EIT CLIMATE-KIC | WORKING PAPER | NOVEMBER 2020
Background thinking and research for *Climate Innovation Insights* Series 5

Shifting norms and values for transitions to net zero

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EXECUTIVE SUMMARY

- Most of the world's governments are failing to take the necessary actions to limit warming below 1.5–2°C and, despite unchanged energy-related CO2 emissions between 2018 and 2019 and the impacts of the 2020 coronavirus pandemic, it would be premature to conclude that global greenhouse gas emissions have peaked.

  Current policies put us on track for a warming of around 3°C before 2100. Limiting warming below 1.5°C (or 2°C) will require a five- (or three-) fold increase in ambition as set out in countries' nationally determined contributions, to achieve net zero greenhouse gas emissions globally by 2050 at the latest.

  Despite its historical leadership and stated commitment to delivering net zero by 2050, the European Union's (EU's) performance on climate change has slipped in recent years, and it is not on track to meet its own post-2020 mitigation targets.

- In the EU, economic growth has been decoupled from growth in territorial emissions. However, it is not a given that the EU can achieve the deep and rapid decarbonisation it needs to achieve net zero emissions by 2050 while maintaining historical rates of GDP growth, due to the continued economic importance of fossil fuels and exporting emissions to manufacturing countries.

  It seems highly unlikely that the deep and rapid decarbonisation needed to achieve net zero can be delivered solely or predominantly through incremental, technology-driven transitions to clean energy based on voluntary and market mechanisms.

  Instead, this transition will require systemic changes framed and driven by government policies and investments. These are needed to address fossil fuel subsidies and create enabling environments for retrofitting or early retirement of existing carbon-intensive infrastructure, abandoning planned carbon-intensive infrastructure expansions, and rapidly developing and scaling up new technologies.

- The rapid electrification of transport will be constrained by the availability of the resources required to manufacture electric vehicles and the

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renewable energy infrastructure needed to meet the additional energy demands of any electrified fleet.

Even if it can be achieved on the necessary timescales, decarbonising existing and planned energy and other infrastructure will not be enough to deliver net zero. High-impact shifts in consumer behaviours and choices will also be required, particularly in the areas of surface transport, aviation and diet, which will involve changes in agriculture and land use.

- At all levels of society, the necessary social and economic transformations to deliver net zero will require decision making outside existing economic, institutional and social norms that continue to drive emissions growth in some sectors and deliver lower-than-necessary reductions in others. These norms are closely related to values, worldviews and ideological systems that, globally, have been actively promoted by networks of vested interests.

  Individualistic and hierarchical worldviews linked with values based on self-interest are antagonistic to climate change mitigation. These have been associated with free market ideologies and ideologies of progress, as well as anthropocentric worldviews in which human beings are viewed as separate from the natural environment.

- Shifting norms in a direction that supports high-impact shifts in behaviour among the public and senior decision makers in government and business is essential for the social and economic transformations required to deliver the Paris goals.

  This can be approached through social innovation that seeks that moves beyond market mechanisms, corporate self-regulation and the encouragement of social enterprise solutions, to deliver social goals that are not necessarily driven by financial or economic motives.

- Social innovation should deploy new ideas and combinations of practices to enable social movements and communities to reclaim a central role in shaping the future. It should emphasise themes of justice, equality and human rights, to drive systemic social change. We can identify four broad approaches through which social innovation might seek to change social norms:

  - **Changing beliefs and values,** and thus shifting a group or population's view of what is acceptable and expected
  - **Appealing to people's existing values/ intrinsic motivations,** and enabling the 'activation' of pro-social and pro-environmental norms, with the aim of propagating and reinforcing these norms more widely throughout society
  - **Appealing to extrinsic motivations** by offering incentives for behaviour change, so that these incentives create new, externally driven norms
  - **Mandating behaviour change through policies** that prohibit certain types of behaviour, on the assumption that norms will align themselves with new patterns of behaviour

- Beliefs and values can be targeted by highlighting and challenging the historically dominant ideologies and worldviews that have shaped them. This might involve emulating some of the strategies used by networks of interest to propagate and entrench anti-mitigation norms and values.

- Appeals to intrinsic motivations have the potential to deliver high-impact, sustained behavioural changes among the general public. Such appeals will seek to activate pro-social and pro-environmental norms, based on values including altruism, fairness, a desire to protect the environment and concern for the psychological and future material wellbeing of their children.

  Activating these norms will involve raising awareness of climate change risks to things that people value, and providing them with mechanisms that enhance their agency to reduce emissions, either individually or by influencing government policy and the behaviour of business.

- Although appeals to extrinsic motivations can backfire by reinforcing existing—for example, economic—framings of climate change mitigation, they can play an important role in shifting norms in business and government.
- Senior decision makers are more likely to hold anti-mitigation values. In addition, their actions are likely to be constrained by institutional norms influenced by pragmatic concerns relating to finance and political economy. However, public pressure and changes in consumer and voter behaviour—driven by appeals to the intrinsic motivations of members of the public—can target extrinsic motivations in government and business.
- Social innovation can target policy directly or leverage people's intrinsic motivations to shift social norms to an extent that pro-mitigation policies become seen as acceptable or necessary. Governments are more likely to pass such policies if they believe they are supported by strong social norms.
- Engaging key influencers is crucial to all four of the above approaches. These include members of certain elites who influence public beliefs and attitudes through cues in print, broadcast and social media; faith leaders who have the capacity to emphasise religious worldviews based on stewardship of—rather than dominion over—nature; and children, who can be particularly effective in changing their parents' attitudes towards climate change.

1 Introduction: addressing the net zero challenge

The Paris Agreement set a goal of limiting global warming below 1.5–2°C above the pre-industrial global mean surface temperature. Achieving this goal requires global greenhouse gas emissions[2] to peak around 2020 and fall to net zero by around 2050 or 2070 for a 66 per cent chance of limiting warming below 1.5 and 2°C respectively (IPCC 2018).

Global energy-related CO2 emissions were unchanged between 2018 and 2019[3] and 2020 is likely to see a record drop in annual emissions due to the coronavirus pandemic (Le Quéré et al. 2020). But it would be premature to conclude that total global greenhouse gas emissions have peaked.[4]

Emissions trajectories in most countries, including most EU member states, remain incompatible with the Paris temperature goals (Le Quéré et al. 2019, UNEP 2019).[5] Current policies are projected to result in 2.8–3.2°C of warming by 2100, falling to 2.5–2.8°C if countries honour their national climate mitigation pledges and targets, some of which are conditional on the availability of international climate finance (UNEP 2019).[6]

Historically, the EU has played a key leadership role in combatting climate change, establishing emissions reductions targets relative to 1990 levels of 20 per cent by 2020, 40 per cent by 2030 and 80–95 per cent by 2050 (EC 2018). By 2018, the EU had reduced its greenhouse gas emissions by 23 per cent relative to 1990 levels, exceeding its 2020 target.

In December 2019 "the European Council endorse[d] the objective of achieving a climate-neutral EU by 2050."[7] Also in December 2019, the European Commission set out a European Green Deal to deliver net zero greenhouse gas emissions by 2050.[8]

However, EU climate leadership has lapsed in recent years. In the 2020 Climate Change Performance Index, the EU had slipped six places, out of 'high performing' to 'medium performing' (Burck et al. 2019). It is not on track to meet its 2030 emissions reduction target or the more ambitious targets required to even approach net zero by 2050.

To have any credible chance of achieving the Paris goals, 2050 is the latest (and arguably optimistic) date by which we need to achieve net zero globally. While the EU aspires

to deliver net zero by 2050, one member state has indicated that it "cannot commit to implement this objective" (European Council 2019: 1).

> Although the Paris Agreement commits countries to limiting global warming below 1.5–2°C, it is estimated that, under current policies, warming will be around 3°C before 2100. Despite its historical leadership, climate policy in the EU is not yet Paris-compliant.

To limit warming below 2°C, the level of ambition represented by commitments in countries' nationally determined contributions needs to triple globally; to limit it below 1.5°C, a five-fold increase in ambition is required (UNEP 2019). This will require "rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and buildings), and industrial systems…unprecedented in terms of scale" (IPCC 2018).

A growing body of evidence indicates that incremental changes predicated solely on smooth, technology-driven transitions to clean energy production within existing economic and political frameworks will not be enough to deliver reductions in greenhouse gas emissions on the scale, or with the rapidity, demanded by the Paris goals (for example, Allwood et al. 2019).

Technology will be an important element in net zero transitions. However, even within technology-dependent sectors, "technological innovation is sufficiently effective only if coupled with organisational innovation" (Mazzanti and Rizzo 2017, 111).

The deep and rapid decarbonisation[9] necessary to achieve net zero by or before 2050 is likely to require transformational changes in the way societies and economies function. This will involve a mix of structural, technological and behavioural changes across the whole of society (Allwood 2019, Carmichael 2019).

It will require significant changes in social and institutional norms, and in the values, worldviews and ideologies that frame and support them, particularly in wealthy countries, including EU member states. Through a review of the literature, this paper identifies norms, values, worldviews and ideologies associated with behaviour that both supports and undermines climate change mitigation, and explores how we might shift these norms to enable rapid social and economic transformation for deep and rapid emissions reductions.

2 Net zero transformations: needs and barriers

2.1 What does transformation for net zero look like?

To deliver net zero within the EU and globally, governments, industry, business and the public will need to make difficult choices around energy production and consumption, infrastructural investments, land use, transport, emissions-intensive consumption and economic policy (Carmichael 2019, CCC 2019, Parrique et al. 2019).

For example, emissions resulting from operating carbon-intensive infrastructure over its intended lifetime will breach the remaining global carbon budget for limiting warming below 1.5–2 °C, and the planned expansion of this infrastructure will add almost the same amount of emissions again (Pfeiffer et al. 2018).

Plans for such expansion must therefore be abandoned and infrastructure retrofitted or retired early, with industry, consumers and/or governments meeting the near-term costs of retrofitting or early retirement (CCC 2019). We must view these costs in the context of the large longer-term economic and other costs of inaction (Glaneman et al. 2020, Sanderson and O'Neill 2020).

This will require challenging the dominant analytical frameworks that prioritise short-term growth and economic risks and opportunities over longer-term climate risks (Rickards et al. 2014). These frameworks, which externalise environmental costs and the costs of climate change impacts, cannot accommodate large existential risks associated with non-linear change (Stern 2015, Rickards et al. 2014, DeFries et al. 2019, Lenton et al. 2019).

It is also important to consider and address the financial and other costs of fossil fuel subsidies, estimated at $372 billion annually (Bridle et al. 2019) or $5.2 trillion in 2017 if environmental and health costs and price distortions are included (Coady et al. 2019). Reallocating 10–30 per cent of these annual costs to renewables projects could play a significant role in driving the transition to clean energy that is required to meet the Paris temperature goals (Bridle et al. 2019).

Delivering net zero will require the very rapid development and scaling up of new technologies and industries. As well as wave and tidal power, hydrogen-based fuels, new manufacturing processes and non-CO2 emitting materials for industrial use, these include carbon capture, carbon storage and atmospheric CO2 removal that are integral to the net zero emissions pathways set out by the IPCC (Davis et al. 2018, IPCC 2018, CCC 2019).

However, net zero will not be achieved by decarbonising energy systems alone, and new zero carbon technologies will not be developed rapidly enough to play a significant role in delivering the necessary near-term deep and rapid emissions reductions (Allwood et al. 2019).

Net zero will not be achieved by decarbonising energy systems alone and new zero carbon technologies will not be developed rapidly enough to play a significant role in delivering the necessary near-term emissions reductions.

Decarbonisation will be particularly challenging in certain sectors, such as surface transport, aviation and agriculture (CCC 2019). For example, the rapid electrification of transport will be constrained by resource availability and electricity generation capacity, as producing batteries for electric vehicles and building the infrastructure required to generate the additional electricity needed will place enormous demands on raw materials.[10] Indeed, estimated requirements based on existing technologies would exceed available resources for five key metals (Tokimatsu et al. 2018).

Biofuels provide a potential alternative fuel source for surface transport and aviation. However, expanding biofuel production will compete with agriculture and other land uses such as afforestation and rehabilitating ecosystems for carbon sequestration. Reducing emissions from surface transport is therefore likely to require reducing our reliance on private vehicle use and ownership, and/or reducing vehicle size (Allwood et al. 2019).

Limited scope for scaling up aviation biofuels, residual emissions associated with their production and use, and the long timescales associated with developing electric aircraft and CO2 removal technologies mean the only way of achieving larger reductions in aviation emissions is by

reducing flying (Lokesh et al. 2015, Geden et al. 2018, 2019, Allwood et al. 2019, O'Connell et al. 2019, Prussi et al. 2019, Schäfer et al. 2019).

Reaching the necessary reductions in agricultural emissions will require reducing beef and mutton/lamb consumption by at least 50 per cent and reducing dairy consumption in the absence of substantial advances in technology (Bryngelsson et al. 2016).

Transformation for net zero will require significant public investment, policy shifts and changes in regulatory environments to enable these changes. Systemic change driven by government policy will need to facilitate and act in concert with actions by businesses and individuals.

Transitioning away from emissions-intensive industrial processes, shifting investment out of carbon-intensive infrastructure, retrofitting carbon-intensive domestic energy and heating systems, expanding the use of public transport and facilitating wider behavioural and societal shifts needs to be accompanied by "…high-impact shifts in consumer behaviours and choices…that are consistent with the scale of the climate challenge, build optimism and commitment, and give weight to new ambitious narratives that inspire wide public participation" (Carmichael 2019: 5). Critically, this will require high-impact behavioural shifts in government and businesses, involving decision making outside of existing frameworks and norms.

Despite the proliferation of national and sub-national net zero targets globally and within the EU, approaches to climate change in both contexts have tended to shy away from large-scale behaviour change, instead relying on voluntary schemes and financial and market mechanisms (Bryant 2016, Ciplet and Roberts 2017, Schneider and La Hoz Theuer 2019). EU climate action emphasises emissions trading, forests and land use, and technological solutions to emissions reductions; behavioural change is essentially absent from high-level policy action.[11]

2.2 Emissions and economic growth

There is evidence of a decoupling of emissions from economic growth in several contexts. This includes—arguably most notably—the EU, where large reductions in territorial emissions have occurred despite continued economic growth (EC 2018, Piłatowska and Włodarczyk 2018). However, recent EU emissions reductions have been well below those required to meet the Paris temperature goals.

In 2018, EU emissions fell by 2 per cent, with those covered by the EU Emissions Trading Scheme (ETS) declining by 4.1 per cent (EEA 2019).[12] Both these figures are considerably lower than the global annual reduction of 7.5 per cent required to deliver net zero by 2050 and limit warming below 1.5°C (UNEP 2019).

To meet the 2°C threshold, emissions must fall by 2.7 per cent per year. This is greater than the EU-wide reduction but lower than the reduction in emissions covered by the ETS. However, global figures (UNEP 2019) are based on the IPCC's (2018) mitigation pathways, which assume varying levels of reliance on future negative emissions technologies that have not been demonstrated at scale and have received little policy attention in the EU (Geden et al. 2018, 2019, Larkin et al. 2018, Allwood 2019).

At current emissions levels, we are also likely to exceed the remaining carbon budget that is compatible with limiting warming below 1.5°C by around 2030; by some estimates, we may have already exceeded it (IPCC 2018, Rogelj et al. 2019). We should therefore view these prescribed global emissions reductions as optimistic.

The EU might accelerate its historical decoupling of emissions and economic growth with bolder climate policy and high-impact behavioural change. However, whether it can reduce emissions to net zero by 2050 while maintaining current levels of economic growth remains an open question, given the required rapidity of emissions reductions and the EU's continued dependence on fossil fuels, which accounted for over 70 per cent of primary energy consumption in 2017 (EEA 2020).

Delivering net zero will mean accelerating decarbonisation in sectors covered by the ETS, and reducing emissions very rapidly in sectors outside the ETS, for which emissions declined by only 0.9 per cent between 2017 and 2018, following several years of increase.[13] Emissions reductions are particularly challenging in the transport, building, agriculture and waste sectors.

It must also be noted that some of the EU's apparent historical reduction in territorial emissions is the result of member states exporting emissions to manufacturing nations outside the EU (Pié et al. 2018, Fezzigna et al. 2019, ONS 2019, Parrique et al. 2019).

These factors raise doubts about the real magnitude of the EU's historical decoupling of growth and emissions, and whether it can accelerate it to such an extent that growth

can continue unabated alongside the deep and rapid reductions in emissions that are necessary to meet the Paris temperature goal.

> Despite an apparent decoupling of economic growth from emissions in the EU, recent emissions reductions fall short of optimistic estimates of global annual percentage reductions required to limit warming below 1.5–2°C, which depend on largely notional negative emissions technologies.

2.3 Emissions across EU member states

Despite declining emissions in the EU overall, mitigation performance is uneven across member states. Between 2005 and 2016, emissions increased in Malta, the Czech Republic, Estonia, Poland, Lithuania, Latvia and Bulgaria.[14]

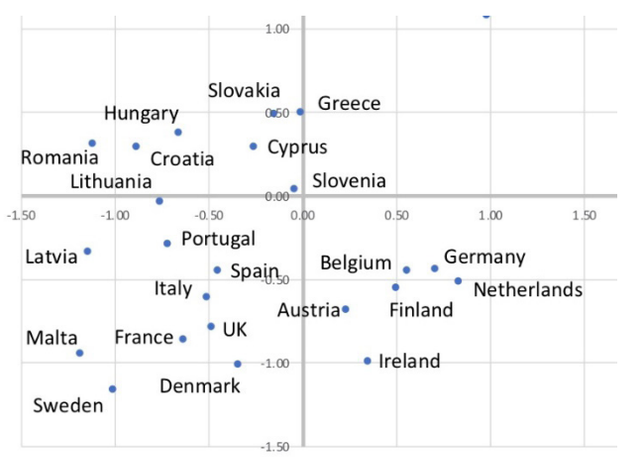
In 2017, Lithuania, Latvia, Romania and Estonia reported large reductions relative to 1990, with emissions down by 57, 56, 54 and per cent respectively. Cyprus, Portugal and Spain all reported large increases, of 56, 23 and 22 per cent respectively (Eurostat 2019). In the same year, seven countries were responsible for three quarters of the EU's emissions: Germany (22 per cent), the United Kingdom (11 per cent), Poland (10 per cent), France (9.8 per cent), Italy (9.8 per cent), Spain (7.8 per cent) and the Netherlands (4.7 per cent).

Figure 1 illustrates the EU's diverse emissions landscape, plotting carbon intensity (CO2 emissions per unit of economic production/GDP) against CO2 emissions per capita to provide a composite measure of 'carbon efficiency'. Units on both axes are standard deviations from the mean across the 28 EU member states in 2019.[15] This allows countries to be grouped into four categories or quadrants, with the seven highest emitters in absolute terms highlighted in bold:

1. Low emissions per capita and high emissions per unit of GDP (upper left): Bulgaria, Croatia, Cyprus, Greece, Hungary, Romania, the Slovak Republic and Slovenia, representing 9.3 per cent of EU emissions, with the largest contributor being Romania at 2.1 per cent
2. High emissions per capita and unit of GDP (upper right): Czech Republic, Estonia and **Poland**, representing 13.6 per cent of the EU's emissions, with Poland contributing 10 per cent and the Czech Republic 3.1 per cent
3. High emissions per capita and low emissions per unit of GDP (lower right): Austria, Belgium, Finland, **Germany**, Ireland, Luxembourg and the **Netherlands**, representing 34.4 per cent of EU emissions, with Germany alone responsible for 22 per cent
4. Low emissions per capita and unit of GDP (lower left): Denmark, **France**, **Italy**, Latvia, Malta, Portugal, Spain, Sweden and the **United Kingdom(UK)**, representing 41.2 per cent of EU emissions, with France, Italy, **Spain** and the UK accounting for 38.4 per cent

Categories 1 and 2 are predominantly populated by countries in Eastern and Central Europe, and Greece. Dependence on coal is significant or high in Poland (77.4 per cent), Greece (60.9 per cent), the Czech Republic (55.5 per cent), Bulgaria (48.6 per cent), Germany (34.1 per cent), Slovenia (26.6 per cent), Romania (17.5 per cent), Hungary (11.5 per cent) and Slovakia (7 per cent). Croatia obtains almost half its energy from oil and gas[16] and Estonia is heavily reliant on shale oil.[17] In these countries, rapid transitions from fossil fuel to renewable energy can deliver large reductions in emissions.

Figure 1. Emissions per unit of GDP (carbon intensity) plotted against emissions per capita for the 28 EU member states in 2019



Source: Based on Global Carbon Atlas 2018 emissions data[18] and World Bank GDP and population data[19]

Note: Expressed in standard deviations from the mean.

Categories 3 and 4 cover Western Europe, the Nordic countries and Latvia, and include six of the seven highest emitters in absolute terms. These countries are all in Western Europe, where large populations and economies are the major factors behind high total emissions. The fact that around two-thirds of EU emissions are generated by the countries with the lowest carbon intensity, and that about half of these emissions are generated by the member states with the lowest per capita emissions, underlines the need for transformational changes in energy production and consumption and in non-energy related sectors and activities that generate emissions.

High absolute and per capita emissions in Germany are in part due to a significant reliance on coal, which provided 34.1 per cent of its energy in 2017. Luxembourg has the highest GDP per capita in the EU by a considerable margin, and its very high per capita emissions are most readily explained by high levels of affluence and consumption.

In Category 3 and 4 countries, continued transition to renewables will deliver further reductions in emissions. However, this will need to be accelerated and complemented by other measures, including developing new renewable energy sources such as wave and tidal energy, new (for example, hydrogen-based) fuels, sustainable bioenergy and carbon capture and storage, greater energy efficiency and changes in industrial processes and land use (CCC 2019).

This will require shifts in policy and investment, and thus in the behaviour of senior decision makers and the institutional environments that frame and constrain their decision making. Changes in consumer behaviour to address emissions from household consumption are particularly urgent in the areas of surface transport, aviation, heating and diet (Allwood et al. 2019, Carmichael 2019). Such changes will ultimately be required across the EU, including in countries that can make initial large reductions by shifting from fossil fuels to renewables.

2.4 Institutional and social barriers to deep and rapid emissions reductions

Within the EU and globally, significant institutional and policy-level barriers to deep and rapid decarbonisation prevent government, industry and business from taking the decisions needed to facilitate deep and rapid decarbonisation. Structural and political economy barriers to such action in government and business include perverse economic and political incentives; institutional complexity and inertia including sunk costs, tensions between collective action and short-term private gain; a lack of vision, leadership and capacity for mitigation; and the influence of vested interests (Rickards et al. 2014).

For example, governments with links to fossil fuel producers through networks of influence, that have limited means and institutional capacity to adopt alternative policies, and that face wider political economy challenges will all struggle to remove fossil fuel subsidies and change regulatory environments to hasten the shift from carbon-intensive to renewable energy production (Victor 2009, Whitley and van der Burg 2015, Rentschler and Bazilian 2017, Newell and Johnstone 2018).

At the same time, governments whose instincts incline towards more incremental, market-oriented mechanisms in a context of light regulation/deregulation will find actions to move away rapidly from fossil fuels or reform energy systems via changes in legislation and regulatory regimes conceptually challenging (Rosewarne 2010, Bryant 2016). They may view the costs of net zero transitions—estimated at 2.5 per cent of global GDP (IPCC 2018) and 1–2 per cent of GDP in the UK (CCC 2019)—as prohibitive, particularly when looking through the lens of economic competitiveness and financial efficiency. Governments may also worry that the public or elite interests will challenge radical policy changes that they are not inclined to make in the first place. Firms may be reluctant to invest in rapid transitions when this would mean the early retirement of infrastructure and abandoning assets that are still economically productive (sunk costs).

These pragmatic considerations and structural factors related to political economy are framed by institutional cultures, paradigms and norms. Prioritising short-term economic risks and opportunities over longer-term environmental and climate change risks is one such norm, underpinned by institutional values of competitiveness and profitability, reinforced by business models that need to satisfy shareholders and markets (Rickards et al. 2014).

Another such norm, economic discounting, is associated with values that prioritise the present over the future, locked in by the use of analytical frameworks based on cost and benefit considerations that are poorly suited to assessing large non-linear changes and existential risks (Caney 2014, Rickards et al. 2014, Stern 2015, Dietz et al. 2016, DeFries et al. 2019, Lenton et al. 2019).

These frameworks' inability to address longer-term risks and "major, non-marginal change" make climate change "the greatest and widest-ranging market failure ever seen" (Stern 2015: 6).

The factors discussed here mean that "access to robust and compelling climate science evidence is not a sufficient basis for decisive climate change action" (Rickards et al. 2014: 4). However, despite the host of structural and institutional factors influencing decision making, decisions are taken by individuals within institutions.

Given that a relatively small number of corporations are ultimately responsible for most of the world's emissions, senior decision makers in these firms and the governments with whom they interact wield considerable power to determine emissions pathways and climate change trajectories.

Pragmatic considerations, political economy and institutional norms and values interact with, shape, and are shaped by the values of these decision makers, who are "particularly resistant to taking significant action" (Rickards et al. 2014: 2).
This resistance to change has also been associated with a dominant intellectual order shaped by the narrow disciplinary backgrounds and perspectives of senior decision makers in economics, law and/or business management; technocentric or 'techno-optimist' worldviews; values based on non-interventionism associated with neoliberal economic ideologies; personal values associated with emissions-intensive lifestyles; male dominance and risk perceptions shaped by masculinity ideals; and "an instrumental and dismissive attitude toward the environment"
(Rickards et al. 2014: 4).

Among the general public, there are "cognitive, behavioral, and structural obstacles to voluntary mitigation" (Semenza et al. 2008: 479). These include a lack of enabling infrastructure, a belief that inaction by others renders personal action irrelevant, fatalism regarding the inevitability or intractability of climate change, mistrust of information sources, as well as scepticism about the reality of climate change, the extent to which it is caused by human activity, and the need for and likely efficacy of mitigation actions (Lorenzoni et al. 2007). People are less likely to accept information about climate change if it conflicts with their personal experiences and values (Lorenzoni et al. 2007, Dunlap and McCright 2008, McCright 2011, Bliuc et al. 2015).

Public perceptions of and attitudes towards climate change are influenced, however, by messaging from politics and industry via the news media (Carmichael and Brulle 2017, Hornsey and Fielding 2019), while public norms and values have been shaped by business interests operating through networks of influence since the mid-twentieth century (Plehwe 2014, Salles-Djelic 2017). In turn, the actions of senior decision makers are influenced by the perceived norms and attitude of the public, as well as the norms of their peers (Rickards et al. 2014).

The necessary social and economic transformations to deliver net zero will require decision making outside the economic, institutional and social norms that continue to drive emissions growth in some sectors and are delivering lower-than-necessary reductions in others.

This will need to happen at all levels of society and involve individual citizens and decision makers in government, industry and business. Achieving these transformations will mean challenging these norms and the values, worldviews and ideologies that underpin them—values and ideologies that often go unexamined or unnoticed in discussions of climate change mitigation (Hoffman 2010).

> At all levels of society, the social and economic transformations needed to deliver net zero will require decision making outside existing economic, institutional and social norms that drive emissions growth in some sectors and deliver slower-than-required reductions in others.

3 Norms, values, worldviews and ideologies in the climate arena

3.1 Social norms and climate change

A large body of literature relates beliefs about, and attitudes towards, climate change to norms, values and worldviews (see, for example, Nilsson et al. 2004, de Groot and Schuitma 2012, Aksit et al. 2017).

Farrow et al. (2017: 2) define social norms as "shared rules of conduct that are partly sustained by approval and disapproval". These rules are inherently implicit and the unplanned result of individual interactions; they also determine what is and is not perceived as acceptable in a society or group.[20]

De Groot and Schuitema (2012) define social norms as "beliefs about what is commonly done or (dis)approved by relevant others in a particular situation." Highlighting the importance of perceived social norms for the acceptability of environmental policies, they explore how more coercive policies and those with higher cost implications for target populations are considered more acceptable when there is a 'strong social norm' indicating perceived majority support for these policies.

Gifford et al. (2011: 3) describes the importance of social norms in supporting climate mitigation behaviour, stating that an individual must believe that the behaviour in question "is normal and congruent with the expectations of important reference individuals or groups."

But social norms may also represent obstacles to action on climate change. For example, Schmid-Petri (2017) discusses how the norm of 'balance' in print and broadcast media can amplify minority views that are in conflict with scientific consensus.

Consumerism and expectations around the right to consume in pursuit of a good standard of living represent another norm associated with high emissions levels (Lorenzoni et al. 2007, Pié et al. 2018, Fezzigna et al. 2019, ONS 2019).

Linked to consumerism are other emissions-intensive norms related to the acceptability of private vehicle use (Kormos et al. 2015), frequent flying for business and leisure (Cohen et al. 2011, Gössling 2019), high levels of meat consumption (Gifford and Chen 2017) and 'fast fashion' (Mair et al. 2015).

It is also possible for conflicting norms—such as materialism and environmentalism—to coexist within a society (Markowicz and Shariff 2012). For example, the historically predominant norm that flying is a normal and acceptable activity, signalled by the behaviour of others and the low price of air travel, is increasingly in conflict with an emerging norm that labels flying as an activity that should attract disapproval, based on emissions considerations (Gössling 2019, Hasberg 2019, Korkea-aho 2019).

A shift in norms may be occurring here, where an activity that was once socially acceptable is becoming unacceptable—or at least the object of disapproval. Such a shift may occur first within certain groups in society before propagating more widely.

In government and business, several norms privilege considerations of short-term economic risks and opportunities over those of environmental sustainability and climate change risks. Prioritising economic growth as a primary policy objective is more-or-less universally accepted, and indeed, mandatory (Victor 2010). Other norms include routinely using cost-benefit analysis frameworks and economic discounting, and favouring market mechanisms, voluntary schemes and technological approaches to deliver emissions reductions (Schlichting 2013, Rickards et al. 2014, Stern 2015, Ciplet and Roberts 2017, DeFries et al. 2019, Schneider and La Hoz Theuer 2019). Several of these norms, acting alongside structural and political economy factors, are evident in low carbon prices and high emissions caps in emissions trading schemes (Boyce 2018).

3.2 Norms and values

Figure 2 shows the relationship between norms and values, which are simple guiding principles that frame an individual or group's interpretation of and interaction with the world (Lopez and Cuervo-Arango 2008, Aksit et al. 2017).

Certain values have been associated with enhanced concern about climate change and greater support for climate change mitigation. These include 'biospheric' values, associated with concern for the wellbeing of nature for its own sake, and altruistic values, which reflect concern for the wellbeing of other humans. Altruism is a 'self-transcendent' value that emphasises collective interest over self-interest (Aksit et al. 2017).

Individualistic and hierarchical values, on the other hand, have been associated with climate scepticism. The former are related to "the extent to which people prioritise the needs of individuals versus a communitarian focus on collectives and society" and the latter to "the extent to which people see hierarchies of status and power as normal and natural versus a more egalitarian worldview." Individuals with these values "are more inclined to value elites and powerful interests, and so by extension are motivated to reject the notion that industry will put the environment at risk" (Hornsey and Fielding 2019: 7).

Stern (2000: 414) highlights that "Self-enhancement or egoistic values and 'traditional' values such as obedience, self-discipline, and family security are negatively associated with pro-environmental norms in some studies." Steg et al. (2004) also find a negative relationship between 'hedonic' values, that emphasise pleasure and comfort, and pro-environmental attitudes, preferences and behaviours.

Values can be translated into norms through 'extrinsic' or 'intrinsic' motivations (Nilsson et al. 2004, Gifford et al. 2011, Markowitz and Shariff 2012). Extrinsic motivations relate to external incentives that encourage individuals or other entities—such as governments and corporations—to act in a certain way. These incentives can be economic, financial or related to conformity to perceived social norms, based on a desire to seek approval or avoid disapproval (Farrow et al. 2017, Davis et al. 2018).

Over time, norms can change as a result of changes in behaviour driven by extrinsic motivations—for example, as a result of policy interventions to encourage or discourage certain behaviours—as beliefs become aligned with new patterns of behaviour (Farrow et al. 2017).

Appeals to extrinsic motivations are often used "to 'nudge' citizens toward desired behavioural outcomes via low-cost and socially acceptable approaches…to change behaviour in a low-impact manner with little regulation" (Gifford et al. 2011:15).

However, such approaches may be inadequate in driving more significant, 'high-impact' behavioural changes.

A focus on the economic and financial benefits of pro-mitigation behaviours may also backfire, encouraging people to focus on behaviour changes associated with economic rewards at the expense of other changes that might be more important (Corner et al. 2019).

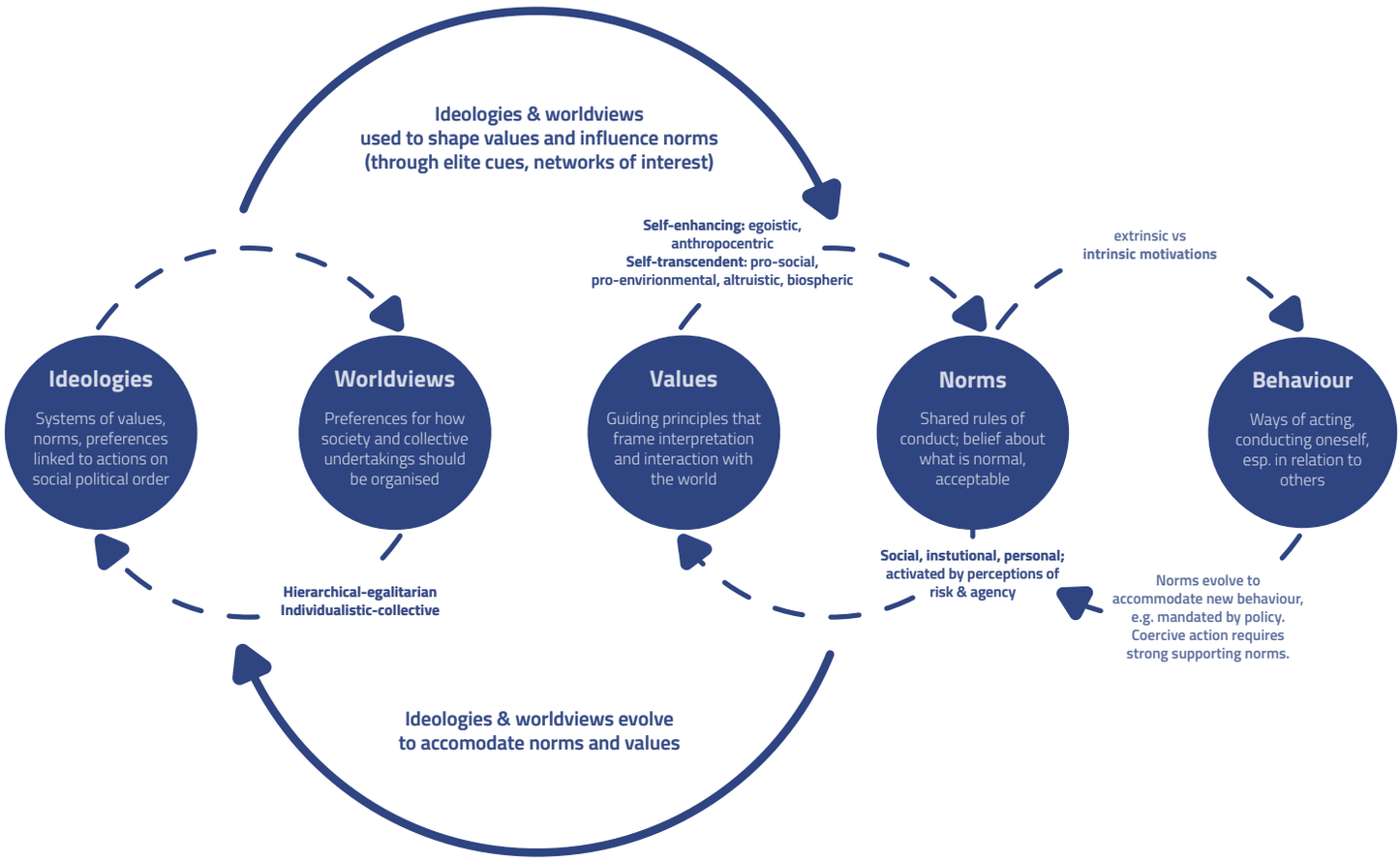
More fundamentally, a focus on such extrinsic motivations can create conflict between the opposing values of materialism and environmentalism, reinforcing the former through an economic framing of climate change that hinders more fundamental shifts (Crompton 2011, Markowitz and Shariff 2012).

> Social norms can be driven by 'extrinsic' motivations related to perceived societal (dis)approval and (for example, financial) incentives, or by 'intrinsic' motivations based on individual values and perceptions of risk.

Intrinsic motivations relate to personal values that may not be used by default—for example, where circumstances make it difficult for an individual to put their values into practice. Reviewing theories of how norms and values relate to behaviour, Stern et al. (1999) and Stern (2000) propose that environmental beliefs are based on personal values, and that pro-environmental behaviour follows from personal norms.

These norms are activated when an individual believes that environmental conditions threaten something they value, and that they can reduce this threat. Applying this 'risk-agency' model to climate change, pro-mitigation behaviour should follow from a belief that climate change threatens something of value—such as nature, culture, rights, property, welfare or future generations—combined with a belief that an individual's actions can make a meaningful contribution to reducing emissions (Gifford et al. 2011).

Figure 2. The relationships between norms, values, worldviews, ideologies and behaviour, based on the literature reviewed in the text



3.3. Worldviews and ideologies

Norms and values are closely related to worldviews (figure 2)—or "preferences for how society and other collective undertakings should be organized" (Kahan et al. 2012)—which influence individuals' beliefs and perceptions of risk (Aksit et al. 2017). Worldviews have been understood in relation to the two dimensions of hierarchy-egalitarianism and individualism-communitarianism (Aksit et al. 2017).

The pro-social, pro-environmental, self-transcendent, biospheric and altruistic values discussed above are associated with more egalitarian and communitarian worldviews, while self-enhancing and egoistic values are associated with more hierarchical and individualistic worldviews. Adherence to the former values and worldviews is positively related to climate-change risk perceptions, and vice versa (Aksit et al. 2017).

Values and worldviews are closely linked with political and economic ideologies (figure 2), or "system[s] of values, norms and political preferences, linked to…program[s] of action vis-à-vis a given social and political order" (Carvalho 2007).

Rickards et al. (2014: 2) explicitly link climate inaction with specific ideologies and worldviews, describing it in terms of 'non-decision making' borne of "a deliberately non-interventionist approach [that] aligns with the still-dominant political philosophies of neoliberalism, ecological modernization, and free-market environmentalism".

Bailey and Wilson (2009) argue that "the neoliberal, technocentric, and ecological modernisation values underpinning the carbon economy create serious obstacles for the incorporation of alternative or complementary transitional strategies."

Antipathy towards climate science and policy has been linked with free market ideology (Hornsey and Fielding 2019) and "core elements of conservative ideology but also faith in science and technology, support for economic growth, faith in material abundance, and faith in future prosperity" (McCright 2011: 247).

Smith and Mayer (2019: 17) find that "the role of political and ideological polarization…is exceptional in shaping climate change attitudes" in English-speaking countries, where "the effect of party affiliation and free-market ideology on the perception of climate change's danger and importance is strongest."

Numerous studies have documented the tendency in English-speaking countries for those on the political left to accept the reality of anthropogenic climate change and those on the right to reject or question it (Dunlap and McCright 2008, McCright 2011, Fielding et al. 2012, Bliuc et al. 2015, Ehret et al. 2018, McCright et al. 2016, Smith and Meyer 2019).

In English-speaking countries, political polarisation around climate change is closely related to accepting or rejecting free market ideology. This has been fostered by vested interests who have shifted their focus from climate science to climate policy as the science becomes more difficult to dispute.

Vested interests opposed to climate change mitigation and their associated networks of climate denial—largely focused around free market thinktanks that actively promote anti-mitigation values and worldviews—have consciously engineered this polarisation around political ideologies (Plehwe 2014, Salles-Djelic 2017, Hornsey et al. 2018).

Carmichael and Brulle (2017) discuss how elite cues—that is, positions on climate change taken by political and business elites propagated through partisan news media—strongly influence levels of public concern about climate change. Special interest groups use such cues to spread doubt, uncertainty and misinformation about climate change science (Antilla 2005).

As the science of climate change becomes more difficult to dispute, these vested interests have shifted their focus away from the science towards the impacts of climate policies—for example, on consumers (Cann and Raymond 2018). When partisan cues on policy are aligned with those on general perceptions of climate change, polarisation is amplified. However, it is not diminished when these cues are at odds with each other, indicating that cues on perceptions are more powerful than those on specific policies (Ehret et al. 2018).

The relationship between conservatism and climate scepticism is not universal (Hornsey and Fielding 2019), and the strong political polarisation around climate change apparent in the Anglosphere is not reproduced in EU countries (Hornsey et al. 2018). Furthermore, Poortinga et al. (2019) find low levels of scepticism about the reality of climate change and its anthropogenic causes in EU member states compared with the United States and Australia (Hornsey and Fielding 2019), while a 2019 Eurobarometer survey found very high levels of support for net zero targets and measures to achieve them (EC 2019).

The strong link between climate scepticism and political conservatism in some English-speaking countries is not universal. However, some degree of political polarisation is apparent in the EU, particularly in Western Europe.

Nonetheless, there is a degree of political polarisation in EU and other European countries. In the EU, scepticism is highest—and perceived negative climate change impacts and concern about climate change lowest—among men, conservatives and those placing themselves on the right of the political spectrum (Poortinga et al. 2019).
In the UK, where levels of scepticism are in line with those across the EU (Poortinga et al. 2019), there is significant polarisation, with Conservative Party supporters less likely to accept the scientific consensus on climate change (Whitmarsh 2011, Poortinga et al. 2011, Johnstone and Deeming 2016).

In Norway, Aasen (2017) finds greater concern for climate change among those holding less individualistic and more egalitarian worldviews. This study also finds increasing polarisation over time that may be due to more focus on policy instruments in the political debate.

There is potential for political polarisation around climate change in the EU to increase, given the rise of right-wing populist parties and the potential for fossil fuel interests to resist more stringent mitigation policies in some member states (box 1).

3.4 An ecology of norms, values, worldviews and ideologies

Based on the literature discussed above, we can identify a set of predictors of resistance to climate change science and mitigation policy, encompassing norms, values, worldviews and ideologies, many of which are closely interrelated and act to reinforce each other.

For example, norms such as vehicle ownership, flying and meat-rich diets are part of consumer lifestyles predicated on values of individualism, in which people should be free to make their own consumer and lifestyle choices. They involve externalising environmental and climate change impacts and costs, and thus reflect anthropocentric values embedded in worldviews predicated on an instrumental view of the environment as something separate from the social sphere, to be used for human ends (Rickards et al. 2014, Asafu-Adjaye et al. 2015, Crist 2015, Symons and Karlsson 2018, Conrad 2019).

Consumerism, individualism and externalising environmental costs are closely aligned with free market ideologies that view market interactions, facilitated by an otherwise non-interventionist state, as the key drivers of technological innovation and economic growth. These, in turn, are seen as instrumental to a goal of improving material conditions for most, but necessarily not all, members of society (Olroyd 1983).

This package of related norms, values, worldviews and ideologies is framed by a deeply rooted belief in progress (Rostow 1960, Sanderson 1990, Spadafora 1990, De Benoist 2008, Cervantes 2013, Mouzakitis 2017), the application of evolutionary theory to the social and economic realm (Hallpike 1985, Olroyd 1983, Arnhart 2005) and a view of humanity as separate from nature (White, 1967, Harrison 1999, Cervantes 2013, Asafu-Adjaye et al. 2015, Conrad 2019).

In the United States, fossil fuel producers have consistently framed narratives around fossil fuel production and consumption using the idea of progress (Dunlap and McCright 2011, Matz and Renfrew 2015). In January 2020, the American Petroleum Institute launched a national campaign entitled 'Energy for Progress'.[21]

> The norms, values, worldviews and ideologies that drive high emissions and act as barriers to deep and rapid decarbonisation are framed by the ideas of progress, of humanity as separate from and dominant over the natural world and by applying evolutionary theory to the social and economic realm.

Changes in social norms among the general public and senior decision makers in government, industry and business will be critical for achieving net zero goals intended to limit warming below 1.5–2°C.

Shifting social norms can be addressed by social innovation, which seeks to identify and implement new ways of driving social change, based on new ideas and new combinations of practices in specific social contexts, aimed at social goals and not necessarily driven by financial or economic motives (Pol and Ville 2008, van der Have and Rubalcaba 2016, Angelidou and Psaltoglou 2017).

Wright and Nyberg (2019) argue that, to address climate change, social innovation must break free of fashionable views of innovation based on market mechanisms, corporate self-regulation and the encouragement of social enterprise solutions. Instead, it should enable social movements and communities to reclaim a central role in shaping the future, emphasising themes—indeed values—of justice, equality and human rights, to drive systemic social change.

Based on the above discussion, we can identify four broad approaches to changing social norms:

1. **Changing beliefs and values**, and thus shifting a group or population's view of what is acceptable and expected

2. **Appealing to people's existing values/intrinsic motivations**, and thus activating existing pro-social and pro-environmental norms, to propagate and reinforce them more widely throughout society

3. **Appealing to extrinsic motivations** by offering incentives for behaviour change to create new, externally driven norms

4. **Mandating behaviour change through policies** that prohibit certain types of behaviour, on the assumption that norms will align themselves with new patterns of behaviour

Approach 3 appeals to, and may legitimise and reinforce, values such as self-interest that are negatively related to concern about climate change (Stern 2000, Aksit et al. 2017). As such, it may be counterproductive, emphasising low-impact changes, diverting attention away from potentially higher-impact changes, locking in existing problematic framings of climate change and being unsustainable if incentives are removed.

Approach 4 requires policy intervention by government and indirectly addresses norms and values only indirectly. It is likely to involve coercive interventions that are only considered politically possible where they are already seen as acceptable as a result of strong social norms (de Groot and Schuitma 2012).

For these reasons, the following discussion focuses mostly on Approaches 1 and 2. We consider Approach 3 for institutional contexts relating to government and business only, where institutional constraints on decision makers mean there is likely to be less potential for changing norms through Approaches 1 and 2.

We only consider Approach 4 indirectly under discussions of the other approaches, in terms of campaigns that might shift social norms to the extent that civil society signals may indicate to governments that such coercive policies—directed either at the public or business/industry—are more acceptable. After exploring the different approaches, we examine the key agents of change who might be engaged in social innovation campaigns.

> Social innovation to drive shifts in social norms might seek to change norms by altering beliefs, values and worldviews, appealing to intrinsic motivations based on existing values or appealing to extrinsic motivations via incentives.

Box 1

Political polarisation around climate change in the EU

While political polarisation and organised climate change denial are less prevalent in the EU than in the Anglosphere, this could change. Hornsey et al. (2018: 616-617) note that "The size of the relationship between climate scepticism and conservative ideologies is positively correlated with national per capita carbon emissions."

Per capita emissions are a proxy not only for fossil fuel reliance, but also for vested interests around climate change. In this context, it is notable that political conservatism is negatively related to climate change beliefs in Germany (Ziegler 2017), which has high per capita emissions and the highest emissions in the EU (figure 1).

The greater concentration of vested interests in countries that are highly dependent on fossil fuels can result in more elite cues intended to coach conservatives (and potentially other groups) in how to think about climate change (Hornsey and Fielding 2019). In this context, it is notable that the EU nations that are most reliant on fossil fuels and exhibit the highest levels of climate scepticism are in Eastern and Central Europe (Poortinga et al. 2019).

The weaker relationship between political orientation and climate change attitudes in Eastern and Central Europe may be a result of the historically low profile of environmental issues in these countries, where parties have not competed for green votes and green issues—

Box 1

including climate change—have not become politicised (Poortinga et al. 2019).

Such politicisation could occur as national or EU-wide climate policy becomes more stringent in pursuit of net zero targets, activating vested interests to oppose mitigation. These interests may also find support from global networks of interests that oppose climate change mitigation on ideological grounds (Stone 2000, Plehwe 2014, Salles-Djelic 2017).

The rise of right-wing populism in Europe could also increase polarisation around climate change and place climate policy increasingly at risk. Right-wing populist parties tend to oppose climate and energy transition policies, and multilateralism and international cooperation in general (Schaller and Carius 2019).

While public support for more ambitious and rapid decarbonisation is strong within the EU, this may not translate into support for decarbonisation mechanisms, policies or pathways, particularly where people perceive these as having high economic or social costs, or differential impacts that disadvantage sections of society or interest groups. Populist parties and fossil fuel interest groups might build on scepticism about climate change science or policy, particularly in countries that still rely heavily on fossil fuels.

In the United States and other English-speaking countries, values and worldviews linked with free market ideology have provided the principal vehicles for political polarisation around climate change. These may be less effective in the EU, where free market ideologies and their associated values of deregulation and non-intervention arguably are less entrenched, and there is lower public support for neoliberal ideas (Tsatsanis 2009).

Nonetheless, neoliberal and free market ideas have been influential in shaping EU policy and retain a significant influence (Fererra 2014, Mijs et al. 2016), even while the EU serves as "one of the central sites of contestation over neoliberalism" (Cahill and Saad-Filho 2017: 612). Indeed, they can be seen in the primacy of market mechanisms in addressing climate change via the ETS, an example of "neoliberal climate governance" (Bailey 2007: 432).

Neoliberal and free market ideas were instrumental in the transition from communism in Eastern and Central Europe (Hanley 1999, Mijs 2016). Today, business owners and those with a university education are more likely to support such ideas than groups such as churchgoers (Grdesic 2019).

Given that leftist parties in some post-communist countries may be more aligned with neoliberal and market-based policies, political polarisation around climate change—if it increases in the EU—may take a different form from that seen in the Anglophone world (Tavits and Letki 2009).

Guarding against the political polarisation seen in the United States will be crucial if the EU is to avoid climate policy deadlocks. Efforts to prevent such polarisation, particularly in relation to energy policy, might focus on member states with the highest per-capita emissions. However, the potential for polarisation may exist across the EU, particularly where the pursuit of deep and rapid decarbonisation is linked with hard choices about lifestyles and economic growth.

4 Shifting norms for rapid and deep decarbonisation

4.1 Shifting social norms directly

4.1.1 Promoting alternative values and worldviews

As discussed above, we can link the cluster of norms and values around high-emissions behaviour with hierarchical and anthropocentric worldviews, free market ideologies and ideologies of progress, and particular interpretations of evolutionary theory applied to economic and social systems. These worldviews and ideologies are open to challenge, and alternatives to them exist.

For example, we can challenge hierarchical worldviews by promoting specific democratic values and norms that emphasise fairness and public participation in decision making, building on and innovating around existing democratic traditions.

We can challenge free market ideologies by highlighting: their roots in narrow and contested applications of evolutionary theory to the social and economic realms; their inability to address systemic, long-term problems associated with non-linear changes and existential risks, such as climate change; and their tendency to ignore context-specific environmental selection pressures in favour of a focus on decontextualised general improvement (Olroyd 1983, DeFries et al. 2019).

We can challenge ideologies of progress on the basis of their origins in discredited antiquarian narratives about the development of human societies, and their often-catastrophic social application (Morgan 1877, Rostow 1960, Redman 1978, Sanderson 1990, Spadafora 1990, Cooper 1997, Brooks 2006).

We can use these challenges to interrogate the doctrines of unlimited economic growth in already-wealthy countries, and the primacy of economic and social systems based on neoliberal and free market ideologies as the natural end-points of human social development, to which there is no alternative (Fukuyama 1992, Balakrishan et al. 2003, Victor 2009, Bleys 2012).

We can also develop and propagate alternative visions to those represented by these ideologies. For example, we can link alternative framings of progress as achieving agreed societal goals (rather than a pre-ordained, universal historical destiny) with economic models that do not assume indefinite growth based on mass consumerism.

This might build on the existing body of work on 'degrowth', defined by Schneider et al. (2010: 512) as "an equitable downscaling of production and consumption that increases human well-being and enhances ecological conditions at the local and global, in the short and long-term", while avoiding certain pitfalls (Strunz and Bartowski 2018, Perkins 2019). Criticisms of degrowth based on its negative 'downward' or 'backward' connotations (Drews and Antal 2016) should be heeded, but they also highlight the utility of challenging ideologies of progress that supply such framings.

> We can approach changing norms through shifts to more pro-mitigation values and worldviews by challenging the known weaknesses in anthropocentric worldviews and ideologies of the free market, growth and progress, and presenting alternatives. These might include ecocentric worldviews and reframing the idea of progress around human wellbeing.

Anthropocentrism, associated with the externalisation of environmental and climate change costs, can be challenged on the grounds that it neglects the dependence of human societies on natural systems and the coupling of social and ecological systems.[22]

More ecocentric worldviews emphasise this co-dependence through concepts such as social relations with nature (Cruickshank 2001, Heyd and Brooks 2009), and link with growing evidence of the beneficial effects of exposure to nature (Hartig et al. 2014, Capaldi et al. 2015).

While social relations with nature are often associated with traditional non-Western societies (see, for example, Cruikshank 2001), they are evident in recent phenomena such as 'funerals' for glaciers 'killed' by climate change in Iceland and Switzerland.[23]

Climate change opens the door to innovative framings of socioecological relations informed by science but rooted in deeper traditions that have been marginalised in the pursuit of modernity (Asprem 2017). For example, Lestar and Böhm (2020) discuss the role of ecospirituality in sustainability transitions, based on a shift away from anthropocentric worldviews that emphasise growth and efficiency to ones focusing on happiness and fulfilment.

4.1.2. Developing and supporting networks of influence

Current norms that facilitate emissions-intensive policies and behaviours have not emerged randomly, but have been shaped deliberately through decades of concerted action by networks of vested interests that have promoted the ideologies and worldviews discussed here, particularly free market ideology, and opposed climate change mitigation on the basis of free market principles (Plehwe 2014, Salles-Djelic 2017).

Establishing counter-networks to develop and promote pro-mitigation narratives, worldviews and principles, and to offer alternatives to currently dominant political and economic ideologies, is one way of seeking to change values and norms.

These networks might include thinktanks and research organisations that seek to increase the visibility of dominant yet largely hidden ideologies and worldviews in locking in high-emissions pathways, and provide alternatives to them, as discussed briefly above.

> Networks of vested interests around fossil fuels and free market ideologies might be countered by the development of networks to promote more pro-mitigation worldviews and discourses.

Mirroring the strategy of free market thinktanks and networks, these new networks might seek to place champions of these alternative models in positions of influence, promote their values through various media, inject pro-mitigation ideas into public discourse, shape public and policy debate, and provide new framings of climate change mitigation.

The role of social innovation will be to identify ways of growing these networks—for example, around existing institutions—amplifying their voices and helping them influence policy agendas and public opinion without the vast sums of money that have enabled free market networks to be so successful.

4.1.3 Shifting narratives around what is (un)acceptable

Developing narratives that make specific high emissions behaviours less socially acceptable is another way to directly shift social norms. For example, the flight shame phenomenon has been credited with shifts in personal behaviour as people, motivated by a realisation of the emissions costs of flying (rather than the social shaming of individuals), have reduced the number of flights they take (Korkea-aho 2019).[24]

Where previous changes in norms around activities such as smoking were promoted through policy interventions acting in tandem with sustained public information and advocacy campaigns (Corner et al. 2015), this apparent trend in behaviour around flying has had no such official support.

The rapid trend towards veganism and reduced meat consumption falls somewhere between these two extremes, supported by official healthy eating guidance,[25] but also driven by environmental and climate change concerns (Cooper 2018).

Social innovation for climate change mitigation can learn from these examples and apply this learning to develop narratives and change norms around other emissions-intensive behaviours. This does not mean directly shaming individuals for their behaviour but rather shifting public discourse in a direction that changes people's own ideas about what is acceptable and socially responsible (Korkea-aho 2019).

> Developing new narratives around what is acceptable and unacceptable can help shape public discourse, reframe issues around climate change mitigation and change what is viewed as politically feasible and desirable.

Shifts in social norms among the general public may also be helpful—indeed, essential—in influencing policy, by changing what is perceived as publicly acceptable and therefore politically feasible.

Deep and rapid decarbonisation requires a moral environment in which government support for fossil fuels and investment in new carbon-intensive infrastructure is seen as unethical and unacceptable. Developing narratives that support such a framing and injecting these into public discourse may help to promote such shifts.

Further normalising the idea of an unfolding climate emergency that requires urgent action is likely to increase acceptance of significant shifts in policy and behaviour. However, campaigns to shift norms need not limit themselves to influencing social norms among the general public. They might also seek to shift norms directly within government and business by engaging senior decision makers, although appealing to their extrinsic motivations may be a more pragmatic approach.

Shifting norms by changing narratives around what is acceptable and what is not will involve a combination of efforts to change people's values and strategies to activate existing values. This will often be a case of recognising that people hold conflicting values, and identifying which of these values provide the most effective leverage for changes in norms and behaviour.

4.2. Activating pro-mitigation norms

Appealing to intrinsic motivations based on pro-social and pro-environmental values such as altruism, community involvement and concern for the environment have more potential than appealing to extrinsic motivations, for galvanising the more meaningful and large-scale actions and changes that are required to deliver net zero (Crompton 2011).

Personal, intrinsic norms that favour pro-mitigation behaviour are activated when an individual perceives a threat to important values and also believes they have the power to reduce or remove that threat. Social innovation to activate intrinsic norms must therefore highlight the threats posed by climate change and give people agency to address these threats through feasible behavioural changes, consumer choices, local action, community involvement, political action or other means.

4.2.1 Increasing awareness of risks

While the vast majority of Europeans believe that climate change is happening and is at least partly caused by human activity, most believe its impacts will be only slightly negative (Poortinga et al. 2019). This raises the possibility that the public might underestimate climate change risks.

Although there is very high support in principle for strong climate mitigation in the EU (Poortinga et al. 2019), greater awareness of climate change risks might be critical if this support is to be sustained when the implications of stringent climate policies and the need for significant behavioural changes become clearer.

These observations suggest that wider public dissemination of evidence and information relating to specific climate change risks could be critical in terms of public acceptance of strong mitigation actions, particularly where these are potentially disruptive in social or economic terms. This might include information on the contribution of climate change to specific extreme events, disseminated in real-time as these events occur, or soon after their occurrence—for example, through news media, social media, weather forecasts and other means such as mobile phone apps.

People engage more with climate change when it is framed as a locally relevant issue (Betsill 2001, Scannell and Gifford 2011, Chu and Yang 2018). Information on the role of climate change in extremes could be linked with information on the local impacts of those extremes, and projections of how these extremes and their impacts might evolve in a warming climate.

The latter can include developing local climate change scenarios to visualise future climate change risks and potential impacts—for example, on places and things of value (Sheppard et al. 2013). Linking national climate policies with local issues and benefits can also reduce political polarisation (Bestill 2001).

Emphasising the actual or potential impacts of climate change and associated climate extremes on things that people value (locally, nationally or globally) addresses one element of the 'risk-agency' model for norm activation. Things of value may include traditions, practices, relationships, places, livelihoods, aspects of the natural world, culturally significant features, future generations, and even cultural identities (Brooks et al. 2020).

Highlighting the disproportionate impacts of climate change on certain (often disadvantaged) groups and addressing climate justice issues can activate norms based

on altruistic values and ideas of fairness. Explicit discussion of which values are important in terms of climate change and its mitigation is one way of encouraging people to think about how their own and their society's values might or should influence their behaviour in relation to mitigation (Tschackert et al. 2016).

By increasing concern and engagement around climate change, such actions could increase or consolidate support for deep and rapid decarbonisation, particularly when they are linked with mitigation actions that the public can take or support (Taylor et al. 2014, Beckage et al. 2018).

> It is possible to activate pro-mitigation personal norms by raising people's awareness of climate change risks to values or things of value, and empowering them to act to reduce those risks through actions such as consumer choice or voting behaviour.

4.2.2 Linking information and awareness with enhanced agency

When disseminating information to enhance awareness and understanding of climate change risks and impacts to things of value, linking it with actions to reduce those risks and impacts will help address the second element of the 'risk-agency' model.

From the perspective of transformations for net zero, this means enabling people to take actions that result in reduced emissions and accelerate systemic decarbonisation. It might involve mechanisms that allow individuals to influence the behaviour of business, industry and government.

Potential levers for such influence include developing ratings systems and apps to allow people to judge—and reward or punish—firms, products, services, utilities, political parties and individual politicians on their social, environmental and climate change mitigation performance and records.

Individual innovators can develop ratings systems and apps to drive behaviour change in business, industry and government, with or without the cooperation of these entities—for example, by indicating the carbon footprints of consumer products.[26]

Social innovation might extend to policy and legislation via advocacy campaigns to put pressure on governments to ensure that there are alternatives to product and service providers that perform badly on climate mitigation. For example, anti-monopoly measures can ensure that a sector is not dominated by firms that are blocking climate action.

Where there are barriers to positive behaviour change—such as inadequate or prohibitively expensive public transport that reinforces private vehicle use—social innovation could support citizen lobbying of local or national governments to target these issues.

Campaigns might also demand that products be labelled to indicate their carbon footprint. Such campaigns would be able to exploit the systems and apps for rating mitigation performance and link with information dissemination.

Providing people with information on climate risks and impacts, and empowering them to make climate-smart purchasing and voting choices could help shift social norms through intrinsic motivations involving the activation of pro-social and pro-environmental personal norms. It could also help to change norms in government and business by appealing to the extrinsic motivations of decision makers within public and private institutions.

4.3 Leveraging decision makers' extrinsic motivations

Rickards et al. (2014) highlight the tendency for senior decision makers in government and business to hold values that are antagonistic to climate change mitigation actions. Even if this were not the case, decision making in these contexts is constrained by structural factors and institutional norms. So, one area where appealing to extrinsic motivations may be appropriate is changing institutional norms.

Empowering consumers and the voting public to base their purchasing and voting behaviour on the mitigation performance of firms, products and individuals is one way of appealing to these extrinsic motivations. This would provide an incentive for government and business to change their own behaviour to attract business and votes, and perhaps shift institutional norms in a pro-mitigation direction.

Appealing to extrinsic motivations has a potentially important role to play in changing norms in government and business—via levers such as litigation, compensation, reparation and prosecution—to make rapid transitions out of fossil fuels the least risky and costly options.

It is also possible to target appeals to extrinsic motivations at primary fossil fuel producers. This would involve creating an environment in which very rapid decarbonisation is seen as less costly and less risky than continued fossil fuel extraction/production.

For example, Biber et al. (2017: 614) describe how "incumbent energy and energy-intensive firms shifted their political strategy from opposing climate regulation to advocating emissions trading as their preferred policy instrument…[to hedge] against the higher compliance cost of alternative regulatory instruments".

In the absence of rapid policy change, creating and promoting public discourses that normalise punitive action against fossil fuel extraction and production might help companies refocus their business models towards renewables.

Such action could include litigation, reparation—which could be linked to the loss and damage discourse—and criminal prosecution of firms and individuals that wilfully seek to expand fossil fuel production and prevent or slow climate change mitigation in the knowledge of climate change risks (Doelle and Sack 2019, Keenan 2019, Wewerinke-Singh 2019). This would amplify existing pressures around litigation, divestment and the declaration of climate change-related financial risks (Linnenluecke et al. 2015, Silver 2017, Healy and Barry 2017).

Such a strategy would aim to increase the risk of continued fossil fuel extraction/production for firms, institutions and senior decision makers to the extent that rapid diversion of investment, technology and capacity away from extracting and producing fossil fuels and towards developing and scaling up renewables becomes the preferable and more cost-effective option, accelerating the decarbonisation transition.

This would also send a signal to institutional investors to avoid investing in such firms (Mielke 2019). Across 26 countries, Tingley and Tomz (2014) find significant support for economic sanctions against, and shaming of, countries that fail to cooperate on climate change, suggesting a public appetite for punitive approaches to enforcing cooperation on climate change mitigation.

4.4 Supporting agents of change

There is evidence that certain individuals and groups are particularly effective at influencing or activating pro-mitigation norms. Social innovation should seek to identify these actors, engage and support them, and amplify their voices.

Support might include training and providing information on climate science, climate change mitigation and adaptation, the political economy of climate change, entry points for action and techniques for influencing target groups such as government, business and the wider public. Supporting these actors to engage with the media and training them in public engagement, public relations and related areas will help amplify their voices.

4.4.1 Empowering children and youth

Through the school strike movement, children have effectively shaped the discourse around climate change, exerting pressure on politicians and adults to address the climate crisis. In a study in North Carolina, United States, Lawson et al. (2019) found that child-to-parent learning is a powerful means of overcoming socio-ideological barriers to concern over climate change. This effect was strongest among male and politically conservative parents with the lowest levels of climate concern. Daughters were most effective at influencing these groups of parents.

In this context, the prominent role of teenage girls in the school strike movement is notable (Kimball 2019).[27] These findings suggest that empowering children, and especially girls, to communicate with adults about climate change, is a potentially powerful lever for social innovation around climate change, with children providing "a communication pathway that is resilient to longstanding socio-ideological barriers to learning about, caring about and ultimately acting to address climate change," due to parents' views of them as non-partisan actors in whom they place high levels of trust (Lawson et al. 2019: 460).

The effectiveness of this communication pathway is presumably also a result of children's articulated climate change concerns activating norms around parental roles and responsibilities, based on perceived climate change risks to children's current and future physical and psychological wellbeing. Parents are influenced by their ability to address both these risks through personal mitigation actions.

> Social innovation should identify, engage and support key actors who can shift attitudes and norms. These include children, faith groups and members of influential elites.

4.4.2 Working with faith groups

Monotheistic religions have arguably played a major role in developing anthropocentric worldviews that see humanity as separate from and dominant over the natural world (White 1967, Harrison 1999, Muhar and Böck 2018). These worldviews enable an instrumental attitude to the environment that is central to externalising environmental and climate change costs and impacts.

Nonetheless, monotheism encompasses traditions of both dominion over and stewardship of nature (Kearns 1996, Hall 2006), with a growing emphasis on the latter.[28] There are numerous examples of explicit support for environmental stewardship,[29] including the Roman Catholic Church's encyclical letter on 'care for our common hope,'[30] and the Islamic Foundation for Ecology and Environmental Sciences' 'Global declaration on climate change'.[31] The threat of fatal combinations of heat and humidity in Islam's holiest sites (Pal and Eltahir 2015, Kang et al. 2019) has also led to arguments for Muslims to join the climate movement.[32]

Amplifying the voices of faith leaders and others concerned about climate change by engaging with these growing movements within Christian and Muslim communities may leverage significant change in attitudes and, ultimately, behaviour among wider faith communities. Engaging with other faith groups—including those that are outside the monotheistic tradition—might also help highlight alternative ways of relating to the environment by recognising how human societies are embedded in ecological and biogeophysical contexts. Social innovation can explore how best to align climate mitigation with different faith traditions and reach faith communities.

4.4.3 Engaging with elites

Members of elite groups and originators of elite cues on climate change are likely to need no support to amplify their voices. However, given the importance of elite cues in shaping public beliefs about climate change (Carmichael and Brulle 2017), engaging with members of elite groups who are sympathetic to a rapid transition to net zero—or indeed, those who are neutral or even hostile to climate action—might be constructive.

As with other agents of change, such engagement might include expert support to help key influencers understand climate change issues and craft powerful messages in support of deep and rapid decarbonisation.

As discussed above, there is evidence that elite cues are more important for shaping general beliefs about climate change than for influencing support for specific policies (Ehret et al. 2018). This suggests that more general messaging around climate change and the need for rapid decarbonisation may be preferable to messaging on individual mitigation initiatives. This approach might also reduce the risk of political polarisation, which could result if we target elite support at specific policies favoured by a particular political party.

5 Conclusions

The failure of global climate change mitigation to date, and the inadequate pace of emissions reductions in the EU, are the result of multiple factors, many of which are structural and related to the political economy.

The role of norms, values, worldviews and ideologies is often overlooked in discussions of barriers and challenges to deep and rapid decarbonisation. However, given the role of vested interests in consciously shaping social norms around consumerism and public beliefs about and attitudes towards climate change, these factors are closely linked with the political economy.

Public beliefs and attitudes are closely related to values and worldviews, which have also been shaped by special interests that operate within, and promote, particular ideological frameworks. Chief among these are the free market and related neoliberal ideologies that favour light regulation, voluntary approaches, market mechanisms and technological solutions for tackling climate change.

Despite its historical leadership on climate change, the EU has internalised this model in the form of the EU ETS and its emphasis on markets and technology to deliver emissions reductions, at the expense of behaviour change.

Given the urgency of the climate crisis and the limits to market and technological approaches, keeping global warming below the Paris temperature thresholds will require high-impact behaviour change at all scales—from the general public to decision makers in government and business.

We are slowly recognising the importance of norms and values in enabling or inhibiting such behaviour change and triggering social tipping points (Tàbara et al. 2018, Schill et al. 2019, Otto et al. 2020). We are also recognising that, to expand conceptions of what is possible and desirable in a context of global environmental change, broader engagement across disciplines is vital (Castree et al. 2014: 763).

To drive the transformations required for net zero, social innovation must grapple with how to change norms and values that are hostile to deep and rapid decarbonisation, and how to activate norms that are inherently pro-mitigation.

Concerted campaigns to shift people's values and worldviews can help us change 'hostile' norms by challenging and proposing alternatives to existing worldviews and the ideologies that frame them. Changing discourses and narratives around climate change—for example, to frame fossil fuel extraction and high-emissions activities as socially unacceptable—will be critical.

We can activate pro-mitigation norms by appealing to intrinsic motivations based on values, or to extrinsic motivations based on incentives. The former is more likely to produce sustained, high-impact changes in norms and behaviour, particularly among the general public, as decision makers in government and industry are constrained by institutional contexts.

Making people understand that climate change poses risks to their values or things they value—and providing them with agency to reduce these risks through pro-mitigation actions—is critical in driving behaviour change. Appropriate entry points for social innovation in this context include raising awareness of risks coupled with activities that empower people to act to reduce risks, framed by an understanding of which values are most relevant and important.

Appeals to extrinsic motivations can be counterproductive, reinforcing existing framings of climate change associated with insufficient and ineffective action. However, they may be appropriate where they target the extrinsic motivations of decision makers in government and business, who are likely to be less amenable to appeals to intrinsic motivations as a result of their personal values and the contexts in which they operate.

> Social transformation for deep and rapid decarbonisation will involve interaction with diverse actors to shift norms and values at individual, institutional and societal scales.

Innovation around social tipping points for rapid decarbonisation needs to recognise the complementary and interconnected roles of actors at different scales in shifting social and institutional norms.

For example, government can shift norms through policy changes mandating or penalising certain types of behaviour among the public or by business. But such changes are more likely to happen where there is a perceived appetite for action. So, shifting social norms among the public to enhance their appetite for action is critical in enabling policy change. Shifting social norms also drives behaviour change in senior decision makers in government and business, who respond to the market, policy and civil society signals resulting from those shifts (Mielke 2019).

All these approaches depend on identifying key actors who can act as effective change agents. For social innovation to help drive the societal transformations required to deliver net zero, learning from the success or otherwise of recent social movements around climate change and building on and complementing those that have proved effective will be crucial.

As the world seeks to recover from the economic and social impacts of the coronavirus pandemic, it will be essential to ensure that investments aimed at driving recovery do not return economic systems to the previous status quo. Instead, they must be targeted at driving the rapid, transformational changes required to deliver net zero.

The period over which recovery measures are planned and implemented provides a narrow window of opportunity for social innovation initiatives to shift narratives, values and norms in favour of deep and rapid emissions reductions built on radical social and economic change.

The coronavirus pandemic has exposed the weaknesses of the previously dominant economic ideologies of neoliberalism and the free market, and by extension the norms, values and worldviews associated with them.

Promoting these ideologies has drawn inspiration from Milton Friedman's observation that "Only a crisis—actual or perceived—produces real change. When that crisis occurs, the actions that are taken depend on the ideas that are lying around…our basic function [is] to develop alternatives to existing policies, to keep them alive and available until the politically impossible becomes politically inevitable" (Friedman 2002: xiv).

A key role for social innovators in the coming months and years will be ensuring that new alternatives are alive, available and highly visible, and ensuring the radical changes required to prevent catastrophic climate change become as inevitable as they may have seemed impossible before the beginning of 2020.

Endnotes

1. Director, Garama 3C Ltd; visiting research fellow, Climatic Research Unit, School of Environmental Sciences, University of East Anglia. Email: nb@garama.co.uk.

2. Throughout this report, the term 'emissions' refers to greenhouse gas emissions from all sources, including CO2 emissions from sources other than energy production and non-CO2 emissions from industry, agriculture and other sources.

3. iea.org/articles/global-co2-emissions-in-2019

4. Including non-CO2 emissions and emissions of other greenhouse gases, which in 2018 brought total global greenhouse gas emissions to an estimated 55.3 Gt CO2 equivalent (UNEP 2019).

5. climateactiontracker.org/countries/

6. climateactiontracker.org/global/temperatures/

7. data.consilium.europa.eu/doc/document/ST-29-2019-INIT/en/pdf

8. eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM:2019:640:FIN

9. Meeting the Paris temperature goals will also require significant reductions in non-CO2 emissions to deliver net zero in terms of CO2 equivalent emissions.

10. Summarised at: tinyurl.com/y9yvpxp5

11. ec.europa.eu/clima/policies/eu-climate-action_en

12. tinyurl.com/y8w8azos

13. ec.europa.eu/clima/policies/strategies/progress_en

14. tinyurl.com/y9lofwtu

15. This analysis includes the UK for reasons of consistency, as it is represented in other statistics relating to EU emissions discussed here, and therefore includes the 28 countries that were full EU member states in 2019.

16. Based on figures for share of total energy production from solid fossil fuel sources in 2017 as listed by Eurostat at: tinyurl.com/y7vxp43q

17. eea.europa.eu/soer-2015/countries/estonia

18. globalcarbonatlas.org/en/CO2-emissions

19. data.worldbank.org/indicator/SP.POP.TOTL and data.worldbank.org/indicator/NY.GDP.MKTP.CD

20. See Farrow et al. 2017 for a detailed discussion of different types of social norms.

21. energyforprogress.org/about/

22. Ecomodernism is an avowedly technocentric attempt to build an explicitly anthropocentric worldview, based on the doctrine of separation from nature, that nonetheless delivers environmental sustainability while ensuring human prosperity (Asafu-Adjaye et al. 2015, Symons and Karlsson 2018). However, the extent to which ecomodernism represents a realistic solution to environmental degradation and climatic destabilisation is highly contested (for example, by Crist 2015, Isenhour 2016, Grunwald 2018).

23. tinyurl.com/ybzvgjs5; bbc.co.uk/news/world-europe-49788483

24. tinyurl.com/ybvu9kah

25. For example, tinyurl.com/ycpky9hc

26. See, for example, climateneutral.org/how-it-works

27. tinyurl.com/yadxbce4; tinyurl.com/ydz5wou6

28. See, for example, operationnoah.org/; tinyurl.com/ya8ynysp; tinyurl.com/ybelhd2z; tinyurl.com/y9jxtjos

29. tinyurl.com/y8uydtvg; tinyurl.com/yawaaten

30. tinyurl.com/ptcm9bz

31. ifees.org.uk/declaration/

32. tinyurl.com/yddcv55h

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Climate-KIC is supported by the EIT, a body of the European Union