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Climate action:
policy options and economic perspectives

In brief

The international community is at a unique moment where the recovery from COVID-19 offers the chance for a fresh commitment to tackle climate change and achieve net zero carbon emissions as a central element in 'building back better'. Analytical frameworks developed by contemporary economists to study this challenge provide approaches that policymakers could consider when designing policy packages to incentivize greenhouse gas (GHG) emissions reductions.

INSIGHTS

- The challenges of climate change require rapid, transformational and coordinated change in the way that the world's economies operate. With net zero commitments increasingly adopted globally, now is the time to translate such commitments into concrete action plans.
- Recovery from the COVID-19 pandemic provides significant opportunities for countries to implement their GHG emissions reduction pledges as part of transformational investments that will generate jobs and long-term benefits for the economy, the environment and wellbeing. These opportunities have however not yet been seized by all countries.
- In individual nations, emissions reductions can be achieved by identifying 'sensitive intervention points' where a relatively simple 'kick' or 'shift' can deliver substantial change.
- Science and economics can provide the evidence base for securing 'win-win' outcomes and navigating trade-offs between different courses of action. One useful framework, though there are many, for assessing potential policies is the 'natural capital' approach that examines each action through the lenses of sustainability, efficiency and equity.
- Greater coordination of action could be achieved by deploying mechanisms such as border carbon adjustments that create a level playing field between countries that have adopted ambitious decarbonisation policies and others that are yet to do so.
- Transdisciplinary research can help inform the full range of social and environmental transformations required to address climate change and other related challenges.

1. Achieving transformational change in economic systems

Recovery projects directed towards reducing GHG emissions can "create more jobs, deliver higher short-term returns per dollar spend and lead to increased long-term cost savings, by comparison with traditional fiscal stimulus".

The world faces an unprecedented challenge in tackling climate change.

Modelling reported by the Intergovernmental Panel on Climate Change (IPCC) shows that for the increase in the world's mean surface temperature to be limited to 1.5 degrees Celsius on pre-industrial times, global net anthropogenic (human-generated) CO_2 emissions need to be roughly halved by 2030 and reach net zero by around 2050[1].

Transformational change is urgently required in the way the world's economy operates, including rapid and far-reaching transitions in energy, land, transport, buildings, social, cultural and business systems. The IPCC and other expert assessments suggest that achieving net zero by 2050 would require additional investment of several trillion US dollars per year[1, 2].

The big question at the start of this decade is whether countries have the collective capacity and commitment to deliver on this objective.

1.1 A turning point?

Countries accounting for most of the world's Gross Domestic Product (GDP) have now made ambitious commitments to carbon neutrality – 'net zero' – by 2050[3] or even earlier. But to be kept, commitments need to be translated into plans, and plans implemented through action.

As the world's economy progressively recovers from the COVID-19 pandemic, incentives for countries to invest more substantially in the transition to net zero are growing and the economic case for an integrated recovery, that also addresses climate change, appears to be strong. In May 2020, a team of internationally recognised economists reviewed over 700 stimulus policies proposed or enacted by governments, and surveyed 231 central bank and finance ministry officials and other experts on their perceived characteristics. They concluded that recovery projects directed towards reducing GHG emissions would not only contribute towards long term climate stability but also "create more jobs, deliver higher short-term returns per dollar spend and lead to increased long-term cost savings, by comparison with traditional fiscal stimulus"[4].

Nevertheless, a follow-up analysis of the $15 trillion in global economic stimulus announced up to the end of December 2020 suggested that, while some countries had made the most of the opportunity, others were at risk of missing it[5]. Decisions made on such packages will be critical in determining whether traditional, unsustainable paths will be retrodden, or whether the global economy will instead be put on a path to net zero, in a manner that takes advantage of the opportunity to create jobs and protect natural capital.

To remain on that path requires countries, individually and collectively, to move beyond immediate stimulus packages and commit to long-term policies for sustainable, low-carbon development, technologies and infrastructures.

As these decisions are taken, the social and natural sciences, and the humanities, can provide useful analyses, frameworks and tools to help governments create the effective policies required to drive the transition to net zero as part of an unprecedented global programme for environmental and economic sustainability and growth.

1.2 Sensitive intervention points

To organise the transformation of their economies, governments can use a range of policy levers, of which carbon pricing through taxation or emissions trading is merely one[6]. Other economic interventions include market mechanisms such as 'reverse auctions' for renewable power licences; subsidies for low-carbon solutions; quotas for required proportions of low carbon energy, for example a percentage of renewable power in electricity generation; and regulations such as energy efficiency building standards or limits for vehicle tailpipe emissions. And, of course, many important interventions to support the transformational change required are social, political, institutional or cultural.

The diversity of national contexts means that there is no one-size-fits-all solution. However, research can help policy-makers to target interventions in areas where they will be most effective both in reducing emissions and reaping economic, social and other positive benefits.

One such approach is to focus on what are known as 'sensitive intervention points' – situations where a relevant socioeconomic system is at or near a state of 'criticality' such that an intervention could trigger an outsized or positively disproportionate response[7]. These interventions can take the form of a 'kick' which shifts a variable – such as a subsidy for green products that increases their uptake – or a 'shift' in the system as a whole – such as new institutions, laws or regulations.

Action taken at such points can create positive feedback dynamics, akin to those that boosted the growth of the solar photovoltaic industry. In this example, early investment by NASA provided initial technology, Germany's feed-in-tariff (the 'kick') set off self-reinforcing expectations on market size, and China's investments and large-scale production generated network effects and economies of scale.

Triggering a 'shift' in the governing system may be more complex, but is likely to have longer-term and wider-ranging effects. One of the key challenges for governments is to design policies which effectively balance the need to signal strong commitment to long-term emissions reduction and for flexibility to accommodate new information[8]. This is further compounded by the various sources of regulatory uncertainty surrounding decarbonisation policy. Studies nevertheless point to these sorts of interventions, such as creating legal duties to set carbon budgets, long-term contracts, or the delegation of powers to independent bodies, as possible ways to drive transformational change[9].

Sensitive intervention points can also take the form of cross-party political statements to shift business expectations, strategic support for 'pathfinder' regions to reach net zero faster than the nation as a whole, to mandating 'Paris-aligned accounts' for companies to ensure that fossil assets are not misleadingly overvalued on corporate accounts[10].

1.3 Win-wins and trade-offs of climate action

Recent insights from the economics community highlight the significant potential for win-wins for the economy, environment, health, wellbeing and society at large of well-designed decarbonisation policies[11, 12, 13]. They also reinforce a wider and longer-established message that focusing on a single goal in isolation, even one as important as net zero, can generate significant adverse trade-offs, such as impacts on the economy or biodiversity[14, 15].

To take three examples, first, investing in renewable energy not only lowers GHG emissions but can create millions more jobs than continuing to operate legacy fossil fuel systems[16]. Second, recovery policies to invest in infrastructure to encourage cycling, instead of driving, offers several win-wins. In addition to reducing GHG emissions, cycling encourages physical fitness and better mental health, reduces obesity and healthcare costs. Third, recovery policies that employ people to regenerate natural ecosystems can make good use of lower skilled labour, reducing unemployment. Such regeneration programmes can also improve agricultural productivity, provide habitats for wildlife and green spaces for people.

Such integrated approaches also have merit from a political economy perspective. In particular, they provide ways to address the market failure that climate change represents in a manner that generates economic benefits such as jobs and well-being and can therefore attract public support.

There are also win-wins outside the current context of lower economic demand with high unemployment. For instance, policies to support eating less red meat can improve human health, lower GHG emissions from agriculture and the food chain, reduce land required for cattle – thus reducing deforestation and liberating land for natural habitats and ecosystem maintenance.

Well-designed decarbonisation policies can secure win-win outcomes for the economy, environment, health, wellbeing and society at large.

(For further insights on the co-benefits of climate action, see briefing 11: *Healthy planet, healthy people*; and briefing 9: *Climate change and land*).

Science and economics can provide the evidence base for designing policies that protect the natural environment, use resources efficiently and promote equity of distribution of benefits and costs across society. One such model is the Natural Capital Framework, which uses the three dimensions of sustainability, efficiency and equity[17] to guide decision-making (see Box 1).

BOX 1

The natural capital framework

Sustainability acts as a first test, with the principle that capital stocks, should be maintained across generations[18] [19]. These stocks include: 'natural capital' such as ecosystems, species, water, soils, air and oceans; 'human capital' such as skills, knowledge and health; and manufactured capital such as machines and buildings. Whereas the 20th century saw natural capital converted into other forms of wealth, the framework recognises natural resources as the wellbeing-bearing assets they are and values them alongside manufactured or human capital in the assessment of wealth. Preserving the sustainability of all forms of capital is the major priority for policy. For example, forest restoration accords with sustainability because the destruction of forests, currently estimated at 10 million hectares per year[20], or roughly the size of Cuba, contributes to climate change as well as damaging biodiversity and livelihoods.

The dimension of efficiency is critical as resources are finite and a decision to produce one thing reduces the ability to produce another. Efficiency is achieved when resources are used in a way that maximises wellbeing without impairing sustainability. Assessments of efficiency must consider anything that affects wellbeing, both positive and negative, whether it is provided through a market (and therefore has a price) or not. To use the example of forestry again, efficiency can deliver the economic benefit of timber revenues but alternatively can include the non-market value of carbon storage for net zero, habitat for biodiversity, water quality, reduced flood risks and recreation for physical and mental health. However, woodland can also generate costs in terms of foregone agricultural output and effects on employment. All of these positive and negative effects have to be assessed[21].

Finally, the dimension of equity relates to the distribution of the benefits and costs of policy across society, nations and generations. While many commentators focus on the moral justification for redistribution, there is also a pragmatic argument that, without an acceptable degree of fairness, policies can fail to be agreed[22]. Turning for a final time to forests, the question of who reaps the benefits and who bears the costs will almost certainly influence the collective ability to reforest the Earth. Equity applies both to the effects of domestic policies on citizens and to burden sharing between countries in funding climate-related action. A 'just transition' can be supported by policies such as the British Columbia carbon tax where proceeds are used to provide tax credits for lower income households[23]. Burden sharing depends in large part on high income countries' willingness to fund emissions reductions in lower income ones.

These dimensions can be operationalised through tools such as Decision Support Systems that help policy-makers in ensuring policies are coordinated and optimised to deliver sustainability, efficiency and equity. The UK's Natural Environment Valuation Online tool (NEVO)[24], for example, enables local and national decision makers to test the outcomes of choices from 2km grid areas to the whole of England and Wales. They can call up a profile for an area and see its value in areas including farming production, carbon sequestration, woodland and timber, recreation, biodiversity and water. They can model how land use and ecosystem services may change over future decades and model the impacts. They can ask 'what if?' questions about possible changes or 'what's best?' questions about optimal routes to follow. The NEVO tool is being used to help design the UK's Environmental Land Management (ELM) scheme, founded on the principle of 'public money for public goods'.

2. The need and options for greater coordination of action at the international level

To harness these opportunities and bring about transformational change globally, a number of obstacles need to be overcome. Research in the political economy of climate change points to mechanisms that can facilitate greater coordination of action by creating a level playing field between countries and incentivizing higher ambition through multilateral agreements.

2.1 From a prisoner's dilemma to coordination of action

The 2015 Paris Agreement aims to limit global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels. A good number of countries have now made commitments that broadly align with those targets, however, many such commitments have not yet been translated into concrete action plans[25]. On the current trajectory of global GHG emissions, the global temperature is expected to increase by more than 3°C by the end of the century[26].

The tension between individual and collective interests can explain why countries pledge contributions that guarantee that their collective goal will be missed. Collectively, most countries want to limit climate change. But if taking action is costly, each country might only be willing to play its part if assured that other countries will play theirs. If countries are unsure of what others will do, they might choose to hold back or simply use this as ex post justification for their inaction. In game theory, this situation is known as the "prisoner's' dilemma", whereby cooperation is in the collective interest of parties but is not easily achieved because it demands of parties to trust each other to renounce solely pursuing their own self-interest.

It is sometimes claimed that 'legally binding emission limits' are the answer. But if a country does not want to abide by a treaty's obligations, it has only to decline to ratify the agreement. Imposing sanctions on any country that fails play its part may not work easily in practice either – sometimes it is costly to impose the sanction; other times retaliation might result.

Finally, while one can hope that international peer pressure will ultimately lead countries to pledge higher emission reduction and translate those into action, a lab experiment suggests that this is unlikely to effectively change what they do[27].

Mechanisms designed to shift the situation from a prisoner's dilemma to a coordination game can however provide useful complements to agreements based on voluntary cooperation, such as the Paris Agreement. A coordination game is characterised by a situation where all players work towards the same objective because the rules of the game make it in their individual and collective interests to do so[28]. Such mechanisms can help ensure that parties are better off participating rather than free riding, which has been a critical challenge in climate policy[29].

Research in the political economy of climate change points to mechanisms that can facilitate greater coordination of action by creating a level playing field between countries and incentivizing higher ambition through multilateral agreements.

Border Carbon Adjustment mechanisms can help ensure that domestic producers and foreign importers pay the same price for GHG emissions, and widen the proportion of the global economy where carbon emissions come at a cost.

2.2 Coordination in practice: Border Carbon Adjustments

One proposal is for parties to a climate agreement who have implemented policies that penalise emissions and reward their abatement (such as carbon prices or taxes) to impose tariffs or other measures on imports from those that have not, often referred to as 'Border Carbon Adjustment' (BCA) mechanisms. These are being considered by parties such as the European Union (EU)[30] and United States of America (US)[31] as mechanisms that can create a level playing field in trade despite different jurisdictions having divergent climate change policies. The idea is that both domestic producers and foreign importers would pay the same price for the emissions – ensuring equal treatment. Such approaches have the effect of widening the proportion of the global economy where carbon emissions come at a cost.

For example, with current fossil-fuel based technologies, a steel product costs more to make in a country with a carbon tax that one without such a tax. This distorts trade in favour of the higher emitting regions. Such carbon adjustment mechanisms redress the balance, typically by imposing a tariff or requiring an importer to buy an emissions allowance (such as those used in the EU Emissions Trading System). The adjustment prices the product as it would be priced in the importing country[32]. The more countries that adopt BCAs, the more effective they are in encouraging exporters to invest in lower carbon practices if they want to enjoy access to major markets.

Governments may modify carbon adjustment mechanisms to soften the impact on emerging economy exporters, recognising that some countries have contributed more than others to emissions over decades – the principle of 'common but differentiated responsibilities'. At the same time, some degree of BCA may encourage a country to lower its carbon footprint. For example, Turkey's steel production, using electric arc furnaces, is less carbon intensive than those of China and Ukraine. The textile industry in Bangladesh, where electricity generation is dominated by natural gas, has a much lower footprint than that of Vietnam, where coal is more prevalent[33]. The level of a BCA needs to match the domestic carbon price, which should be set at a 'sweet spot' where it incentivises lower-carbon production technologies rather than discouraging economic activity and trade[34].

From a geopolitical point of view, while parties choosing to unilaterally implement BCAs may face retaliation and undermine relationships with their trade partners, negotiating their design within a multilateral framework such as the World Trade Organization and Paris Agreement might help garner support from third parties[35]. This is also the appropriate venue for addressing the practical difficulties of designing BCAs. Another possible response from countries facing a BCA is to themselves impose a carbon levy on exports, therefore keeping the revenues at home and avoiding the collection of carbon revenue by the importing country[36].

2.3 Coordination in practice: a multilateral approach

Alternatively, a wider and all-embracing multilateral approach that links trade cooperation in key sectors to reductions in GHG could also be adopted, effectively creating a 'Climate Club'[37].

Such an approach underpinned the Montreal Protocol of 1987 that phased out ozone-depleting chlorofluorocarbons (CFCs), previously widely used in air conditioners and refrigerators. The Protocol recognised ozone depletion as an urgent threat, mainly because of the risks of increased skin cancers. Critically, in addition to setting out pathways to phasing out CFCs and other controlled substances for Parties, the Montreal Protocol also banned trade of those substances with non-parties[38].

The 2016 Kigali Amendment to the Montreal Protocol adopts the same design, targeting reductions in hydrofluorocarbons (HFCs)—compounds that substitute for CFCs, but are potent GHG. Key elements of the agreement are a restriction on trade in HFCs between parties and non-parties and the provision of financial and technological support for poorer countries[39]. The trade restriction transforms the game, by forcing countries to decide between 'free riding,' by continuing to produce and consume HFCs, and continuing to trade in HFCs while working towards progressively phasing them out with the other members of this agreement. If the gain from belonging to the trading bloc is large relative to the gain from free riding, all countries will want to participate in Kigali, once assured that most others will participate. In the same way that the Protocol was successful because it framed participation in the agreement as a coordination game[40], the Amendment creates strong incentives for countries to align their practices rather than to free ride.

Although fossil fuels are much more systematically embedded in the economy than CFCs, making it harder to deliver transformation at the same scale and speed, similar mechanisms possibly targeted at specific carbon-intensive practices and technologies could help create a level playing field and spur innovation in low-carbon technologies.

3. A trans-disciplinary approach

This paper has outlined some of the critical challenges and opportunities associated with the decarbonisation of the world's economies, drawing on the perspectives of contemporary economists.

The briefing acts as one illustration of the important contributions that the social sciences can provide in addressing this problem. Other contributions from across the social sciences and humanities can be made, for example, by: scholars in organisational dynamics; scientists who focus on the behaviours of individuals, including consumers; lawyers and political scientists who are expert in crafting and implementing policies; historians who provide reference points, perspectives, and contexts to understand and frame current policy debates; international relations specialists, who provide expertise in international agreements and organisations; anthropologists who work with local communities; philosophers who prompt us to consider the frameworks and ethical principles of climate change; and geographers whose work spans many related areas.

Such insights complement the evidence presented by natural sciences and help to inform policy-making in a broad-based and connected way. Reflecting a common theme across the set of 12 briefings in this series, it underscores the need for all scientific disciplines to work together to support the design and delivery of policies to address climate change as well as associated challenges such as biodiversity loss and environmental degradation in the wider context of sustainable development.

This briefing is one of a series looking at how science and technology can support the global effort to achieve net zero emissions and adapt to climate change. The series aims to inform policymakers around the world on 12 issues where science can inform understanding and action as each country creates its own road map to net zero by 2050.

To view the whole series, visit **royalsociety.org/climate-science-solutions**
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