towards a net-negative greenhouse gas emissions economy that can limit global warming to 1.5 °C with a clearly defined carbon budget in a sustainable and cost-effective manner based on 100% renewable energy-industry-CDR systems. Initially, the field encountered very strong skepticism. Therefore, this paper also includes a response to major critiques against 100% renewable energy systems, and also discusses the institutional inertia that hampers adoption by the International Energy Agency and the Intergovernmental Panel on Climate Change, as well as possible negative connections to community acceptance and energy justice. We conclude by discussing how this emergent research field can further progress to the benefit of society.

Coskun, A., Metta, J., Bakırlioğlu, Y., Çay, D. and Bachus, K. (2022)  
**Make it a circular city: Experiences and challenges from European cities striving for sustainability through promoting circular making.**  
Resources, Conservation and Recycling, 185, 106495

[link](#)

A growing number of cities are deploying circular economy practices to contribute to the Sustainable Development Goals (SDGs). Makerspaces are community-driven initiatives enabling the collaboration between a city's diverse stakeholders in that objective. They can enhance the citizens' contribution to circularity by engaging them in circular "making" activities (e.g., reuse, repair, sharing) and by providing them with novel means, skills, and knowledge in these activities. However, cities face various challenges during the process of engaging citizens to create a vibrant circular city. Based on an in-depth analysis of experiences and challenges in seven European cities, which attempted to embrace the SDGs through circular making activities, this paper presents ten engagement-related challenges and five strategies to overcome them. Integrating these challenges and strategies in a strategy-challenge matrix offers several recommendations for cities striving to address SDGs through establishing and maintaining circular makerspaces.

Furszyfer Del Rio, D., Sovacool, B. K., Griffiths, S., Bazilian, M., Kim, K., Foley, A. M. and Rooney, D. (2022)

**Decarbonizing the pulp and paper industry: A critical and systematic review of sociotechnical developments and policy options.**

Renewable & Sustainable Energy Reviews, 167, 112706, pp. 1-33

[link](#)

Paper has shaped society for centuries and is considered one of humanity's most important inventions. However, pulp and paper products can be damaging to social and natural systems along their lifecycle of material extraction, processing, transportation, and waste handling. The pulp and paper industry is among the top five most energy-intensive industries globally and is the fourth largest industrial energy user. This industry accounts for approximately 6% of global industrial energy use and 2% of direct industrial CO<sub>2</sub> emissions. The pulp and paper industry is also the largest user of original or virgin wood, with deleterious impacts on both human health and local flora and fauna, including aquatic ecosystems. This critical and systematic review seeks to identify alternatives for mitigating the climate impacts of pulp and paper processes and products, thus making the pulp and paper industry more environmentally sustainable. This study reviews 466 studies to answer the following questions: what are the main determinants of energy and carbon emissions emerging from the pulp and paper industry? What are the benefits of this industry adopting low-carbon manufacturing processes, and what barriers will need to be tackled to enable such

adoption? Using a sociotechnical lens, we answer these questions, identify barriers for the pulp and paper industry's decarbonization, and present promising avenues for future research.

Hermann, R. R., Pansera, M., Nogueira, L. A. and Monteiro, M. (2022)

**Socio-technical imaginaries of a circular economy in governmental discourse and among science, technology, and innovation actors: A Norwegian case study.**

Technological Forecasting and Social Change, 183, 121903

[link](#)

A growing body of research is investigating the connections between the discursive construction of circular economy (CE) and its influences on public policies that promote the socio-technological transition towards circular production and consumption systems. However, surprisingly little attention has focused on how CE discourses interact with science, technology, and innovation (ST&I) actors. To address this gap, this research adopts the prism of socio-technical imaginaries to understand specific visions of circularity in science and innovation, exploring how competing imaginaries mobilize specific actors, institutions, and visions of a greener future. Our empirical material included archival documentation from the Norwegian government and funded research projects on CE. Our analysis identified two key tension points within these imaginaries: "International drivers versus regional and local transition arenas" and "Ecological modernization versus sectoral transformation." We suggest that tensions are inherent in CE socio-technical imaginaries but are often silenced or minimized by institutional discourses on circularity. Our findings suggest that official CE policy programs tend to minimize or overtly ignore criticisms and contestation that are increasingly raised in academic circles. Our findings indicate the need for increased involvement of ST&I actors and other societal actors (such as NGOs and the private sector) in the CE policymaking process to avoid endless growth as an unexpected CE policy outcome.

Hoicka, C.E., Zhao, Y., McMaster, M.-L. and Das, R. R., (2022)

**Diffusion of demand-side low-carbon innovations and socio-technical energy system change.**

Renewable and Sustainable Energy Transition, 100034

[link](#)

To mitigate climate change in an accelerated time frame, more research is needed to understand how to achieve effective large-scale diffusion of low-carbon



innovations. The conceptualization of sectoral socio-technical system transitions requires extending beyond an economic and technological focus, towards a wider system view that combines societal, behavioural, and institutional elements alongside the natural environments and infrastructures. Any socio-technical system reconfiguration will be shaped by the diffusion of multiple innovations. This study employs a novel empirical and quantitative framework that integrates considerations of system actors, behaviours, innovations, and infrastructure simultaneously. Based on a review of socio-technical literature, the framework scores demand-side, low-carbon innovations on a scale from regime reinforcing to disruptive across the dimensions of decarbonization, democratisation and decentralisation. It also scores the innovations according to the policy (economic, regulatory, informational) and legitimacy (actors, discourse) factors that support or inhibit their diffusion. This allows for the investigation of the relationship between the diffusion of innovations and socio-technical energy system change, including whether a relationship exists, its strength, and direction. In analysing 80 innovations that diffused to the demand-side between 1998-2018 in Ontario, Canada, diffusion is found to be negatively correlated with system disruption and decarbonization. Although economic supports tend to be a focus of mainstream policymaking, this study found that economic instruments, legitimacy through discourse, and combined policy and legitimacy supports are important to the systemic diffusion of demand-side low-carbon innovations.

John, N., Wesseling, J. H., Worrell, E. and Hekkert, M., (2022)

**How key-enabling technologies' regimes influence sociotechnical transitions: The impact of artificial intelligence on decarbonization in the steel industry.**

Journal of Cleaner Production 370, 133624.

[link](#)

Key Enabling Technologies (KETs) are pervasive groups of technologies expected to enable innovation. They have been promoted as technologies with tremendous potential for boosting economic growth and sustainability in all sectors of society – a claim whose validity remains underexplored. Building on systems thinking and the Multi-Level Perspective, we develop a novel approach to assess the socio-technical impact of a KET regime on a transitioning sectoral regime. This approach is applied to the case of the Artificial Intelligence (AI) KET impacting the decarbonization of the energy-intensive steel industry. To assess AI's technical impact, we compiled an inventory of AI tools based on reviewing technical scientific articles. Our analysis shows that AI adds technological value to the full range of areas in the steel industry, like predicting

process parameters; optimizing operations, scheduling, and electrical energy; and forecasting product demand, quality, and site emissions. Semi-structured interviews were the primary data source to assess AI's broader socio-institutional impact. The results indicate that AI may currently be reinforcing path dependencies of the steel industry, as AI tools are more focused on incremental improvement for existing technologies rather than novel low-carbon technologies. However, AI also offers capabilities to reduce barriers to sustainability innovation, like system integration challenges, flexibility challenges, demand-side barriers, and risk-related barriers. Finally, we reflect on the generalizability of our approach for studying other transitions, and we induce characteristics of the AI-Digital KET regimes. We find that through these characteristics, the AI-Digital KET regime alters existing and creates new system structures (actors, networks, and institutions) within the impacted sector.

Krom, P., Piscicelli, L. and Frenken, K. (2022)

**Digital platforms for industrial symbiosis.**

Journal of Innovation Economics Management, I124-XXVI

[link](#)

Industrial symbiosis contributes to the realisation of a circular economy where underutilised assets are shared among different companies and the residual outputs from one industry are used as feedstock for the production processes of other industries. While digital platforms have the potential to facilitate the exchange of excess resources in industrial symbiosis networks, existing platforms have not been very successful hitherto. This research empirically investigates the barriers to industrial symbiosis and how digital platforms (fail to) address them. Qualitative, semi-structured interviews were conducted with eleven prospective platform providers based in Norwegian industrial parks, and two platform developers and one provider in the Netherlands. Results show that the uptake of platform-enabled industrial symbiosis is still hampered by limited commitment to sustainability, a lack of cooperation and information sharing, as well as technical and economic barriers. Platform design only partially solves the challenges specific to matchmaking platforms that facilitate the identification and exploitation of synergy opportunities.

Libertson, F. (2022)

**Requesting control and flexibility: Exploring Swedish user perspectives of electric vehicle smart charging.**

Energy Research & Social Science, 92, 102774

[link](#)

The electrification of several sectors and the increasing role of volatile energy production mean that future

energy systems will have to balance supply and demand to a higher degree. The increasing use of electric vehicles in particular will pose both challenges and opportunities for energy systems. Smart electric vehicle charging and user flexibility have been proposed as potential remedies for future imbalances in energy consumption, but the success of such remedies requires close collaboration between users and system operators. In smart charging schemes, users are expected to relinquish their control over charging while also being more flexible in their energy use. This study constitutes a mixed method case study, in which supplier-managed charging was tested at public charging stations and followed by three surveys (N = 1428, N = 24, N = 31) and semi-structured interviews (N = 27). The results show that while the participants were positive toward smart charging as a concept, the technology was also associated with uncertainty and anxiety. Furthermore, while the participants were willing to relinquish some control, their capacity for flexible energy use was dependent on factors beyond their direct control, including working patterns, financial resources, and access to charging stations. The conclusion is that the implementation and optimization of smart charging schemes are reliant not only on user attitudes but also on the extent to which these factors can be compensated for to facilitate user flexibility and avoid unfair flexibility markets.

Magnusson, T. and Werner, W. (2022)

**Conceptualisations of incumbent firms in sustainability transitions: Insights from organisation theory and a systematic literature review.**

Business Strategy and the Environment, early view [link](#)

Following the tradition of using opposing concepts as a basis for organisational analysis, this article advances a theory-based understanding of incumbent firms in sustainability transitions. Building on seminal transition studies, we propose innovating/defending and collaborating/competing as two useful spectra to describe organisational behaviours in transitions. Presenting the automotive industry as an explanatory case, we show results from a systematic literature review that reveal motives for diverging behaviours. Combining the spectra into a 2×2 matrix, we then introduce four conceptualisations to explain the observed motives and behaviours. The conceptualisations are associated with different streams of organisation theory: dynamic capabilities and the resource-based view, resource-dependence theory, neo-institutional theory and theories on organisational learning and path dependence. Referring to organisational ambidexterity, value configurations and political arenas, we conclude that transitions research can reach a more multifaceted understanding

by challenging the prevailing notion of the firm as a coherent actor.

Nobre, F. S. (2022)

**Cultured meat and the sustainable development goals.**

Trends in Food Science & Technology, 124, 140-153

[link](#)

There is a need and urgency to strengthen the analysis of the interactions between cultured meat and the Sustainable Development Goals (SDGs) to shed new light on the map of synergies and trade-offs within and between the multiple goals in the context of regional differences. Accordingly, this article seeks to answer the question: what are the interactions between cultured meat and the SDGs?

The methodology comprises an integrative literature review and content analysis of the 17 SDGs and their 169 targets and the application of a seven-point scale framework that assists decision-makers in mapping the nature and the strengths of the interactions. The analysis advances novel propositions about the impact of cultured meat on the SDGs and well-being.

Cultured meat systems will effectively unleash a virtuous cycle of SDGs and well-being within and across the North-South when confronting and juxtaposing environmental, health, social, economic, and law-oriented goals. They will be more successful when engaging in institutional change to resolve tensions between the short-term (socioeconomic) objectives and the long-term (societal and planetary) outcomes needed to fuel systemic resilience and sustainable development. Culture meat comprises technological capabilities but lacks sustainable businesses to tackle multiple SDGs grand challenges and systemically address their relationships. This article informs policymakers with significant perspectives to foster a virtuous cycle and outlines strategic capabilities needed to responsibly deliver long-term sustainable values in the scope of cultured meat.

Nogueira, L. A., Lindeløv, B. and Olsen, J. (2022)

**From waste to market: Exploring markets, institutions, and innovation ecosystems for waste valorization.**

Business Strategy and the Environment

[link](#)

This article explores the emergence of waste valorization innovations to investigate how they interact with incumbent waste management systems and what roles markets play in the process. We build upon innovation ecosystems as an analytical framework and investigate empirically three cases distributed across the waste hierarchy pyramid: (i) upcycling of discarded fishing gear; (ii) reusing constructions and recovering

demolition waste; and (iii) establishing a biomass-based district heating facility. Our cases indicate that waste valorization initiatives are deeply entangled in incumbent waste management systems and that markets alone appear to be insufficient to drive innovations in waste valorization. Our analysis also points to a relationship between the position of waste innovation in the waste hierarchy and the presence and effectiveness of markets. Markets function better when resources already have some economic value, which is what waste valorization processes seek to obtain. When the environmental value is higher than the economic value, other mechanisms are needed to enable innovations, markets, and sustainability transitions. Support from the public sector in various capacities, from international regulation to demand shaping, seems to be essential for circular economy transitions. Understanding issues such as how waste innovations reach the market and how markets for waste resources function is imperative for circular economy transitions.

Rahmani, S., Ranjbar, M. S. and Mafi, V. (2022)  
**Transition pathways, transition failure, and sustainable transition in developing countries: Insights from wind turbines in Iran.**  
Energy for Sustainable Development, 70, 133-145  
[link](#)

This study aims to investigate transition pathways, identify transition failures and propose policy solutions based on functions of technological innovation system (TIS) to overcome transition failures in the wind turbine industry in Iran. To this end, this paper employs a qualitative approach and case study research strategy. In this regard, the historical evolution of the wind turbines in Iran from 1988 to 2020 is investigated through the lens of sustainable transitions pathways, the integrated theoretical framework (combination of technological innovation system and multi-level perspective) with identifying a kind of pathway in each. Then, the reasons for the transition failure in each stage are extracted by employing a transition failure theoretical framework. Finally, to address the transition failures, appropriate policy solutions are proposed based on each function of the technological innovation system (TIS) theory. This paper contributes to the literature of sustainability transition by shedding light on the evolution of a renewable energy sector in a developing country with huge underground oil and gas reserves.

Rohe, S., Chlebna, C. (2021)  
**The evolving role of networking organizations in advanced sustainability transitions.**  
Technological Forecasting and Social Change, 183, 121916  
[link](#)

In transition studies, formal inter-organizational networks – ‘networking organizations’ – are considered essential for inducing socio-technical change. Yet, there is little research on how their structural composition and role evolve in advanced transitions and which tensions arise over time. We address these gaps by combining insights from network research in social and economic science with transition studies, where networking organizations are conceptualized as intermediaries and elements of Technological Innovation Systems. We synthesize a framework capturing the evolution of and resulting tensions within networking organizations in sustainability transitions. It is applied to two regional energy networking organizations from Germany. We draw on qualitative expert interviews and a complementary social network analysis. We show that networking organizations do not necessarily stabilize once the initial technologies they were centered around become established. Instead, their member base broadens to different sectors. This can lead to tensions over the networking organizations' scope. Tensions also arise from misalignments between ‘private’ goals of member firms and the ‘public’ goal of transforming system-level structures. Furthermore, complementary or competing networking organizations might emerge during the transition. We conclude by outlining responses to these tensions, which might help practitioners to maintain the legitimacy of networking organizations and their relevance in the transition.

Rosenbloom, D. and Meadowcroft, J. (2022)  
**Accelerating Pathways to Net Zero: Governance Strategies from Transition Studies and the Transition Accelerator.**  
Current Climate Change Reports  
[link](#)

After decades of delay, there are promising signs that society may finally be getting serious about climate change. But the problem is now of such urgency that accelerating transition pathways to net zero is of paramount importance. Which governance approach gives society the best chance of simultaneously realizing the multiple sectoral and industrial transformations that net zero entails? How can policymakers and broader societal actors accelerate these transformative processes, setting in motion transition pathways to desirable futures? In response to these interrelated questions, we survey the literature on sustainability transitions and present an approach that aims directly at radical system change. Transition research indicates that reaching net zero entails radically transforming essentially all sectors and industries as they are deeply entwined with the use of fossil fuels and the release of greenhouse gas emissions. An ambitious state in conjunction with a strong constellation of intermediary organizations can set in motion and accelerate transition pathways by



actively driving niche development surrounding promising innovations, promoting the diffusion of emerging alternatives, and phasing out carbon-intensive arrangements.

Sovacool, B. K., Baum, C., and Low, S. (2022)  
**Climate protection or privilege? A whole systems justice milieu of twenty negative emissions and solar geoengineering technologies.**

Political Geography 97, 102702, pp. 1-21

[link](#)

In this study, we utilize a large and diverse expert interview exercise (N = 125) to critically examine the whole systems justice issues associated with ten negative emissions and ten solar geoengineering technologies. We ask: What equity and justice concerns arise with these 20 options? What particular vulnerable groups could be affected? What risks do these options entail for communities or the climate? Utilizing a “claims making” approach, we examine existing and prospective injustices across a pluralistic whole systems framework analyzing (i) resource extraction issues including minerals, chemicals, and fertilizers (ii) manufacturing, labor and ownership concerns, (iii) transportation-network and land-grabbing dynamics, (iv) unfair and exclusionary policymaking and planning, (v) operational injustices resulting from deployment and use, and (vi) waste flows, liabilities and disposal requirements. We then explore how these potential concerns culminate in a milieu of injustice cutting across the dimensions of distribution (who gets what), recognition (who counts), participation (who gets heard), capabilities (what matters), and responsibility (who does what). We conclude with insights for both policy and future research.

Upham, P., Sovacool, B. K. and Ghosh, B. (2022)  
**Just transitions for industrial decarbonization: A framework for innovation, participation, and justice.**

Renewable & Sustainable Energy Reviews, 167, 112699, pp. 1-16

[link](#)

Here we propose a framework for considering the justice issues of industrial cluster decarbonisation, a pressing challenge confronting many industrialised economies. Industrial clusters are large, multi-point source emitters, users of energy and employers of regional and national significance. In the UK, establishing low carbon industrial clusters is one of several grand challenges of industrial strategy. Theorising the just transition of industrial clusters requires concepts from multiple literatures. We abstract relevant themes from the intersections of the literatures

of just transitions, innovation studies and sociotechnical transitions, and public participation in spatial planning, and illustrate their empirical relevance. The broad themes of our framework are (i) politics, space and institutions, with sub-themes of justice, democracy, financialization; (ii) new processes and procedures, with sub-themes of legal recognition of public concerns, community-based planning, community capacity enhancement and life cycle impact assessment; and (iii) correlates of acceptance and resistance, with sub-themes of environmental values, perceived loss of amenity, pre-existing politics, perceptions of just process and trust in the developer. The framework is intended to both guide the design of just transition processes ex-ante and evaluate these post-hoc.