

Institution: University of Manchester		
Unit of Assessment: 17 (Business and Management)		
Title of case study: Changing how international policy organizations understand and manage environmental problems		
Period when the underpinning research was undertaken: 2012 - 2019		
Details of staff conducting the underpinning research from the submitting unit:		
Name:	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Frank Geels	Professor of System Innovation	2012 - present
Period when the claimed impact occurred: 2014 - 2020		
Is this case study continued from a case study submitted in 2014? N		
<p>1. Summary of the impact Professor Geels' research on socio-technical transitions has transformed how reducing greenhouse gas emissions is understood and addressed. The traditional approach focused on taxes and regulations. In contrast, Geels' research frames environmental problems in terms of underlying unsustainable socio-technical systems, leading to new debate and policies focused on sustainable energy, food and mobility systems. This new framing and Geels' multi-level perspective have transformed how the European Environment Agency (EEA), the EU and the United Nations' Intergovernmental Panel on Climate Change (IPCC) approach policies concerning energy, decarbonisation, and biodiversity loss.</p>		
<p>2. Underpinning research Since September 2012, Geels has undertaken world-leading research into socio-technical transitions at Alliance Manchester Business School. Socio-technical transitions are large-scale shifts in energy, food and transport systems, which involve new technologies as well as changes in user practices, business models, cultural meanings, public policies and infrastructures. Over the last eight years, Geels has conducted multiple studies that have all demonstrated how these large-scale shifts are needed to deliver significant climate change and sustainable development goals. An important outcome of Geels' research using his multilevel perspective, published in <i>Science</i> [1], is that, instead of simple causality in transitions, it emphasizes co-evolving elements and interacting social groups.</p> <p>Geels' multilevel perspective provides a 'big-picture' understanding of transitions as interactions between radical niche-innovations, established locked-in regimes and exogenous landscape developments. According to the multilevel perspective, radical niche-innovations provide the seeds for socio-technical transitions. The emergence and diffusion of these innovations depends on how they co-evolve with social, technical, political, cultural and economic dimensions. In turn, this co-evolution influences and is influenced by prevailing governance structures. Struggles between challengers and incumbent actors thus play out on multiple dimensions and involve various social groups.</p> <p>Geels tested and refined his analytical framework on different historical case studies, including sea, land and air transport, water supply, farming, horticulture and coal [2]. He has also applied the framework to contemporary and future sustainability transitions in biogas, electricity, renewable energy technologies and automobility [3]. Hence, the framework has proven useful in multiple contexts. In the past eight years, socio-technical transitions research has become a cumulative research program to which many scholars now contribute and provides a comprehensive framework for policy actors, as documented in a recent review by Geels [4].</p>		

With regard to environmental policy, Geels' research shows that persistent environmental problems should be considered in terms of underlying socio-technical systems. To support the governance of sustainability transitions, identify and assess potential transition pathways, Geels developed a 'bridging approach' that combines insights from computer models, socio-technical transition research and on-the-ground demonstration projects [5, 6]. By addressing the differing knowledge needs of international, national and local policymakers, this combination of approaches is more comprehensive and useful than a single catch-all approach.

3. References to the research

The following key outputs underpin the research described above. Geels has received the Web of Science Highly Cited Researcher prize in 2014, 2019 and 2020, and was the world's third most cited scholar in social science in 2019 according to data presented by the Stanford Meta-Research Centre.

- [1] **Geels, F.W.**, Sovacool, B.K., Schwanen, T., Sorrell, S., (2017) 'Sociotechnical transitions for deep decarbonization', *Science*, 357(6357), 1242-1244. <https://doi.org/10.1126/science.aao3760> [185 Web of Science citations – this paper was partly an output from the £3.5m UKRI Research Centre on Innovation and Energy Demand (IED), where Geels was a Co-I, as well as the €6.3m EU project *Innovation pathways, strategies and policies for the Low-Carbon Transition in Europe* (INNOPATHS), where Geels is a collaborator.]
- [2] **Geels, F.W.**, Kern, F., Fuchs, G., Hinderer, N., Kungl, G., Mylan, J., Neukirch, M., Wassermann, S., (2016) 'The enactment of socio-technical transition pathways: A reformulated typology and a comparative multi-level analysis of the German and UK low-carbon electricity transitions (1990-2014)', *Research Policy*, 45(4), 896-913. <https://doi.org/10.1016/j.respol.2016.01.015> [249 Web of Science citations – this paper was partly an output from the IED Centre, partly from a visiting professorship held by Geels at the University of Stuttgart and funded by Helmholtz Alliance ENERGY-TRANS programme, and partly the £3.8m EU project *Exploring transitions pathways to sustainable, low carbon societies* (PATHWAYS), where Geels was a collaborator.]
- [3] **Geels, F.W.**, (2014) 'Regime resistance against low-carbon energy transitions: Introducing politics and power in the multi-level perspective', *Theory, Culture & Society*, 31(5), 21-40. <https://doi.org/10.1177/0263276414531627> [This paper was partly an output from the IED Centre, and partly from PATHWAYS]
- [4] **Geels, F.W.**, (2019) 'Socio-technical transitions to sustainability: A review of criticisms and elaborations of the Multi-Level Perspective', *Current Opinion in Environmental Sustainability*, 39, 187-201. <https://doi.org/10.1016/j.cosust.2019.06.009>
- [5] Turnheim, B., Berkhout, F., **Geels, F.W.**, Hof, A., McMeekin, A., Nykvist, B., Van Vuuren, D., (2015) 'Evaluating sustainability transitions pathways: Bridging analytical approaches to address governance challenges', *Global Environmental Change*, 35, 239–253. <https://doi.org/10.1016/j.gloenvcha.2015.08.010> [This paper was an output from PATHWAYS]
- [6] **Geels, F.W.**, Berkhout, F. and Van Vuuren, D., (2016) 'Bridging analytical approaches for low-carbon transitions', *Nature Climate Change*, 6(6), 576-583. <https://doi.org/10.1038/nclimate2980> [153 Web of Science citations - this paper was an output from PATHWAYS]

4. Details of the impact

Since 2014, Geels' research has made a substantial contribution to shaping environmental thinking and policy-making at the international level, for example with the European Environment Agency and the Intergovernmental Panel on Climate Change.

Changed Understandings and Influenced Policy Recommendations at the European Environment Agency

Geels' research has had a profound impact on the EEA, which is a scientific advisory body designed to provide independent information on the environment to inform policy-making at

European level. Impact has been facilitated through extensive engagement with EEA officials since 2014 that culminated in Geels' appointment to the EEA's Scientific Committee in 2017. The Committee provides scientific advice on areas of work undertaken by the Agency and is influential in framing the agenda of the Agency. As described below, Geels' work and close involvement with the EEA has significantly influenced the EEA's thinking and informed its knowledge base. The Executive Director of the EEA, credits Geels with "*inform[ing] the European Commission, the European Parliament, Member States, and the wider public about the need to frame climate and environmental challenges in a systemic sustainability transitions perspective*" [A].

Changed EEA Thinking

Since 2014, the EEA has explicitly adopted Professor Geels' socio-technical transition framework to frame the causes of persistent environmental problems, such as climate change, biodiversity loss, and resource scarcity problems. The 2014 work programme *Expanding the Knowledge Base for Policy Implementation and Long-term Transitions* [B] used Geels' concept of 'socio-technical systems' to argue the need for transitions. The work programme was significant because it set out the EEA's vision and agenda for the provision of timely, targeted, relevant and reliable information to policy-making agents across the 27 EU member states. The work programme was the prime source of knowledge at European level informing the implementation of European and national environment and climate policies between 2014 and 2018. One of the four Strategic Areas outlined by the work programme was 'Assessing Systemic Challenges', which heavily relied on Geels' work on socio-technical transitions. For example, environmental policy was traditionally framed in terms of externalities and input-output problems, leading to a focus on taxes and regulations as environmental policy instruments. However, for long-term, structural problems, the EEA recognised that this approach was not sufficient. Geels' work helped to reframe the issues in the work programme in terms of the need to fundamentally change core socio-technical systems (particularly food, energy, mobility), which involved changes in technology, markets, industry, consumption and values [B]. The Executive Director of the EEA has attested that "*Professor Geels' research on socio-technical transitions has increased our fundamental understanding of sustainability transitions...He has been the most influential academic in the domain of sustainability transitions and technological innovation that we have worked with*" [A].

In 2016, Geels wrote a scientific background paper for the EEA based on his research into the multilevel perspective that provided key understandings of sustainability transitions. Since then, the EEA has used Geels' multilevel perspective as an analytical framework underpinning much of its work. For example, in 2016/2017 the EEA published three reports (*Sustainability Transitions: Now for the Long term; Transitions towards a more sustainable mobility system and Circular by Design: Products in the Circular Economy*) which extensively apply the multilevel perspective and draw on Geels' work throughout. The first report uses Geels' research [3] to identify the trade-offs of transforming socio-technical systems. The second report uses the multilevel perspective to guide empirical work in four chapters concerning the shape of future transport systems. The third report uses Geels' observations on the dynamic and power-laden nature of transitions to provide insights into the mechanisms required for successfully transitioning towards a circular economy.

This increasing reliance on Geels' work prompted the EEA to invite Geels to write a chapter on the multilevel perspective in the EEA report *Perspectives on Transitions to Sustainability* (2018). The general introduction to this report [C] states that "*the multi-level perspective (MLP) has emerged as the dominant analytical framework for understanding transitions*". The Executive Director of the EEA reports that the framework is utilised in several subsequent assessment reports on sustainable mobility, the circular economy, and food systems and through Geels' research "*our knowledge base on Sustainability Transitions has developed substantially since 2015*" [A].

Geels' work has most recently influenced the EEA's five yearly flagship report SOER 2020 (*The European Environment: State and Outlook 2020: Knowledge for Transition to a*

Sustainable Europe) [D] which offers science-based insights on how society and policy-makers must respond to huge and complex environmental challenges. The report's analysis of worsening environmental trends stresses how Europe will not achieve its 2030 goals without urgent action to address the increasing impacts of climate change and the overconsumption of natural resources. The report uses Geels' multilevel perspective as an organising framework and dedicates a whole chapter to Geels' concept of transitions, namely Chapter 17 'Responding to Sustainability Challenges', which references five of Geels' Manchester publications, including [1, 2].

Influenced Policy Recommendations

Since 2018, Geels' research has directly fed into policy recommendations made by the EEA to the EU and its member states. Geels was the Principal Investigator on three specific service contracts for the EEA within a wider framework contract for "*provision of expert assistance on forward-looking analysis, sustainability assessments and systemic transitions*". This research resulted in the 2019 EEA report *Sustainability transitions: Policy and practice* [E] that highlights how transitions thinking is being operationalised at different scales across Europe. The report uses the multilevel perspective as its core framework, citing 11 of Geels' Manchester produced articles (including [1], [2], [3]). As the Executive Director of the EEA highlights, Geels' framework underpins several of the report's specific policy suggestions — illustrated through cases from across Europe — concerning innovation, diffusion, impacts, cities, finance, missions, and wider governance challenges; as such, Geels provides "*concrete approaches and instruments that policymakers can use to advance sustainability transitions*" [A].

The EEA launched its Policy and Practice report on sustainability transitions [E] on 10 September 2019 in Brussels at a closed, high-level meeting, with participation from one deputy secretary-general, four directors-general, two deputy directors-general, and six directors from multiple European Commission departments, including the departments of Environment, Climate Action, Research and Innovation, Regional and Urban Policy, Agriculture and Rural Development, and Mobility and Transport. This endorsement enabled the report to feed into discussions about the European Green Deal, which is an ambitious set of policy initiatives by the European Commission with the aim to make the EU carbon neutral by 2050 across buildings, agri-food, energy and mobility systems. The Green Deal will affect all 27 member-states and will invest an estimated EUR1,000,000,000,000 in sustainable transitions to a carbon neutral society [F]. As the Executive Director of the EEA attests: "*The ideas developed over the last years of collaboration [with Geels] are deeply embedded in the European Green Deal, formulated by the President of the European Commission, Mrs. Von der Leyen ... I am confident to say that it is the thinking of academics like Professor Geels that is pivotal to our society meeting challenges framed in the Paris Agreement, the Sustainable Development Goals and multiple other ambitious processes of European and global importance.*" [A]

Informing the Intergovernmental Panel on Climate Change (IPCC)

Geels' research has had a pivotal influence on the Intergovernmental Panel on Climate Change (IPCC), a body of the United Nations that provides evidenced-based advice to governments and citizens to help society tackle global climate change.

Geels gave a Keynote Talk in 2016 at the Scoping Meeting of the IPCC for the Special Report on 1.5°C Global Warming. The corresponding IPCC report [G], *Global warming of 1.5°C* (published in October 2018), was strongly framed in transition terms, especially Chapter 2 (on mitigation pathways) and Chapter 4 (strengthening and implementing the global response). The report explicitly defines Geels' concept of socio-technical transitions in its glossary of key underpinning concepts and terms, and cites Geels numerous times, drawing on five of his publications, including [1], [2], [3] and [6]. The report recognises that "*the socio-technical transition literature points to multiple complexities in real-world settings that prevent reaching 'idealised' policy conditions but at the same time can still accelerate transformative change through other co-evolutionary processes of technology and society (Geels et al., 2017).*" [G]

The IPCC report argued that limiting climate change to 1.5°C will require deep and rapid transitions in several systems (energy, land-use, cities, transport and industry). The report received global coverage in the media. The New York Times described it as a “*landmark report*” [H]. It featured on the front page of The Guardian and on the evening news reports of ABC, NBC and PBS in the USA.

Following the IPCC report, the Secretary General of the United Nations convened a Climate Action Summit in December 2019. The official report from the summit recognized that “*the Climate Action Summit reinforced 1.5°C as the socially, economically, politically and scientifically safe limit to global warming by the end of this century*” [I]. The report calls for nations to develop plans “*in line with the findings of the IPCC 1.5°C report*” and observes that the summit secured “*the commitments of 70 countries to deliver more ambitious NDCs [Nationally Determined Contributions] in 2020 in line with net zero emissions by 2050 strategies*” [I].

As a result of Geels’ expertise and influence following his involvement with the Scoping Meeting of the IPCC for the Special Report on 1.5°C Global Warming, Geels was chosen to be a Lead Author for the Working Group III contribution to the IPCC Sixth Assessment Report (AR6, due in 2021), particularly for Chapter 5 – “*Demand, services and social aspects of mitigation*” [J]. The IPCC Assessment reports are important policy-relevant documents that feed into the international negotiations to address climate change.

5. Sources to corroborate the impact

- [A] Testimonial letter from EEA Executive Director, 1 January 2020
- [B] *Expanding The Knowledge Base for Policy Implementation and Long-Term Transitions*, presentation by the Executive Director of the EEA
- [C] EEA Report No 25/2017 *Perspectives on transitions to sustainability*, <https://www.eea.europa.eu/publications/perspectives-on-transitions-to-sustainability>
- [D] EEA SOER 2020 report *The European Environment: State and Outlook 2020*, <https://www.eea.europa.eu/publications/soer-2020>
- [E] EEA Report 09/2019 *Sustainability Transitions: Policy and Practice*, <https://www.eea.europa.eu/publications/sustainability-transitions-policy-and-practice>
- [F] EC press release, https://ec.europa.eu/regional_policy/en/newsroom/news/2020/01/14-01-2020-financing-the-green-transition-the-european-green-deal-investment-plan-and-just-transition-mechanism (accessed 20th January 2021)
- [G] Global warming of 1.5°C: An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Full_Report_High_Res.pdf
- [H] New York Times article ‘Major Climate Report Describes a Strong Risk of Crisis as Early as 2040’, <https://www.nytimes.com/2018/10/07/climate/ipcc-climate-report-2040.html> (accessed 4 March 2021)
- [I] United Nations (2019) *Report Of The Secretary-General On The 2019 Climate Action Summit The Way Forward In 2020*, https://www.un.org/sites/un2.un.org/files/cas_report_11_dec_0.pdf
- [J] Invitation to Frank Geels to be IPCC AR6 WGIII Lead Author of Chapter 5