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Briefing Note (Oct 2025)

Irreversible progress in climate policy and technology

Amy Russell, University of East Anglia (Rapporteur); Nigel Topping, Ambition Loop; Prof. Charlie Wilson, University of Oxford; Prof. Corinne Le Quéré, University of East Anglia (Chair)

During the Critical Decade for Climate Action Conference, hosted by the Tyndall Centre for Climate Change Research at the University of East Anglia (UEA), climate experts gathered to showcase evidence-based ideas and critically evaluate opportunities for climate action. This briefing note serves as a summary of Session 10 on Wednesday 10 September 2025.

Climate policy and the technological advances they have triggered are providing new opportunities and constraints. While there has been rapid expansion and progress in both policy and technology, the road ahead is less clear. On the one hand, falling prices and industry expansion mean a snowball effect is imminent for important elements of the net zero transition (e.g. electrification of transport); on the other hand, uncertainty in long-term policy support undermines necessary investments to go further. This session offered presentations that identified and discussed the emerging transitions and how they interact with policy and society in ways that can accelerate, or slow down, climate actions. The 2020s are a turning point for the world's cohabitation with the planet. Climate change and climate responses are shaping the environment, including soils, wetlands and forests, while climate policy and technological advances are providing new opportunities and constraints. Tipping points in the physical and social systems are looming. This session offered presentations that provided insights into the most important physical and socio-economic climate-induced transitions that are emerging in the 2020s.

Can we now say that actions to tackle climate change are "irreversibly" set in motion? On the one hand, falling prices and industry expansion mean a snowball effect could be imminent for important elements of the net zero transition (e.g. electrification of transport); on the other hand, uncertainty in long-term policy support undermines necessary investments to go further. This briefing note summarises discussions that took place during the Tyndall Centre's 25th anniversary conference on emerging transitions and how they interact with policy and society in ways that can accelerate, or slow down, climate actions.

Feedback loops

Businesses and policymakers are engaged in reciprocal feedback loops. It is not the case that only one leads the other. Policymakers shape the rules and incentives that guide business practices, while businesses not only respond but often set the pace, sometimes exceeding policy and then helping to shape it. This dynamic accelerates change across sectors. For example, early commitments to zero-carbon shipping or aviation fuel targets create momentum for exponential progress: 5% zero-carbon ships by 2030 can become 100% by 2050 if the mindset shifts from linear to exponential growth. These loops rely on assembling a critical mass of actors (e.g. businesses, universities, hospitals) around shared targets. Initiatives like Race to Resilience, Race to Zero, the Earth Investment Engine, Mission Possible Partnership, Breakthrough Agenda, Tripling of Renewables by 2030, de-risk the transition by pooling efforts, encouraging further participation, and unlocking innovation. Here, the roles of engineers, policymakers, and economists become central, applying solutions-oriented thinking informed by the urgency of climate science.

Lock-ins of interdependent elements

Systems develop along particular paths, and the trajectory they take can create "lock-ins" that are difficult to reverse. These arise when technologies, infrastructures, policies, and social norms reinforce each other. For example, cycling infrastructure, cultural acceptance, and supportive regulation form a mutually reinforcing system that sustains itself once established (as in The Netherlands). Lock-ins can work in favour of the transition. Electric vehicles (EVs) and photovoltaics (PV) demonstrate positive returns to scale: as adoption increases, costs fall, mass production expands, and network effects accelerate uptake. At a certain threshold, the shift becomes irreversible. This is illustrated by Norway, where 95% of new vehicles sold in 2024 were EVs costing the same or lower at the point of purchase with conventional internal combustion engine vehicles. Such dynamics highlight the power of positive tipping points. When boundary conditions change through technological advances, cost reductions, or policy frameworks, the system can move to a new equilibrium that resists reversal, provided those conditions remain in place.

Stabilising factors that stop sliding back

To prevent regression, stabilising mechanisms are needed to anchor positive change. One is the steady expansion of climate policies worldwide: more than 4,000 policy instruments across 200 countries. Importantly, effectiveness comes not just from the number of policies but their stringency and focus, particularly on emissions-intensive sectors. This iterative learning process of identifying which policies work best creates an irreversible trend. Likewise, infrastructure, when it supports low carbon and resilient development, can also offer a backstop to anchor progress.

Electrification of end use is another stabilising factor. Electricity is a far more efficient energy carrier: EVs are three times more efficient than combustion engines, while heat pumps outperform gas boilers by the same margin. Advances since 2000 mean large subsectors (e.g. transport, heating, and parts of industry) are now technically and economically ready for electrification, often moving faster in emerging economies than in the Global North. To reinforce this trend, the benefits of cheaper and renewable electricity need to be felt more directly by the end users.

Climate litigation may also act as a stabilising force. Climate litigation, while punitive in nature, could serve as a boundary condition that helps prevent policy backsliding, particularly where statutory laws anchor government commitments. The risk of litigation alone can stabilise ambition by holding governments and corporations accountable, even if it sometimes encourages a "race to the regulatory floor." Yet litigation is also dynamic: as liabilities mount, it ratchets up pressure over time, making inaction increasingly costly. This potential for law to stabilise and reinforce ambition recalls social tipping dynamics, where seemingly isolated actions – such as Greta Thunberg's protest, sparking a global movement – influence policy at scale. Despite limited empirical evidence of causal impact, law's creative use offers both incentives and consequences, forming part of the conditions that help lock in climate progress and resist reversal.

Effective feedback loops require not only international collaboration but also robust inter-organisational knowledge transfer to accelerate the adoption of new technologies and to build trust in their cost-effectiveness. Justice concerns must be integrated into these loops to maintain legitimacy. Even when national politics turn anti-climate, local authorities can play a stabilising role, provided they have the resources, policy levers, and capacity to act. Striking the balance between scalability, speed, and local adaptability is essential for creating trust and sustaining ambition in the transition.

Together, these stabilising factors form a positive and largely irreversible story, one where feedbacks between technology, policy, and markets prevent sliding back into high-carbon pathways. Artificial intelligence can also support climate action in many different ways, for example, by enabling breakthroughs in material science and battery catalysts, improving resource and energy efficiency. However, these potential gains may be offset by rebound effects from increased demand and intensified energy use. Importantly, there is currently no framework to ensure AI gains for energy and emissions will be delivered.

Generating positive feedbacks with narratives

Not all feedback loops are technical or institutional – the most powerful may lie in the stories we tell. Narratives shape whether people see change as possible, desirable, and necessary. "Doom loops" emphasise inadequacy and failure, creating apathy, anger, and disengagement. By contrast, "ambition loops" highlight strengths and the potential for improvement, inspiring action and cooperation. Narratives such as Kim Stanley Robinson's The Ministry for the Future, a "critical utopia" that acknowledges both dark forces and collective problem-solving, demonstrate how storytelling can anchor belief in a viable path forward. The moral choice, then, is whether to amplify despair or to generate hope. Stories that envision a positive, achievable future are themselves feedback mechanisms: they attract investment, foster collaboration, and build the collective will to act. Our collective response to climate change has been too slow, but history shows that when we work together, we are capable of rapid innovation. The challenge is to hold both truths and recognise that how we frame our response is part of the response itself.

Different disciplines have different roles in driving these feedback loops. What we need now is solutions. This is the domain of engineers, economists and policymakers, supported by new insights from social science, lessons from the humanities, and informed by the urgency of sciences.

Tyndall Centre Headquarters University of East Anglia Norwich NR4 7TJ UK
email: a.minns@uea.ac.uk tel: +44 (0)7880 547 843 tyndall.ac.uk