

## 1. Articles



# Harnessing social tipping dynamics for the ecological transition: the case of the electric car

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Researchers and practitioners are paying growing attention to the possibility of a fast transition in practices and technologies that could accelerate the achievement of emission reductions targets. Although these rapid transitions are usually identifiable in retrospective, experts argue that a transition from combustion engine cars to electric vehicles is imminent. Why do they think a tipping point is about to be reached? What can be done to create the right conditions for the transition to electric vehicles?

## Why social tipping matters

The warning from the International Panel on Climate Change could not be starker: 'Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a liveable and sustainable future for all.'<sup>1</sup>

Behind this urgency is a growing scientific understanding that we are reaching critical thresholds at which small disturbances could cause large, abrupt and persistent transformations in parts of the Earth system by activating self-enhancing dynamics<sup>2</sup>. These changes threaten to undermine the integrity of ecological processes, human well-being and the conditions for civilised life.<sup>3</sup>

The key point here is that because there is a direct relation between accumulated emissions and increases in temperatures, the climate system<sup>4</sup> responds to levels of greenhouse gases in the atmosphere, hence the need to stop emissions swiftly before tipping points are reached. Globally, emissions need to fall by 7.6 per cent each year (year on year) between 2020 and 2030 and in wealthier countries this needs to be over 10% if we are to have a chance to keep temperatures below 1.5 degrees.<sup>5</sup> This scale of change is unprecedented.

While acknowledging the severity of the situation, sustainability and climate researchers and activists are paying growing attention to the possibility of a fast transition in practices and technologies that could accelerate the achievement of emission reductions targets. In the same way that there are swift, self-reinforcing dynamics in the Earth system, they argue, there are also similar dynamics shaping socio-technical systems. But can we identify positive social tipping points? And, more importantly, can we trigger them?

Researchers studying social tipping argue that we can at the very least help to create the conditions under which social tipping arises, and note that one of the areas in which a tipping point may soon be reached if the current trends persist and additional enabling conditions are created is the transition from combustion engine cars to electric cars. This article discusses these developments without implying that a mitigation approach in mobility can rely solely on this technology. Before doing so I introduce the notion of social tipping.

## The notion of tipping point in the social sciences

The *Oxford English Dictionary* defines tipping point as 'the point at which a series of small changes or incidents become significant enough to cause a larger, more important change.' In complex systems thinking it refers to a critical point at which a small additional quantitative change in the system shifts radically and potentially irreversibly into a different equilibrium state (qualitatively different system). Although the term tipping point has gained prominence in debates about climate through the work of Earth system scientists<sup>6</sup>, it first emerged in discussions about social change. In 1958 political scientist Morton Grodzins observed in his study of racial integration in US neighbourhoods that 'once the proportion of non-whites exceeds the limits of the neighbourhood's tolerance for interracial living, whites move out.' 'This 'tip point' varies from city to city and from neighbourhood to neighbourhood.'<sup>7</sup>

Since Grodzins' pioneering work, the notion of tipping point has informed studies of social and environmental change.<sup>8</sup> These studies discuss mainly the existence of tipping points as illustrated in John Urry's article *The System of Automobility*<sup>9</sup>—probably the first text discussing social tipping in relation to climate change:

A tipping or turning point will occur during the 21st century, when the steel and petroleum car system will finally be seen as a dinosaur (a bit like the Soviet empire, early freestanding PCs or immobile phones). When it is so seen then it will be dispatched for good and no one will comprehend how such a large, wasteful and planet-destroying creature could have ruled the earth. Suddenly, the system of automobility will disappear and become like a dinosaur, housed in museums, and we will wonder what all the fuss was about.

Since the late 2000s and especially during the last five years growing attention has been paid to the potential of specific interventions to set off positive social tipping dynamics.<sup>10</sup> Reflecting this development, in his book from 2016 Urry encouraged sociologists to use complex systems thinking not just to understand processes of rapid change but also to help create, along with economic and civil society actors, the conditions under which more democratic futures may materialise.<sup>11</sup>

## Approaching a tipping point in the use of electric cars

Urry's prediction of the disappearance of the system of automobility sometime in the 21st century remains to be seen. What we are seeing at the moment, though, is the morphing of the automobility system, from a focus on internal combustion engine (ICE) to electric cars (EVs). Sales of EVs are currently growing exponentially and, according to experts, a tipping point in the transition from ICE cars to EVs may soon be reached if the right conditions are put in place.

Why do experts think a tipping point is about to be reached? According to The Breakthrough Report, a collaboration between the University of Exeter and Systemiq, a number of factors are at play in a virtuous dynamic.<sup>12</sup>

### 1. Falling prices

There has been a 90% fall in the price of lithium batteries in the last ten years as production scaled up and this is bringing the price of electric cars closer to that of ICE cars.<sup>13</sup> Car makers are adjusting their production plans to this new reality — more than 10 million electric cars were sold worldwide in 2022 and sales are expected to grow by another 35% in 2023 to reach 14 million<sup>14</sup> — which will then help to lower the price further due to economies of scale and better knowledge on how to develop the new technology, lowering the time and resources to produce each additional unit (since fixed costs are spread along greater numbers and there is a more effective division of labour).

### 2. Better performance

This in turn will help increase the performance of the technology (average range of new EVs has increased by 9% per year from 2015-2021, reaching 350km vs. median of ~650km for average gas ICE vehicle). Lower price and better performance will increase the attractiveness of EVs compared to the high-carbon option, and as the number of EVs on the road increases so will the incentive to install more charging points, further increasing the accessibility of this technology. This is a crucial point because concerns about the autonomy of the EV and where it can be charged are barriers to greater acceptability and adoption of this technology.<sup>15</sup>

### 3. Greater social acceptability

As the EV emerges as a strong alternative to the ICE car and the sales expectations are met or exceeded, car makers have greater incentives to reallocate investment from the old to the new technology which helps to accelerate innovation, including innovation in design. As the demand for electric cars increases, a larger number of models are produced and this increases the appeal of the EV in terms of aesthetics and convenience. And the more one's friends, acquaintances and neighbours use EVs the quicker the use of the new technology is normalised in everyday life (as in the case of other technologies such as fax and mobile phone, people's views on EVs may shift through viral contagion of social norms).<sup>16</sup>

What we are seeing here are reinforcing feedback loops where affordability increases demand and production which in turn leads to greater attractiveness and performance and greater adoption of the technology which in turn helps to reduce the cost further. These processes are bringing the EV closer to the incumbent technology—ICE car—in terms of price, quality, convenience and reliability.

So when exactly is a tipping point reached? The authors of The Breakthrough Report argue that in the case of the EV, the tipping point is that threshold beyond which there is an exponential acceleration in the adoption of the new technology and the beginning of the decline of the old one. Beyond the tipping point, the transition from the old to the new technology is likely to be irreversible.<sup>17</sup> For this two conditions need to be met: first, the price of the EV is lower than the price of the ICE car (price parity is expected to be reached within two to four years in leading markets i.e. EU, USA, China); second, the number of public chargers for electric vehicles reaches around 5 million globally (at the end of 2021 there were 1.8 million public EV chargers installed globally).

## The importance of policy support: the Norwegian example

What makes the initial stage in the transition a relatively slow one is that the incumbent technology is resilient to attempts to disrupt it because it has structural advantages—dominant business models<sup>18</sup>, user preferences and investment strategies have developed around it. The incumbent technology exists in a social, political, technological and financial environment which is favourable to it and ensures its continuity. In this context, unlocking system change requires increasing the number of people interested in the new technology and targeting the preferences of car users ('market development'), and, importantly, policy support to boost positive dynamics and, simultaneously, to accelerate the decline of the old (that is, supporting the emergence of disruptive actors and destabilising incumbent actors).

The uptake of EVs in Norway illustrates the importance of policy support. Over a period of fifteen years, policies aimed at making EVs more affordable, convenient and desirable than fossil fuel cars were implemented. These policies were not just encouraging EVs but also actively discouraging ICE cars. According to Norwegian authorities, key among these has been the implementation of a unique progressive tax system since 1994 making most electric models cheaper to buy compared to a similar fossil fuel model (even when the import price for the electric model is higher). The graphic below shows years when different incentives were implemented and uptake of EVs in Norway.<sup>19</sup>





Figure 1. Incentives to promote EVs since 1997 and trend in the number of EVs in the passenger fleet. Source: Peter Zeniewski <sup>20</sup>

In each Norwegian municipality, local governments can decide the specific incentives to enable access of electric vehicles to bus lanes and provide free municipal parking. Across the country, drivers of EVs cannot be charged more than 50% of the price paid by drivers of ICE cars for parking, driving on a motorway, and carrying an ICE car in a ferry. To enable long-distance travel an extensive charging network has been developed along all main roads. This infrastructure is being partly financed by higher taxes on ICE cars, especially road

tolling. Thanks to these policies, Norway is a pioneering country in the uptake of EVs: 87% of new cars sold in 2021 were electric and there are more than 18,000 charging points including more than 5,000 fast chargers. Ilona Otto from the Postdam Institute for Climate Impact Research, and her colleagues argue that these policies have made the shift to EVs in Norway irreversible. <sup>21</sup>

## A note of caution

This example and more specifically the list of policies in Figure 1 illustrate the need to be cautious about misrepresentations of social tipping as requiring just a one-off small action that, on its own, transforms a system. This 'silver bullet' understanding of social tipping that some political and economic actors find appealing is an oversimplification for it ignores the multiple mechanisms, multiple points of action and actors involved in one way or another in the creation of conditions for change. <sup>22</sup> Actions that trigger a tipping point, by definition, can be very small at the moment of tipping but to reach that point extensive preparatory work is often needed.

One also needs to be cautious about representations of social tipping as a clearly identifiable and predictable moment or threshold. The challenge faced by researchers, activists and politicians pursuing an agenda for change inspired by social tipping is that it is largely uncharted territory. Social tipping is not the norm—history is dominated by periods of relative stability sparsely punctuated by moments of crises. <sup>23</sup> Our understanding of social change reflects this. Political science, for example, has developed compelling arguments about why institutions and policies are stable most of the time, but is less well equipped to understand moments of rapid change. <sup>24</sup> Likewise, the literature on sustainability transitions argues that although the pace of change is not predetermined, transitions to new socio-technical paradigms are usually measured in decades if not generations. <sup>25</sup>

## Notes

- 1 [Climate change: a threat to human wellbeing and health of the planet. Taking action now can secure our future — IPCC](#)
- 2 A process that occurs when the effects of a perturbation on a system include an increase in the magnitude of the perturbation, reinforcing the direction of change—also known as self-amplifying positive feedback.
- 3 [Climate tipping points — too risky to bet against](#) (nature.com)
- 4 The climate system consists of the atmosphere, the oceans, the cryosphere (snow and ice), the land surface, the biosphere, and the interactions between them.
- 5 [A factor of two: how the mitigation plans of 'climate progressive' nations fall far short of Paris-compliant pathways](#) (tandfonline.com)
- 6 [Tipping elements in the Earth's climate system](#) (pnas.org)
- 7 Grodzins M, *The Metropolitan Area as a Racial Problem*, Pittsburgh, University of Pittsburgh Press, 1958.
- 8 There is some debate about whether the notion of tipping point is helpful for describing and communicating possible climate futures. See [Is the concept of climate 'tipping point' helpful?](#) - Mike Hulme
- 9 [The 'System' of Automobility - John Urry, 2004](#) (sagepub.com)
- 10 For example: [Social tipping dynamics for stabilizing Earth's climate by 2050](#) | PNAS . In 2007 scientist Tim Lenton wondered what can be done to avoid tipping points in the Earth system: 'The best choice is to avoid tipping events at acceptable social costs. This can be achieved by inducing a fast transition to a low/no-carbon economy which will have to materialize eventually anyway with the depletion of the fossil fuel resources. When we say 'fast', we envisage a Third Industrial Revolution in the sense of a socioeconomic tipping event. As in the biogeophysical planetary machinery, there should be aggregated control parameters in civilization, which can bring about highly non-linear changes.' See [Tipping the scales](#). | [Nature Climate Change](#)
- 11 [What is the Future? | Wiley](#).
- 12 [The Breakthrough Effect: How to Trigger a Cascade of Tipping points to Accelerate the Net Zero Transition](#), published in January 2023.
- 13 <https://insideevs.com/news/630407/ev-batteries-90-percent-cheaper-2022/>
- 14 [Demand for electric cars is booming, with sales expected to leap 35% this year after a record-breaking 2022 - News - IEA](#)
- 15 In leading countries the number of charging points is increasing at rate of 20-30% per year.
- 16 See Robert Frank [Under the Influence](#) | [Princeton University Press](#)
- 17 Although where precisely the line is and whether the changes are irreversible may be known only, at best, in retrospective. Trying to orchestrate action requires humility to accept that information about how a system works may be limited. In this respect it is worth noting that in her classic text on leverage points, Donella Meadows argues that actors tend to misunderstand complex systems and often overlook places of intervention that have the most transformative potential. See [www.donellameadows.org/wp-content/userfiles/Leverage\\_Points.pdf](http://www.donellameadows.org/wp-content/userfiles/Leverage_Points.pdf)
- 18 The notion of business model refers to the way in which firms and industries create and capture value. In the automobility sector traditional business models revolved around the production, assemblage and sale of the parts of the ICE vehicle and maintenance services. Broadly speaking, new business models in the car sector are increasingly focused on the provision of networked mobility services.
- 19 For further information about the uptake of electric vehicles in Norway see [The mobility revolution as seen through Norwegian eyes: Architectural Science Review: Vol 61, No 5](#) (tandfonline.com)
- 20 Zeniewski, P, « Electric vehicle policy in Norway », [ClimateXchange.org.uk](#), 2017.
- 21 [Social tipping dynamics for stabilizing Earth-s climate by 2050](#)

22 For further details see [Operationalising positive tipping points towards global sustainability | Global Sustainability | Cambridge Core](#)

23 [Increasing Returns, Path Dependence, and the Study of Politics on JSTOR](#)

24 [Understanding policy stability and change: the interplay of advocacy coalitions and epistemic communities, windows of opportunity, and Dutch coastal flooding policy 1945–2003: Journal of European Public Policy: Vol 12, No 6 \(tandfonline.com\)](#).

25 See [Transtions to Sustainable Development: New Directions in the Study of](#) (routledge.com). The possibility of rapid change is acknowledged by transition scholars such as Frank Geels, but the main bulk of research is still devoted to relatively long-term transitions. See [Typology of sociotechnical transition pathways - ScienceDirect](#)

## Mobility

For the Mobile Lives Forum, mobility is understood as the process of how individuals travel across distances in order to deploy through time and space the activities that make up their lifestyles. These travel practices are embedded in socio-technical systems, produced by transport and communication industries and techniques, and by normative discourses on these practices, with considerable social, environmental and spatial impacts.

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## Long-distance travel

Long-distance travel is variously defined, with reference to either distance, travel time, overnighing or being outside of a person's usual environment. When defined by distance (for example, over 100km), it typically accounts for the top 1-2% of trips.

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Aniss Mouad Mezoued, Mobile Lives Forum



#### [Transport for Suburbia: Beyond the Automobile Age, by Paul Mess](#)

Javier Caletrío



#### [Geopolitics and electric vehicles: the rise of climate protectionism](#)

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#### [Can universities learn to leave behind air travel?](#)

Tamara Ben Ari, Parke Wilde

- 1 <https://www.ipcc.ch/2022/02/28/pr-wgii-ar6/>
- 2 <https://www.nature.com/articles/d41586-019-03595-0>
- 3 <https://www.tandfonline.com/doi/full/10.1080/14693062.2020.1728209>
- 4 <https://www.pnas.org/doi/epdf/10.1073/pnas.0705414105>
- 5 <https://mikehulme.org/is-the-concept-of-climate-tipping-point-helpful/>
- 6 <https://journals.sagepub.com/doi/10.1177/0263276404046059>
- 7 <https://www.pnas.org/doi/10.1073/pnas.1900577117>
- 8 <https://www.nature.com/articles/climate.2007.65>
- 9 <https://www.wiley.com/en-gb/What+is+the+Future%3F-p-9780745696539>
- 10 <https://www.climate-kic.org/in-detail/systemiq-breakthrough-effect-report/>
- 11 <https://www.iea.org/news/demand-for-electric-cars-is-booming-with-sales-expected-to-leap-35-this-year-after-a-record-breaking-2022>
- 12 <https://press.princeton.edu/books/hardcover/9780691193083/under-the-influence>
- 13 [http://www.donellameadows.org/wp-content/userfiles/Leverage\\_Points.pdf](http://www.donellameadows.org/wp-content/userfiles/Leverage_Points.pdf)
- 14 <https://www.tandfonline.com/doi/abs/10.1080/00038628.2018.1502152?journalCode=tasr20>
- 15 <https://www.pnas.org/doi/10.1073/pnas.1900577117>
- 16 <https://www.cambridge.org/core/journals/global-sustainability/article/operationalising-positive-tipping-points-towards-global-sustainability/8E318C85A8E462AEC26913EC43FE60B1>
- 17 <https://www.jstor.org/stable/2586011>
- 18 <https://www.tandfonline.com/doi/abs/10.1080/13501760500270745?journalCode=rjpp20>
- 19 <https://www.routledge.com/Transitions-to-Sustainable-Development-New-Directions-in-the-Study-of-Long-Grin-Rotmans-Schot/p/book/9780415898041>
- 20 <https://www.sciencedirect.com/science/article/abs/pii/S0048733307000248>