Limiting climate change requires research on climate action

To realize ambitious climate targets, research should focus more on effective ways to encourage rapid and wide-scale changes in climate mitigation actions, and less on understanding climate change beliefs.

Linda Steg

What percentage of Europeans believes that climate change is not happening, and that it is not caused by human action? When I pose this question in my talks, most scientists and practitioners come up with percentages well above 20%, and in many cases even around 50%. Yet the eighth round of the European Social Survey (ESS8)[1] conducted in 2016–2017 indicates that, on average, only 2.3% of the respondents in the 23 participating countries (22 in Europe and Israel) believe that the world's climate is definitely not changing, and only 4.5% believe that the climate is probably not changing (Fig. 1). The largest proportion of true climate deniers was found in the Russian Federation, where 9.7% believe the climate is definitely not changing. Similarly, only 1.9% of ESS respondents who do not deny climate change believe that climate change is entirely caused by natural processes (with again the highest proportion, but still only 5.7%, in the Russian Federation), and only 6.9% believe it is mainly caused by natural processes (Fig. 2).

Despite this, people generally do not consistently engage in actions that would reduce climate change[2,3]. Thus, the main challenge is not that many people do not believe in the reality and anthropogenic origins of climate change, but that these beliefs do not persistently translate into climate mitigation actions[4]. The latter is particularly troublesome, as recent integrated assessment modelling studies reveal that rapid and wide-ranging changes in individual climate mitigation actions are needed to limit climate change to 1.5 °C, particularly if we do not want to employ negative-emissions technologies that are associated with significant limitations and uncertainties[5,6]. It is therefore critical to focus our research efforts on understanding which factors and strategies encourage rapid and significant climate mitigation actions across the world.

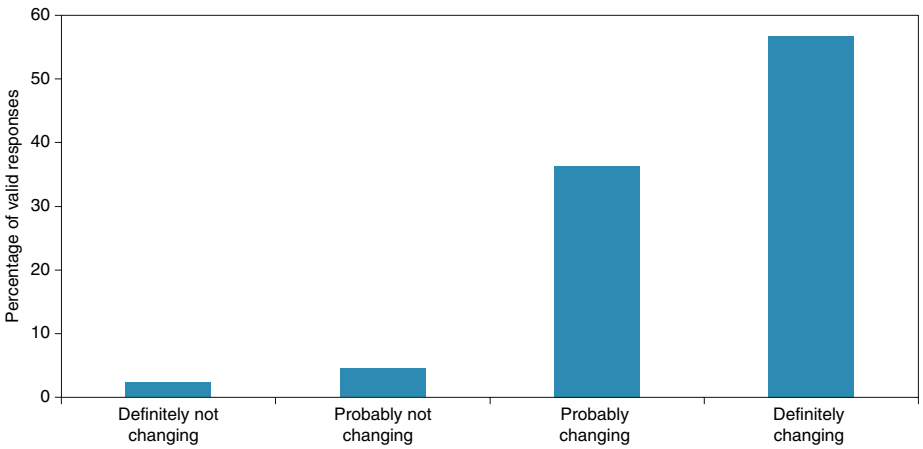

Fig. 1 | Belief in the reality of climate change. Valid responses for each response option for the question "You may have heard the idea that the world's climate is changing due to increases in temperature over the past 100 years. What is your personal opinion on this? Do you think the world's climate is changing?"[13] are plotted. Data are from the 23 countries included in ESS8 (Austria, Belgium, the Czech Republic, Estonia, Finland, France, Germany, Hungary, Iceland, Ireland, Israel, Italy, Lithuania, the Netherlands, Norway, Poland, Portugal, the Russian Federation, Slovenia, Spain, Sweden, Switzerland and the United Kingdom; $N = 43{,}288$; sample size varies across questions due to missing values, including the lack of a response and "do not know")[1].

Climate actions to achieve 1.5°C

The Low Energy Demand (LED) scenario developed by Grubler and colleagues[5] and alternative pathways to the 1.5 °C target developed by Van Vuuren and coworkers[6] both emphasize that wide-scale changes in individual behaviour and social systems are required to drastically reduce energy demand to achieve ambitious climate targets. This is not limited to changes in daily energy-use behaviour, such as changing indoor temperature settings and reducing the use of motorized transport. It also involves the uptake of renewable energy sources, low-emission technologies, energy- and materials-efficient appliances, passive houses, retrofits, sharing rather than owning appliances and equipment, living in smaller houses and dietary changes (particularly reducing meat consumption)[3,5,7].

Climate policy efforts that aim to encourage such extensive changes in climate actions will be more effective when they target key factors that motivate, enable or inhibit behaviour change. This implies that we need to better understand which factors influence climate mitigation actions in different parts of the world. Not only individual cognitions and motivations need to be considered, but also social and contextual factors that enable or inhibit climate mitigation actions[8,9]. Moreover, we need to better understand which policy approaches would be most effective in promoting the scale and pace of behavioural changes that are assumed in these scenarios and pathways. For instance, strategies that target general antecedents that encourage people to consistently engage in many different climate mitigation actions, such as environmental values, environmental self-identity and feelings of responsibility to act on climate change[8,10], may be particularly important. Although the body of knowledge on the factors that promote climate mitigation actions is growing[11], more systematic research is needed — particularly on which factors encourage mitigation behaviours with high climate impact, such as retrofitting existing buildings, reducing

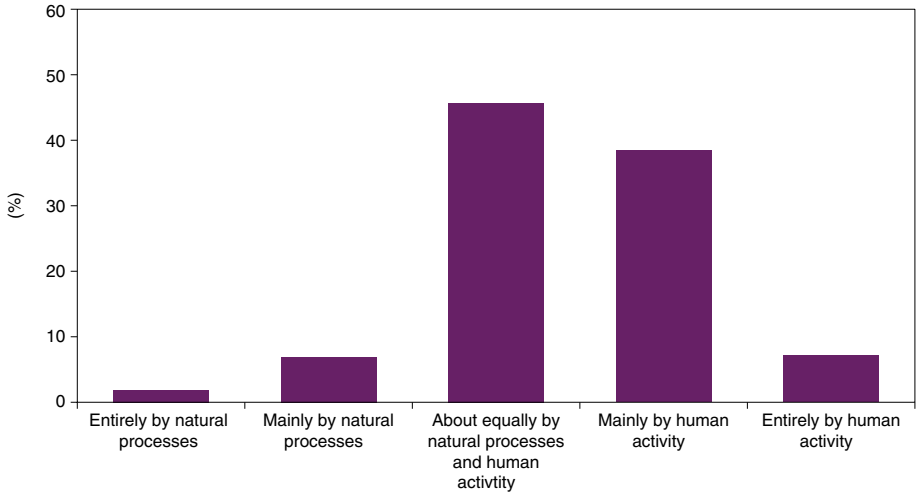

Fig. 2 | Beliefs about the causes of climate change. Valid responses for each response option for the question "Do you think that climate change is caused by natural processes, human activity, or both?"[13] among respondents who do not deny climate change are plotted. Data are from the 23 countries included in the ESS8 ($N = 41{,}884$; sample size varies across questions due to missing values, including the lack of a response and "do not know")[1].

motorized travel and meat consumption[9,12], and other behaviours included in recent pathway and scenario studies[5,6].

Feasibility of rapid change

Grubler et al.[5] and Van Vuuren and colleagues[6] demonstrate that, in theory, we can meet the 1.5 °C target despite rising population, income and activity, and without employing negative-emissions technologies that face major limitations and uncertainty, when substantial and rapid changes in behaviour and lifestyles are achieved. A critical next question is how feasible it is to achieve these rapid and transformative changes in behaviour, lifestyles, organizations, institutions and political systems that are assumed in the scenarios and pathways, and how to enhance the effects and acceptability of approaches to realize such behavioural changes in different regions of the world.

For example, the supply side of the LED scenario[5] assumes that by mid-century, no more electricity is produced from fossil fuels, about 85% of electricity is produced from renewables (wind, solar and hydro) and 15% is produced from nuclear energy. Similarly, Van Vuuren and colleagues[6] report that renewable electrification in all end-use sectors is particularly effective in limiting climate change to 1.5 °C without employing negative-emissions technologies. But to what extent are such changes in energy supply acceptable to the public? Data from ESS8 reveal that a strong increase in renewables is in line with public preferences; a vast majority (between 69% and 77%) thinks that a (very) large amount of electricity should be produced by wind, solar or hydro, while only 1–3% indicate that no electricity should be produced by these renewables (Fig. 3). Nuclear power receives far less public support; about 44% of the ESS8 sample think that nuclear energy should not be used to produce electricity at all, while only 17% think that a (very) large amount of nuclear should be used (Fig. 3). Other key questions include the conditions under which high electrification rates and integrated energy systems are acceptable to the public, and how energy demand can best be matched to the supply of renewables. Research on these topics, and on the factors influencing many of the other types of action assumed in the 1.5 °C scenarios and pathways, is still limited.

The LED scenario also assumes rapid organizational, institutional and political changes in how energy services are provided and consumed that enable and motivate individual climate mitigation actions. Important questions here include: how can such wider system changes be achieved; to what extent (and under which conditions) are such system changes effective and acceptable to different stakeholders, including the general public; and to what extent will the effects of such system changes on climate mitigation actions depend on individual cognitions and motivations.

By assuming different climate mitigation actions in the global North and global South, the LED scenario highlights the potential regional variation in climate mitigation actions. As yet, however, most studies on the factors that underlie (change in) climate mitigation actions have been conducted for high-income countries and in the global North, while far less is known about the factors that encourage climate mitigation actions in middle- and low-income countries and in the global South. More research is needed to understand such factors, and to examine which policy approaches would be most effective in promoting significant climate mitigation

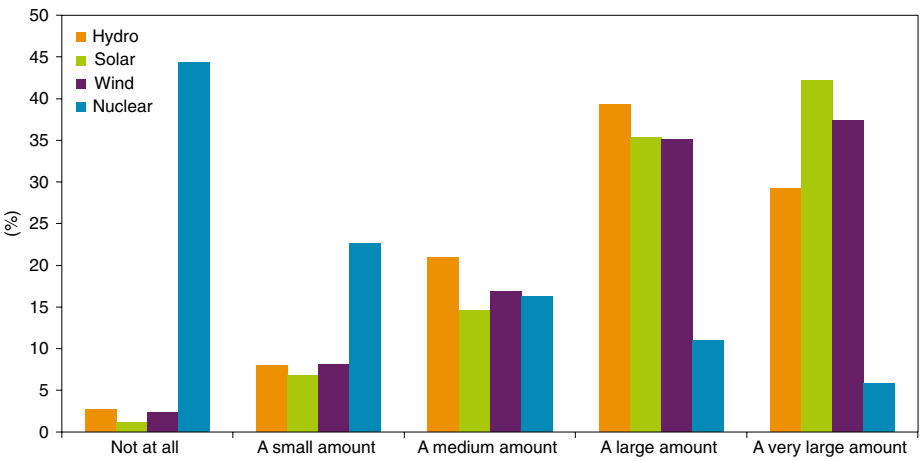

Fig. 3 | Preferences for energy sources in electricity production. Valid responses for each response option for the question "The highlighted box at the top of this card shows a number of energy sources that can be used to generate electricity. Please take a moment to look over them. How much of the electricity used in [country] should be generated from each energy source?"[13] are plotted. Data are from the 23 countries included in the ESS8 (hydro: $N = 41{,}884$; solar: $N = 42{,}586$; wind: $N = 42{,}223$; nuclear: $N = 40{,}982$; sample size varies due to missing values, including the lack of a response and "do not know")[1].

actions in different regions that align with the broader sustainable development goals.

The studies by Grubler and colleagues[5] and Van Vuuren et al.[6] demonstrate that limiting climate change to 1.5 °C by the end of this century, or even by mid-century, is feasible when people across the world rapidly adopt low-carbon lifestyles. Future studies are urgently needed to systematically examine how to achieve the accelerated and wide-scale changes in behaviour, organizations, institutions and political systems that are assumed in scenarios and pathways. This requires a close collaboration between the integrated assessment model research community and social sciences and humanities, to identify effective and acceptable ways to encourage people across the world to consistently engage in climate mitigation actions so that their collective efforts will limit climate change to 1.5 °C. ❐

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