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Framing Transformative Change

Key messages

Transformative change is a fundamental, system-wide reorganisation across technological, economic and social factors, including paradigms and goals, and valuing the climate, the environment, equity and wellbeing within decision making (IPBES, 2018; IPCC, 2018). If Ireland is to achieve its goals under the national climate objective, the Paris Agreement and the Kunming–Montreal Global Biodiversity Framework, transformations will be necessary in the energy, food and land systems, urban systems (including planning, transport and buildings), livelihoods, lifestyles, development pathway, systems of governance and in participation. A clear long-term vision and plan for the transformation of each system will accelerate short-term action and enhance synergies while minimising and managing trade-offs and realising the benefits of transformative change.

The decisions and actions taken this decade will reverberate for generations. Much of the groundwork for action has been lain and most technologies and solutions are already available. However, climate action is not occurring quickly enough: opportunities and benefits are being missed and the possibility of shaping a better future for all is being put at risk by not taking a holistic and systemic approach to change.

Action needs to be scaled up and accelerated. An incremental approach will not deliver what is required. If Ireland is to address the scale, speed and depth of the change required to close the gap between ambition and action, an approach that focuses on rapid and systemic transformations is necessary.

Equity is an important societal goal and an essential element of achieving transformative change both in terms of mitigation and adaptation to climate change. Including considerations of equity at the core of decision making is key to enabling transformative change that enhances living standards, while halving associated energy demand, reducing vulnerability and proactively preparing individuals, households, communities and systems for climate shocks.

Climate change and biodiversity loss share many underlying drivers. These underlying drivers need to be addressed if Ireland is to achieve its national and international commitments. Just as the drivers of these crises are linked so too are the solutions.

A long-term integrated strategic plan is necessary to drive action in the immediate and short terms, but also to deliver a strong signal on the direction of travel towards a climate-neutral, climate-resilient, biodiverse and sustainable future. Such a plan can leverage greater benefits and opportunities, now and in the future.

1.1. Urgency and the challenges ahead

A safe climate system and functioning natural world are the foundation of human wellbeing and prosperity. It is not too late to act to protect these essential life support systems. To close the gap between ambition and action (mitigation and adaptation) and match the scale, speed and depth of change required if Ireland is to deliver on the national climate objective, necessitates major transformations. These transformations will be required across all sectors – energy, food and land systems, urban systems (including planning, transport and buildings) – livelihoods, lifestyles, development pathway and systems of governance and in participation. Delivering this change will be challenging. However, most of the technologies and know-how to reduce emissions and to adapt to climate change already exist (IPCC, 2023b; see Figure 1.1). In many cases, the financial cost of action is cheaper than the status quo (IPCC, 2022c; New et al., 2022). Greenhouse gas emissions can be cut in the short term through addressing the drivers of demand, making it easier to decarbonise the energy system in the long term (Creutzig, et al., 2022a, 2022b; Gaur et al., 2022; see Chapter 5 and section 6.2.2). The challenges and their associated costs are increasingly social and political, rather than financial or technological (Markkanen and Anger-Kraavi, 2019; Jewell and Cherp, 2020; see Volume 2, Chapter 1). Experiencing and responding to climate extremes reduces the capacity for longer-term systemic action by drawing focus and resources, adding to the effort required to make change happen (Laybourn et al., 2023).

Climate change is far from the only challenge facing Ireland. Housing, health care, inequality and other environmental issues also require action (Social Justice Ireland, 2021; see Chapter 4). If measures taken to address climate change conflict with these objectives, opportunities to realise co-benefits through addressing core systemic issues will be missed, and action on climate will slow down (Falduto and Rocha, 2020). However, research shows that a achieving a decent standard of living for all, within nature's limits, can be an essential component of delivering climate action and allowing all people to live well now and in the future (Raworth, 2017; Creutzig et al., 2022b).

While the carbon budgets developed under the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a) have specific targets, the Act also states the wider national climate objective of "the transition to a climate *resilient, biodiversity rich, environmentally sustainable* and climate neutral economy" by no later than the end of the year 2050. Although these objectives do not undergo the same level of scrutiny as greenhouse gas emissions through the carbon budgets (see Volume 2, Chapter 2), they are important and significant goals that require the same level of urgency, attention and action. There are multiple pathways that can deliver on the national climate objective and the goals of the Paris Agreement and the Kunming–Montreal Global Biodiversity Framework. Transformative change can set in motion a myriad benefits and opportunities associated with developing and delivering these pathways, including a safer climate, functioning natural ecosystems and gains for society, such as good jobs, more comfortable homes and enhanced wellbeing, and for the economy, such as avoiding the disastrous effects of climate impacts. Ireland is not on track to deliver on this long-term transformation, as ambition is not being matched with action on emissions, resilience, biodiversity or environmental sustainability (CCAC, 2021a, 2022; EPA, 2020).

However, there is evidence to suggest that some of groundwork necessary to support these transformations is taking place. Ireland was among the first countries to declare a climate and biodiversity crisis, divest public funds from oil, gas and coal companies[1], halt new exploration for oil and gas and ban hydraulic fracking. Other examples include the Climate Action Plan 2021 and 2023 (DECC, 2021, 2022), carbon budgets and sectoral ceilings (CCAC, 2021b), the development of sectoral adaptation plans (CCAC, 2022), a €14 billion a year investment in climate action between 2021 and 2030 (DECC, 2021), not to mention the groundbreaking citizens' assemblies on climate action and more recently on biodiversity loss, as well as a parallel Children and Young People's Assembly on Biodiversity Loss. Pathfinder projects are bringing more public transport, cycling and walking to Irish villages, towns and cities. Those who will deliver much of the emissions reductions in the building sector are being recruited and trained (Government of Ireland, 2020). The enhancement of the electricity grid will ensure its capacity to manage the huge increase in renewables that is in the planning pipeline. Most of the technologies required to deliver rapid reductions in greenhouse gas emissions are mature and cost-effective already, without subsidies (IPCC, 2022d; see Volume 2, Chapters 4, 5 and 7). Alongside these and many other developments, momentum is building in civil society, driven in large part by children and young people becoming involved in activism and linking climate change and human rights issues in the judicial system, and successfully keeping climate change on the political agenda (Creutzig et al., 2022b; Daly, 2022; Dubash et al., 2022; see section 8.5).

[1] In the case of divesting public funds, this had global implications, reducing the market value of the biggest fossil fuels companies in the USA, by €14 billion, in the 3-day window around the announcement (Becht et al., 2023).

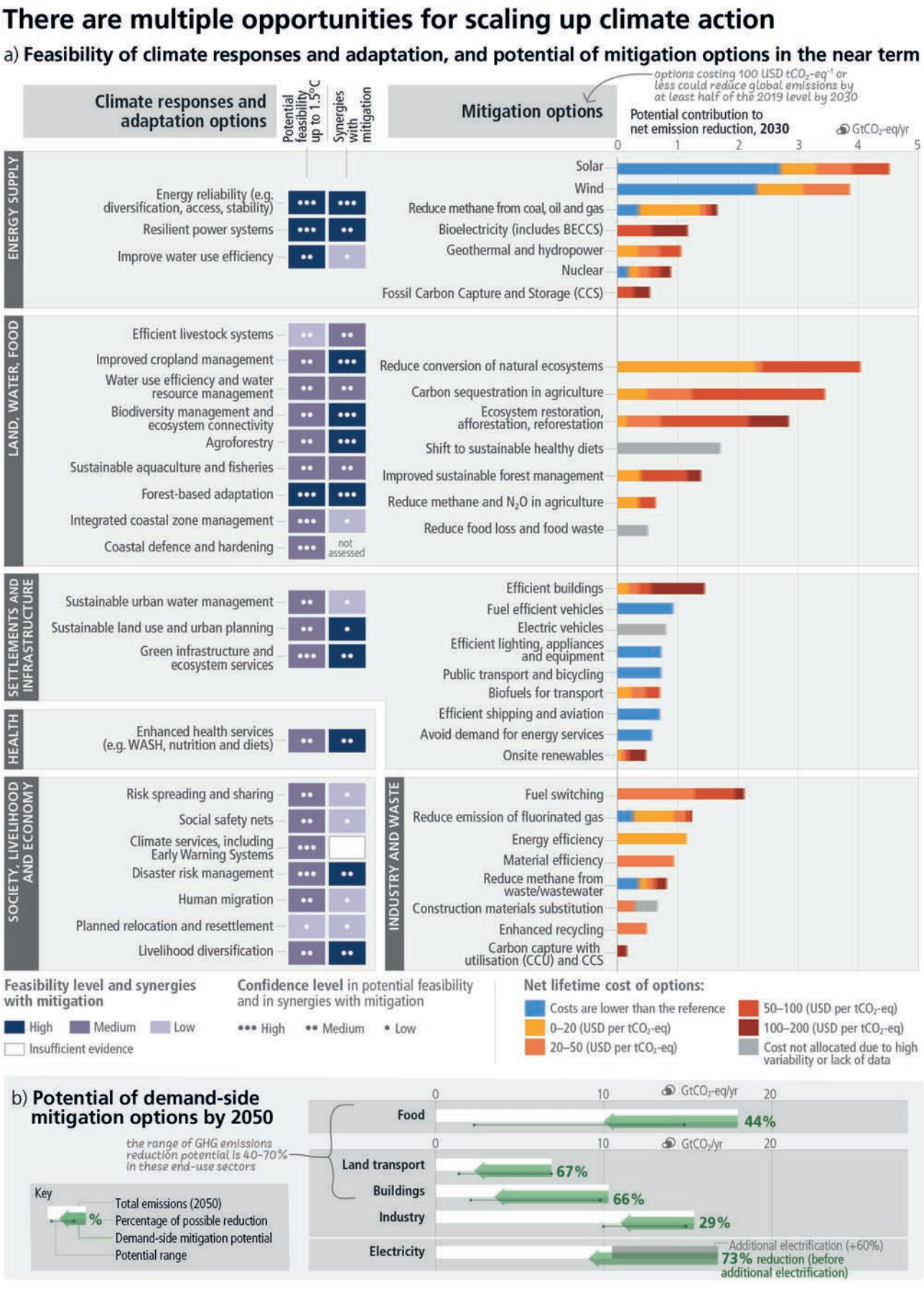


Figure 1.1 Multiple opportunities for scaling up climate action. Source: IPCC (2023b; their figure SPM.7).

This volume uses international evidence and research to frame and assess transformation and synthesises existing Irish research, focusing on the type of change – transformative change – that can make a difference when it comes to upscaling and accelerating action to match ambition. This volume looks at key elements of possible pathways and explores how to achieve transformative change. It highlights the benefits and opportunities that result from taking decisive action in the short term, not only as outcomes of action but as critical ingredients of the transformation itself. Transformative change, the seeds of which have already taken root in Ireland, can allow Ireland to continue to develop and prosper and become a place where people and nature flourish in a safer climate now and in the future (see also Chapter 6, Volume 3, Chapter 9, and O'Mahony, 2022).

1.2. Wellbeing and equity are at the heart of transformations to sustainability

Acting on climate change or on biodiversity loss can often seem removed from or even at odds with actions to enhance human wellbeing and equity, but climate action and safeguarding nature are fundamentally about securing a liveable future for all and improving people's lives (New et al., 2022; see Figure 1.2). The Fifth Assessment of the Intergovernmental Panel on Climate Change (IPCC) identified human wellbeing as a fundamental route to climate action (Fleurbaey et al., 2014). Building on this, O'Mahony (2022) developed a 'sustainable wellbeing' conceptual framework for transitions and transformations (see also sections 4.3, 6.2 and 7.3.4, and Volume 3, Box 9.1). From another perspective, if "living well within the limits of the planet" (EEA, 2017) is to be achieved then the role of human wellbeing and equity are central. Globally, achieving a universal decent standard of living can halve energy demand while increasing the wellbeing of most people (Creutzig et al., 2022a, 2022b; Millward-Hopkins, 2022; Rockström et al., 2023; see Chapter 5).

Energy poverty is a manifestation of the interrelationship between socioeconomic disadvantage, climate action and wellbeing. Households with lower incomes spend a much larger share of their income on fuel and are particularly vulnerable to energy price rises (Barrett et al., 2022). Energy poverty is also associated with poor health outcomes (Thomson et al., 2017). Climate action measures can either exacerbate or alleviate energy poverty, depending on their design (Belaïd, 2022). Addressing greenhouse gas emissions, deprivation and health in tandem, therefore, is an opportunity to deliver multiple benefits and avoid barriers to climate action.

Consideration of equity is also critical when considering adaptation options. Proactive or anticipatory adaptation that reduces the exposure and vulnerability of people and systems means that they are better prepared for climate shocks (Bezner Kerr et al., 2022; see Volume 3). When inequalities are reduced, climate adaptation interventions are designed, implemented and evaluated more effectively, and vulnerabilities decrease (Ireland and McKinnon, 2013; Eriksen et al., 2021; Schipper et al., 2021). Transformative adaptation requires fundamental systems change to address the root causes of vulnerability (Fedele et al., 2019). Equity is also critical in delivering the societal and political transformations that occur to enable transformative change and achieve sustainability (Dubash et al., 2022; see sections 4.2.1 and 6.2.2).

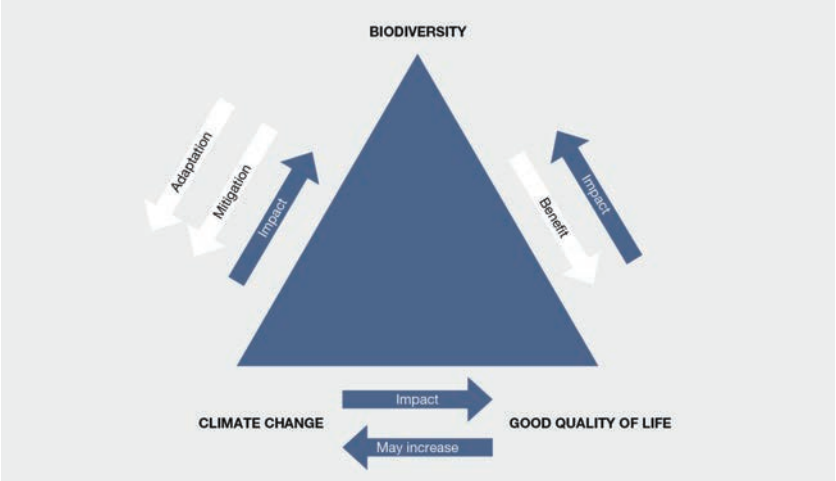
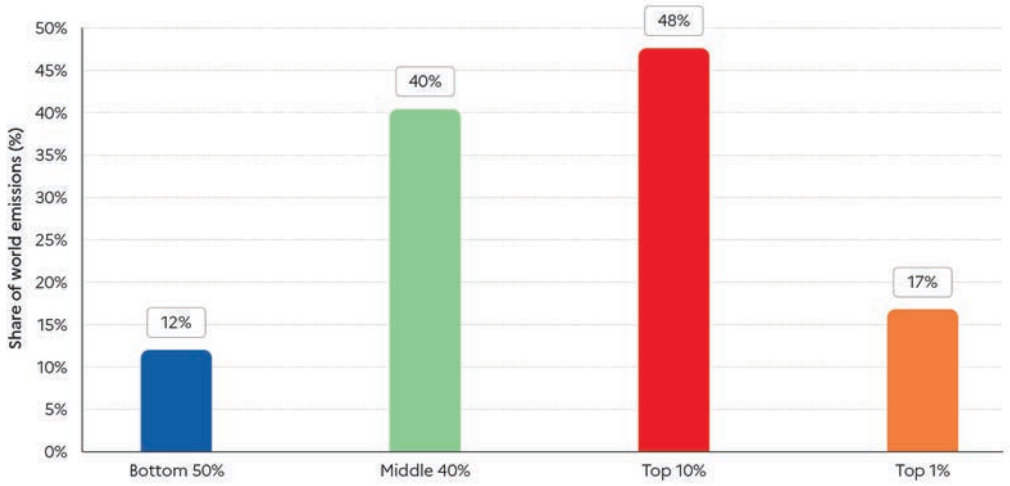


Figure 1.2 Relationship between climate change, biodiversity and good quality of life. Blue arrows represent interactions that are predominantly threats, and white arrows represent opportunities. Source: Pörtner et al. (2021; their figure 1.1); originally adapted from Korn et al. (2019).

Economic indicators such as gross domestic product (GDP; or, in Ireland's case, modified gross national income; Honohan, 2021) do not adequately reflect wellbeing in all its economic, social or environmental aspects (OECD, 2018; NESC, 2021). A wellbeing framework, including a set of wellbeing indicators, is currently undergoing development and implementation (Government of Ireland, 2021b, 2022). This could signal the beginning of a move away from using narrow economic indicators of progress as a proxy for wellbeing. However, as long as the wellbeing indicators remain peripheral (e.g. used to inform financial budgets) as opposed to substantive (e.g. enshrined in law and central to policymaking and long-term strategy), the central role of wellbeing and equity in achieving long-term and intergenerational sustainability may not be realised. Carefully considered climate policy can help deliver on societal, environmental and economic objectives and accelerate climate action and transformation (see sections 6.2.3 and 7.4). Putting wellbeing and equity alongside sustainability at the centre of decision making, as fundamental goals, is an important part of creating transformative change (OECD, 2019; NESC, 2021; O'Mahony, 2022).

Box 1.1 The interplay of carbon emissions and income inequality

Carbon emissions are closely linked to global wealth disparities. For context, while the global average carbon dioxide emission per person stands at 6.6 tonnes annually, a member of the top 1% emits a staggering 110 tonnes (Chancel et al., 2022). This difference becomes more pronounced when considering that someone from the top 1% may have a carbon footprint up to 175 times greater than someone in the bottom 10% (Otto et al., 2019). Statistically, the top 10% of emitters are responsible for approximately 50% of total emissions, contrasted against the bottom 50%, which account for just 12% (Chancel et al., 2022; Box 1.1, Figure 1). See section 5.2.3 for Ireland's specific figures.



Box 1.1 Figure 1 Global carbon inequality 2019: global emissions by income groups, accounting for domestic consumption, investments and carbon in traded goods and services. Source: Chancel et al. (2022). Reproduction licensed under the Creative Commons Attribution CC BY 4.0 licence (https://creativecommons.org/licenses/by/4.0/).

These disparities extend to consumption patterns. Evidence suggests that nearly half of the world's energy consumption is shouldered by the top 10%, especially when accounting for the energy embedded within imported goods (Creutzig et al., 2022b). The consumption behaviours of the affluent not only exert a direct environmental cost, but also set aspirational benchmarks for the larger populace. Therefore, any substantial behavioural modification among this group could cascade into wider societal change, amplifying the overall impact (Otto et al., 2019).

A sustainable and equitable future mandates a paradigm shift in both sociocultural norms and economic infrastructures. These very structures are, at present, exacerbating the challenges contributing to climate change (Stoddard et al., 2021). Identifying and addressing underlying drivers that promote high-carbon lifestyles can enhance the effectiveness of interventions and drive more substantial emissions reductions (Stoddard et al., 2021).

A significant untapped potential exists in reducing global carbon emissions by modifying the lifestyles of the affluent. A 20% reduction in their carbon footprint is feasible by transitioning their homes to carbon-neutral standards, promoting decentralised renewable energy and encouraging electric vehicle use. Moreover, opting for durable goods and curtailing excessive consumption, especially frequent air travel, can further decrease emissions (Otto et al., 2019). Notably, conventional policies like heavy environmental taxation might be insufficient as deterrents for the ultra-wealthy, who can readily bear the cost of continued pollution. Instead, introducing compulsory measures, like mandatory renewable installations for properties above specific sizes, could yield more substantive results (Otto et al., 2019). See section 5.2.3 for more policy recommendations.

Targeted demand management focused on high emitters holds significant potential, given that a disproportionate share of global emissions comes from a minor segment of the population. To underscore this, reducing emissions of the top 10% to the EU average would lead to a 30% decline in global carbon dioxide emissions (Stoddard et al., 2021).

1.3. What is transformative change?

Transformative change is a fundamental, system-wide reorganisation across technological, economic and social factors, including paradigms and goals, and valuing the climate, the environment, equity and wellbeing within decision making (IPBES, 2018; IPCC, 2018). These factors often work in concert and on multiple scales to tackle the root or underlying drivers of the connected crises of climate change and biodiversity loss (IPBES, 2019a; IPCC, 2018, 2022b, 2022c). It "relies on shifting away from predominant values that currently over emphasise short-term and individual material gains, to nurturing sustainability-aligned values across society" (IPBES, 2022).

If the national climate objective is to be achieved it will require what the IPCC describe as "transformative systemic change integrated with sustainable development" (IPCC, 2018; see section 6.2) and "transformative changes across economic, social, political and technological factors" (IPBES, 2019a; see Chapter 7). Sustainability can be achieved through "significant and enduring societal shifts at all levels" and a "conscious and deliberative transformation that addresses the underlying or root causes of multiple interconnected problems", which will require integrated and long-term planning (Sachs et al., 2019; O'Brien et al., 2022; see section 7.3.4).

Some principal elements of transformative change have been identified during recent global assessments on climate change and biodiversity loss, including:

- recognising that climate change and biodiversity loss are intrinsically linked and pose grave threat to the natural world and human wellbeing (Pörtner et al., 2021; IPBES, 2022; see Figure 1.2);
- recognising that these dual crises need to be tackled together to make the most of synergies and manage trade-offs (IPBES, 2022; IPCC, 2022c);
- recognising the importance of justice and equity and the roles they play in societal acceptance of change and in the effective policymaking that can allow a sustainable development pathway to be developed while also delivering action on climate and biodiversity loss (IPBES, 2019b; IPCC, 2022c; see section 6.2);
- recognising the need to tackle the indirect drivers or underlying causes that are acting as barriers to action on direct drivers (Barger et al., 2018; Balvanera et al., 2019; Pathak et al., 2022; de Koning et al., 2023);
- recognising that an integrated long-term strategy for solving these problems has the potential to improve human wellbeing in both the near and long terms (Sachs et al., 2019; Turnhout et al., 2021; see section 7.3.4);

- acknowledging that addressing climate change requires more than technical solutions, that it requires societal change (Schreuder and Horlings, 2022; Stephens, 2022; see section 6.2 and Chapter 8);
- emphasising the need for inclusive and participatory approaches to engage multiple stakeholders to foster systemic shifts towards sustainability (Schreuder and Horlings, 2022; see Chapter 8).

When considering transformative change in relation to climate change and biodiversity loss, three dimensions require attention: the depth, scale and speed of change (Fazey et al., 2018; Moore et al., 2021). If change is systemic then it has the appropriate depth. This involves substantial alterations in policies, technologies, infrastructures and behaviours to move to low-carbon and sustainable pathways (Moore et al., 2021). If it is comprehensive, occurring on multiple scales, individuals to systems, local to global, then it has the appropriate scale. This involves engaging diverse stakeholders, fostering collaboration across sectors, and addressing interconnected issues such as social equity, economic factors and environmental justice (Moore et al., 2021). If the intended consequences are rapid, then it has the appropriate speed. This calls for agile policy frameworks, innovation and adaptive governance structures to facilitate swift and effective responses to climate challenges (Moore et al., 2021; see Chapter 7). If Ireland is to address the speed, scale and depth of the change required to close the gap between ambition and action, an approach that focuses on systemic, comprehensive and rapid transformations is necessary (Roy et al., 2018). The current incremental approach to transition is not sufficient if the transformative change required is to be achieved (Pathak et al., 2022).

While Ireland is laying the foundations that could support the achievement of the national climate objective, global studies such as Morrison et al. (2022) make it ever more clear that this requires radical[2] interventions. This volume focuses on identifying (1) the seeds of transformative change that have already taken root in Ireland, (2) synergies and how they may be enhanced while managing trade-offs to make the most of benefits and opportunities that come with transformative change, (3) how to enable transformative change and (4) the next steps in terms of developing research to address knowledge gaps, in order to increase the speed, scale and depth of the change necessary if transformation is to be achieved.

[2] Transformative change requires radical, from the Latin word radicalis meaning 'of or related to a root', interventions to get at the underlying or root causes of the climate change (Temper et al., 2018; McPhearson et al., 2021; Morrison et al., 2022).

1.3.1. What is being transformed?

Multiple transformations, in economic, societal, political, technological and environmental systems, will take place, by 2050, if Ireland is to deliver on its commitments under the Paris Agreement and the national climate objective. Structural change will be required to change how production and consumption are 'governed, organised and practiced' by society, to shift production and consumption to sustainable activities, such as moving from fossil fuels to renewables (Scoones et al., 2020). System change will be required to transform sociotechnological systems, such as the energy, transport, food and land systems, that are made up of the technologies, infrastructures, organisations, markets, regulations and practices that allow society to function (Geels et al., 2017). The way in which people engage with one another and work together will have to change so that new transformative pathways, to a better future through social, cultural and political change, can be achieved (O'Brien, 2015). Enhancing capacity and processes and focusing on power asymmetries and social justice will be required to deliver this change (Pereira et al., 2019).

Box 1.2 Post-growth: questioning the growth-based economy

there's another way to count wealth and abundance – as hope for the future, safety and public confidence, emotional wellbeing, love and friendship and strong social networks, meaningful work and purposeful lives, equality and justice and inclusion. Rebecca Solnit (Solnit, 2023)

Recent major assessments by the IPCC, the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the European Environment Agency (EEA) have discussed moving past growth-oriented economics to explore post-growth pathways, as the need for transformative change calls for a 'profound rethink' of humans activities with regard to sustainability (IPBES, 2019b; EEA, 2021; IPCC, 2022b, 2022c; Riahi et al., 2022).

Post-growth, an approach to economics that focuses on the possibility of prosperity without growth, challenges the assumption that growth is a necessary requirement for wellbeing in developed economies. Growth-based economics, and the high levels of consumption necessary to support it, is at odds with the actions to curtail activities that breach the limits of the planet and of the ecosystems that sustain human wellbeing. It considers a world that is not centred on productivism, output or consumption, but on quality of life, the social world and creativity[3].

Calls for post-growth-oriented economies[4] are gaining attention, and policymakers and research funders in Europe are actively seeking information. In May 2023, the European Parliament organised an event – Beyond Growth: Pathways towards Sustainable Prosperity in the EU – to explore ideas related to societal wellbeing, sustainably prosperity and what post-growth might look like in Europe. Meanwhile, the European Research Council funded a prestigious Synergy Grant of €10 million to learn more about pathways to post-growth economics, around "how dramatic reductions in energy and resource use can be achieved, while at the same time ending poverty and ensuring decent lives for all"[5]. Recent research in Ireland supports this, as it finds that achieving mitigation pathways is more feasible with lower energy demand and results in many benefits to society and a better standard of living (Gaur et al., 2022). See also section 6.2.2, which discusses and assesses literature on economic growth, green growth, degrowth and post-growth.

[3] https://www.greeneuropeanjournal.eu/beyond-the-choke-hold-of-growth-post-growth-or-radical-degrowth/

[4] For developed economies.

[5] https://www.uab.cat/web/sala-de-premsa-icta-uab/detall-noticia/european-project-to-explore-pathways-towards-post-growth-economics-1345819915004.html?detid=1345872411651 and https://erc.europa.eu/news-events/news/erc-synergy-grants-2022-project-highlights

1.3.2. Who is transforming it?

Research on sustainability transitions suggests that transformative change begins with a stable system, consisting of actors, technologies and institutions (Köhler et al., 2019). Enabling approaches, in particular, recognise the potential of human agents, particularly the role of the individual, in community, and grassroots-led change (Scoones et al., 2020). Various agents of change have been identified, for example individuals, social movements, communities, associations, activists (including strategic and political activists), intermediate actors (e.g. policy entrepreneurs), consumers, system users (i.e. energy users), businesses and policymakers, and various combinations of these actors working together (Farla et al., 2012; de Haan and Rotmans, 2018; see Chapter 8).

Radical innovations often emerge in protected spaces or niches, sometimes introduced by new players or outsiders (Geels and Schot, 2007). Successful innovations gradually expand in scale, scope and geographic reach, contributing to the emergence of new regimes (Geels et al., 2017). Incumbent actors can either support or resist these innovations through a combination of government policies, economic forces, institutional factors and behavioural pressures (EEA, 2018). Transformations are characterised as non-linear processes in which periods of rapid change, triggered by tipping point behaviours, alternate with periods of relative stability. Transformative change may be perceived as the result of the deliberate and strategic actions of many different actors, promoting tipping point behaviour by taking gradual steps that grow in strength over time (de Haan and Rotmans, 2018). Numerous actors have the potential to either initiate or impede significant systemic change.

Interesting examples of transformative change, led by individuals, grassroots organisations, communities up to semi-states and state involvement have been included throughout this volume. These examples demonstrate transformative change that is happening in Ireland today, and the associated benefits and opportunities are highlighted. Individuals, social movements, non-governmental organisations (NGOs) and the state are prevalent in the Irish context as agents driving transformative change (see section 8.4). While these actors are aware of the changes they are making and how they affect surrounding communities, at local regional and national levels, they may not refer to their work as transformative.

Box 1.3 COVID-19 as an example of rapid transition

The pandemic swiftly and significantly transformed various aspects of society, highlighting the potential for accelerated change in response to a crisis. COVID-19 necessitated immediate and wide-ranging adaptations in health care systems, public health measures and daily routines. Governments implemented strict lockdown measures, travel restrictions and social distancing protocols to mitigate the spread of the virus. These measures resulted in unprecedented shifts in societal behaviour and economic activities (European Centre for Disease Prevention and Control, 2022). There is strong evidence and high consensus indicating that the COVID-19 pandemic has amplified the likelihood of governments implementing extensive measures to support public goods and address climate change (Creutzig et al., 2022b; see Chapter 5).

The pandemic also triggered rapid innovation and digital transformation (Von Krogh et al., 2020; Kronblad and Envall, 2021). Remote work and online education became the new norm, with businesses, educational institutions and individuals quickly adapting to virtual platforms and digital communication tools. e-commerce experienced a significant surge as consumers turned to online shopping to meet their needs. These changes exemplify how a crisis like COVID-19 can expedite the adoption of new technologies and reshape traditional practices.

The behavioural shifts resulting from the pandemic have further strengthened the importance of sufficiency and solidarity and economies focused on care, protection of livelihoods, collective efforts and the provision of essential services. These changes have also been associated with reduced emissions (Creutzig et al., 2022b; see Box 5.2) The crisis reinforced the need for interconnectedness and collaboration, transcending national borders and prompting joint efforts at the European and global levels to coordinate responses and share resources.

1.3.3. Getting to the roots of the problem

Interventions that act on the direct drivers of climate change, biodiversity loss and inequality are hampered by the, often shared, indirect or underlying drivers of change (see Figure 1.3). These indirect drivers take many forms, including "formal and informal institutions, such as norms, values, rules and governance systems, demographic and sociocultural factors, economic and technological factors" (Díaz et al., 2015; Barger et al., 2018; Brondízio et al., 2019; Cumming et al., 2020) and "conflicts and epidemics" (Díaz et al., 2019; IPBES, 2019a).

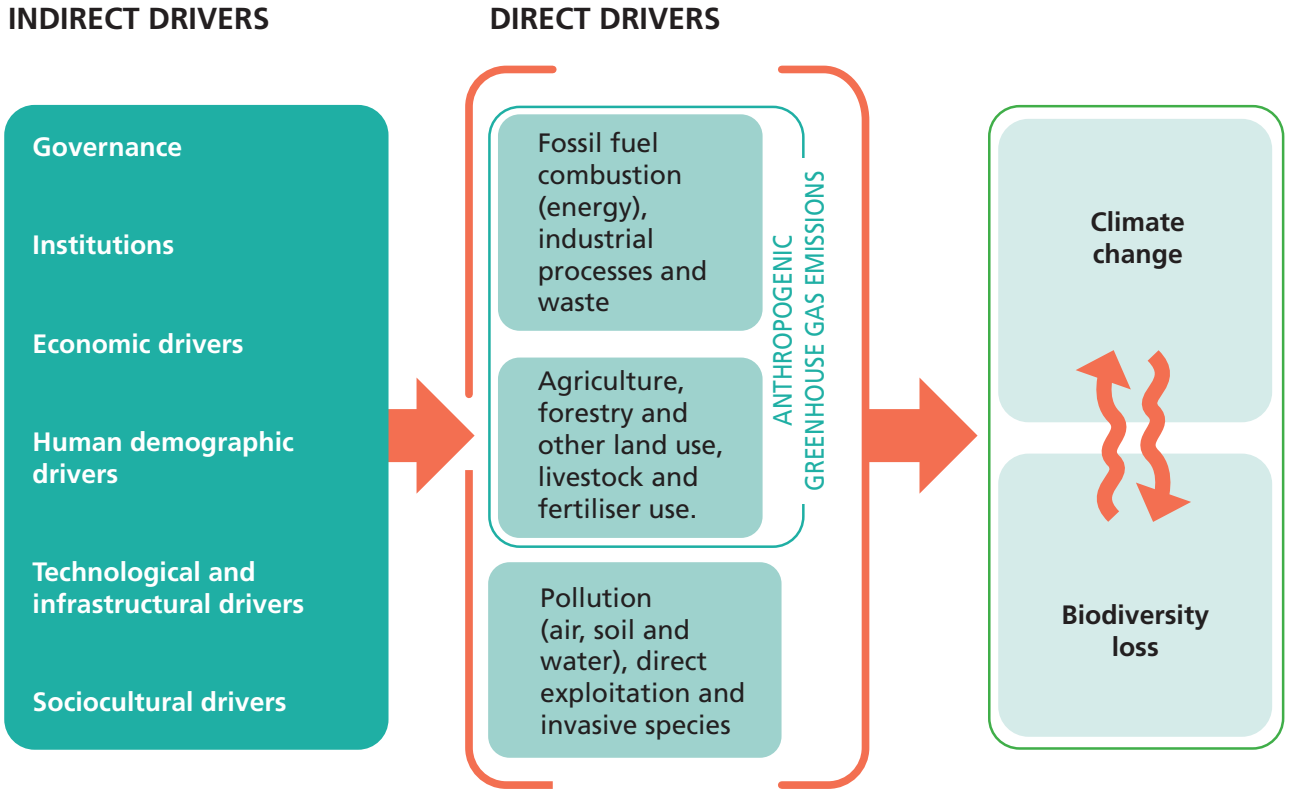


Figure 1.3 Indirect and direct drivers of anthropogenic greenhouse gas emissions causing climate change and of human activities linked to biodiversity loss. Source: Adapted from figure 1.3 in Pörtner et al. (2021).

Indirect drivers determine the economic activities that propel direct drivers of change (Chan et al., 2020). For example, sociocultural and demographic factors influence consumption patterns that determine fossil fuel and land-use emissions (see Chapter 5). The food system and the energy system underpin human societies and have deep links to and are embedded within, for example, systems of governance (Ehrlich and Pringle, 2008). Interventions aimed at direct drivers challenge vested interests who benefit from the status quo and strongly oppose any change (Chan et al., 2020; see Box 1.4). Addressing the underlying drivers requires "systemic change and structural transformation of human to human and human to nature relationship" (Morrison et al., 2022).

How can those underlying drivers start to be addressed in Ireland? A better, deeper understanding of the systems and structures that are present in Ireland and how they act as barriers, or, better still, how they can be augmented to enable change, is required. One recent example, with policy relevant and actionable recommendations for Ireland, is a report from the Organisation for Economic Co-operation and Development (OECD) titled *Redesigning Ireland's Transport for Net Zero: Towards Systems the Work for People and the Planet* (OECD, 2022), which found that "the Irish transport system fosters growing car use and emissions by design". As part of this analysis, systems thinking and systemic tools were used to identify policies that have the power to be transformative. This helped to refocus Ireland's transport decarbonisation strategy within the Climate Action Plan 2023 to go beyond vehicle technology change, and to prioritise the reduction in car dependency, a transformational approach, alongside vehicle electrification (OECD, 2022).

Box 1.4 The status quo bias

The status quo bias refers to the preference for the existing state of affairs. Behavioural, sociocultural, business and corporate, institutional and infrastructural drivers can act to maintain the status quo or assist in generating the momentum to achieve a sustainable, resilient and equitable future with enhanced human wellbeing (Creutzig et al., 2022b; see Box 1.4, Table 1, and Chapter 5). Box 1.4, Table 1, summarises how these drivers contribute to the status quo, what can be done to change this, alongside implications for policy and examples from the international literature (Creutzig et al., 2022b).

Institutional drivers that contribute to the status quo have been studied in the Irish context. A major barrier to overcoming the status quo is the political power that comes with the economic centrality of fossil fuels and agriculture (Denton et al., 2022; Grubb et al., 2022). Incumbent actors use this power to block effective climate action through lobbying government and are more effective than other stakeholders who wish to see the benefits of strong climate action (Meng and Rode, 2019). The preferences of institutionally important and economically power institutions, particularly those related to the agricultural sector, are reflected in Irish law, while the preferences of those who advocate for stronger regulation are not (OECD, 2017; Torney, 2017; Wagner and Ylä-Anttila, 2018). New policy instruments, discussions, platforms and implementation agencies with enhanced capacity will be necessary to overcome institutional barriers to change (Creutzig et al., 2022b; see Chapter 7).

Throughout this volume, examples of research related to other drivers – behavioural (see Chapter 5), sociocultural (see Chapter 8), business and corporate (see Chapter 4) and infrastructural (see Chapter 3) – that maintain the status quo are considered based on the available evidence.

Box 1.4 *Table 1 Drivers of the status quo bias: main features, insights and policy implications of five drivers of decision and action*

Driver	How does driver contribute to status quo bias?	What needs to change?	Driver's policy implications	Examples
Behavioural	Habits and routines formed under different circumstances do not get updated Present bias penalises upfront costs and discourages energy efficiency investments Loss aversion magnifies the costs of change When climate change is seen as distant, it is not feared Nuclear power and accident potential score high on psychological dread	New goals (sustainable lifestyle) New capabilities (online real-time communication) New resources (increased education) Use of full range of incentives and mechanisms to change demand-side behaviour	Policies need to be context specific and coordinate economic, legal, social and infrastructural tools and nudges Relate climate action to salient local risks and issues	India's new LPG scale-up policy uses insights about multiple behavioural drivers of adoption and use Rooftop solar adoption expanded in Germany, when feed-in tariffs removed risk from upfront cost recovery Nuclear power policies in Germany post Fukushima affected by emotional factors

Driver	How does driver contribute to status quo bias?	What needs to change?	Driver's policy implications	Examples
Sociocultural	Cultural norms (e.g. status, comfort, convenience) support existing behaviour Lack of social trust reduces willingness to shift behaviour (e.g. adopt car sharing) Fear of social disapproval decreases willingness to adopt new behaviours Lack of opportunities to participate in policy create reaction against 'top-down' imposition Unclear or dystopian narratives of climate response reduce willingness to change and to accept new policies and technolo-gies	Create positive meanings and norms around low-emission service delivery (e.g. mass transit) Community initiatives to build social trust and engagement, capacity building, and social capital formation Climate movements that call out the insufficient, highly problematic state of delayed climate action Public participation in policymaking and technology implementation that increases trust, builds capacity and increases social acceptance Positive narratives about possible futures that avoid emissions (e.g. emphasis upon health and slow/ active travel)	Embed policies in supportive social norms Support collective action on climate mitigation to create social trust and inclusion Involve arts and humanities to create narratives for policy process	Communicate descriptive norms to electricity end users Community energy initiative REScoop Fridays for Future
Business and corporate	Lock-in mechanisms that make incumbent firms reluctant to change: core capabilities, sunk investments in staff and factories, stranded assets	New companies (e.g. car-sharing companies, renewable energy start-ups) that pioneer new business models or energy service provisions	Influence consumer behaviour via product innovation Provide capital for clean energy innovation	Electrification of transport opens up new markets for more than a hundred million new vehicles

Driver	How does driver contribute to status quo bias?	What needs to change?	Driver's policy implications	Examples
Institutional	Lock-in mechanisms related to power struggles, lobbying, political economy	New policy instruments, policy discussions, policy platforms, implementation agencies, including capacity	Feed-in tariffs and other regulations that turn energy consumers into prosumers	Mobility case study, India's LPG policy sequence
Infrastructural	Various lock-in mechanisms such as sunk investments, capabilities, embedding in routines/lifestyles	Many emerging technologies, which are initially often more expensive but may benefit from learning curves and scale economies that drive costs down	Systemic governance to avoid rebound effects	Urban walking and bike paths Stable and continuous electricity supply fostering induction stoves

Notes: Entries in each column represent independent lists, not intended to line up with each other. LPG, liberalisation, privatisation and globalisation.

Source: Creutzig et al. (2022b; their table 5.4).

1.4. Closing the gap

Taking a transformative approach to climate change mitigation and adaptation is an opportunity to start closing the gap between ambition and action while enhancing benefits – environmental, societal and economic – in the near term as well as in the long term. This holistic and systemic approach addresses the underlying drivers that are acting as barriers to change and through iterative learning, co-creation, visioning and cooperation enable the emergence of new and equitable pathways to sustainability. To close the gap, strategies that can bring together the benefits of action in the near term and action on a longer timescale are necessary. Action on mitigation and adaptation this decade can reduce the losses and damages to human wellbeing and natural systems, but this window of opportunity is rapidly closing. Long-term plans give strength to near-term actions, putting them in the context of the overall goal and signposting to all actors the long-term direction of travel, allowing those actors to adjust their near- and medium-term plans accordingly. Exploring synergies and trade-offs can assist in understanding how actions on mitigation and adaptation can either enhance or compete with other objectives. Maximising synergies while minimising and managing the remaining trade-offs can help accelerate change in different areas of policy and, at the same time, enhance societal gains.

1.4.1. Enabling conditions

Enabling transformative change involves iterative processes of change, as opposed to following a predetermined pathway. The literature does not provide a consensus on the best approach for actors to deliberately pursue transformation or the extent to which actors can guide the process (Grubb et al., 2022). Instead, the transitions and transformation literatures, drawing from a complex systems perspective (Köhler et al., 2019), indicate that interventions in such systems rarely lead to predetermined outcomes, and successful interventions often resemble iterative processes of action, observation and response (Grubb et al., 2022).

Transformation is viewed as a collective action challenge that involves actors with common and differing values, interests and capabilities interacting over time, with cooperation and competition. Grounded in the sustainability transitions literature, transition management (Loorbach, 2010) supports collaborative arenas where actors co-create visions of change, plan pathways and engage additional actors in the transformation process. These frameworks and tools embrace multiple objectives and measures to consider trade-offs among diverse parties with different interests and values. Multiple scenarios are used to stress-test proposed actions, identifying conditions under which they would fail to meet their goals and informing ways to enhance their robustness and resilience across multiple possible futures (Denton et al., 2022; see section 6.2.4). On the other hand, focusing solely on single or overly aggregated measures and scenarios can favour certain actors' perspectives, reduce transparency and impede the identification of resilient and equitable solutions to complex, uncertain, non-linear and contested problems (Grubb et al., 2022).

Transitioning to sustainable practices can face various barriers, such as infrastructure lock-ins, resistance to behavioural and cultural changes, institutional inertia, trade-offs with competing social and political objectives, and the cost and availability of reliable renewable energy technologies and materials (Denton et al., 2022). The transition to a low-carbon economy is often hindered by lock-ins and path dependencies. Lock-ins occur when existing technologies and systems become dominant and resistant to change due to factors like infrastructure investments, economic interests and social norms. Path dependencies arise from historical choices and decisions that limit future options, making it difficult to deviate from established paths (Goldstein et al., 2023). Other barriers include institutional challenges such as inadequate coordination and policy inconsistencies, political obstacles like short-term planning and resistance, and social and cultural barriers such as resistance to change and lack of social acceptance (Burch, 2010; Simonet and Leseur, 2019; Moosavi et al., 2023). Conversely, the factors that can hinder a transition can also be turned around and used to support and facilitate the transition. This can be done by transforming barriers into enablers by addressing the underlying causes of the obstacles and implementing strategies to overcome them (Burch, 2010). By leveraging drivers and enablers, actors can overcome barriers and promote effective action on climate change.

Essential factors that enable and leverage the transition include individual and collective actions, such as strong leadership and education (see Chapter 8); drivers like financial, material, social and technical support that encourage innovation; effective national and regional systems that promote the spread of new technologies; supportive policies and governance structures at various levels that allow for flexibility and coherence; efforts to address and overcome the equality challenges associated with the transition; and comprehensive, long-term planning that aims to achieve synergy between climate change and sustainable development, while avoiding trade-offs (Denton et al., 2022). In this volume, the factors that can enable transformations are organised into three main categories: finance and innovation (see Chapter 6), governance and policy (see Chapter 7) and people (see Chapter 8). This broad classification also encompasses other aspects, including research, education, communication and equity.

1.4.2. Benefits of near-term planning for climate action

Choices made, and actions implemented, in the near term will determine the magnitude and the rate of climate change (IPCC, 2023b). The Synthesis Report of the IPCC Sixth Assessment Report highlights the benefits that would arise from deep, rapid and sustained mitigation and accelerated implementation of adaptation actions taken this decade, including reduced losses and damages for both human and natural systems and many co-benefits for human health and wellbeing (IPCC, 2023a). Accelerating adaptation implementation can enhance benefits, including improving agricultural productivity, innovation, health and wellbeing, food security, livelihoods and biodiversity (IPCC, 2023a). However, implementation times for adaptation are long, and so it is important to close existing gaps, in the near term, to ensure those benefits. Accelerating mitigation can provide benefits for health, primarily though reducing air pollution, increasing active mobility and shifting people towards sustainable healthy diets (IPCC, 2023a; see Chapter 5). Economic benefits that come from near-term improvements in air quality and health are of a similar or greater magnitude as mitigation costs before considering the avoided economic, social and environmental benefits of limiting warming to 2°C (IPCC, 2023a). Accelerating mitigation and peaking emissions sooner allows for more co-benefits and reduces feasibility risks and cost in the long term, but requires more upfront investment (IPCC, 2023a). Adaptation options that are feasible and effective today will become less effective as the impacts of climate change intensify (IPCC, 2023a).

1.4.3. Benefits of long-term planning for climate action

A long-term strategy stabilises the regulatory environment for climate action, giving rise to investor, business and community trust, and enabling sustainable investments across sectors (IEA, 2021). A carefully thought-out plan is vital to transition from fossil fuels to greener energy sources and to build resilience within systems. With long-term planning, the power system can expand in a way that is compatible with increased renewable energy (Fay et al., 2015). The lack of long-term planning when policy packages are under development may result in increased risk of carbon lock-in. This makes it more difficult to achieve the high levels of mitigation necessary, for example investing in new gas infrastructure (IRENA, 2017). In addition, considering land-use changes is essential for both restoring natural habitats and enhancing carbon storage in forests and peatlands (see Chapter 2).

Aligning short-term targets with long-term goals can reduce mitigation costs by four times more than if there was no long-term strategy (Vogt-Schilb and Hallegatte, 2014; Falduto and Rocha, 2020). However, focusing solely on the immediate targets can overshadow long-term necessities, like substantial infrastructure projects, which could lead to challenging economic transitions down the road (IEA, 2017). Without weighing the far-reaching impacts of all policies, genuine transformative change is unlikely (Falduto and Rocha, 2020). Clearly defined transition pathways, inherent to long-term planning, facilitate the move to low-carbon, resilient systems, pinpointing key steps, milestones and measures to reach climate objectives (Hölscher et al., 2020). By offering clarity, it minimises disruptions, aids sectors in transformation strategies and garners broader support for changes like the just transition (Campos et al., 2016).

Strengthened institutional capacities at multiple governance levels further underpin effective planning (Hölscher et al., 2020). Collaboration across government sectors, focus on climate units and consistent engagement with various stakeholders can streamline policy execution. For informed decision making, scenario analyses that weigh varied drivers are vital, as recommended by the IPCC (2022c; see sections 6.2.4 and 7.3). Policy stability, a by-product of foresight, boosts business confidence in climate solutions, spurring technological progress and investments (Bolton and Foxon, 2015). With defined market signals for clean energy and sustainable practices, an innovative environment emerges, promoting research and

technology deployment. Furthermore, long-term perspectives ensure preparedness against climate change impacts, fortifying resilience in susceptible sectors and communities (Campos et al., 2016). Such planning can allow Ireland to anticipate and develop strategies against climate threats, integrating these considerations into diverse areas like infrastructure, water and agriculture (see section 7.3.4). Long-term planning in adaptation can not only provide benefits when disaster strikes, but unlock economic potential and development co-benefits (Tanner et al., 2015).

1.4.4. Synergies and trade-offs

While the focus of this volume is the benefits and opportunities that come with change, synergies and trade-offs[6] are explored as a framework that allows a systematic identification of benefits. Understanding and optimising synergies and managing trade-offs are essential for getting the most from the choices that are made to bring about change, while enhancing human wellbeing and societal gains, alongside environmental and economic gains.

The concept of synergies and trade-offs is used within the IPCC Sixth Assessment to assess options in a systematic and qualitative manner, where evidence is available, and to better understand dependence of interactions (IPCC, 2023b; see Figure 1.4). Such a framework could be employed to develop an integrated process for the mapping, assessment and management, at local, regional and national level, of synergies and trade-offs both associated with, and between, mitigation and adaptation actions in Ireland.

It is not always clear what the effects of climate action will be and whether there are synergies between policies and measures related to other objectives, for example potential synergies between renewables and biodiversity or nature restoration and job creation. This is also true for trade-offs, although research suggests that synergies outweigh trade-offs when it comes to mitigation, adaption and sustainability, including in near-term synergies in energy, land and urban systems (Rogelj et al., 2018; Ara Begum et al., 2022; Grubb et al., 2022; IPCC, 2023b). Nonetheless, it is important to identify trade-offs and manage them to enhance outcomes where possible. Working systematically towards synergies may also minimise trade-offs.

This volume primarily focuses on the benefits and opportunities of transformation, with less of a focus on trade-offs, although they will be addressed where relevant. This approach allows the identification of synergies between actions on climate, biodiversity and equity alongside the wider benefits to society and the economy. Synergies can be powerful enablers of just transitions, allow deeper and faster climate action and strengthen societal ambition through equity and inclusion (IPCC, 2023b). Integrated cross-sectoral policies and planning can help maximise synergies and manage trade-offs between mitigation and adaptation, and with consideration of equity and inclusion can reduce trade-offs with sustainable development (IPCC, 2023b).

It was beyond the scope and timeline of this volume to make a comprehensive and systematic assessment of all the synergies and trade-offs related to climate action and transformative change in the Irish context. Some of the main synergies that are covered within this volume include working on climate change and biodiversity loss together (see Chapter 2), climate action and societal gain (see Chapters 3–6). Benefits have been identified, in the relevant chapters, where there is evidence to do so. It should be noted that many benefits associated with action on climate mitigation and adaption are identified throughout previous volumes of this report (see Volumes 1–3).

[6] A synergy is when the combined effect of different actions, e.g. action on climate and action on biodiversity, becomes greater than the sum of those individual actions. A trade-off is a competition between different objectives within a decision situation, where pursuing one objective will diminish the achievement of other objectives and has the potential to reduce any net benefit to society or the environment (IPCC, 2022a).

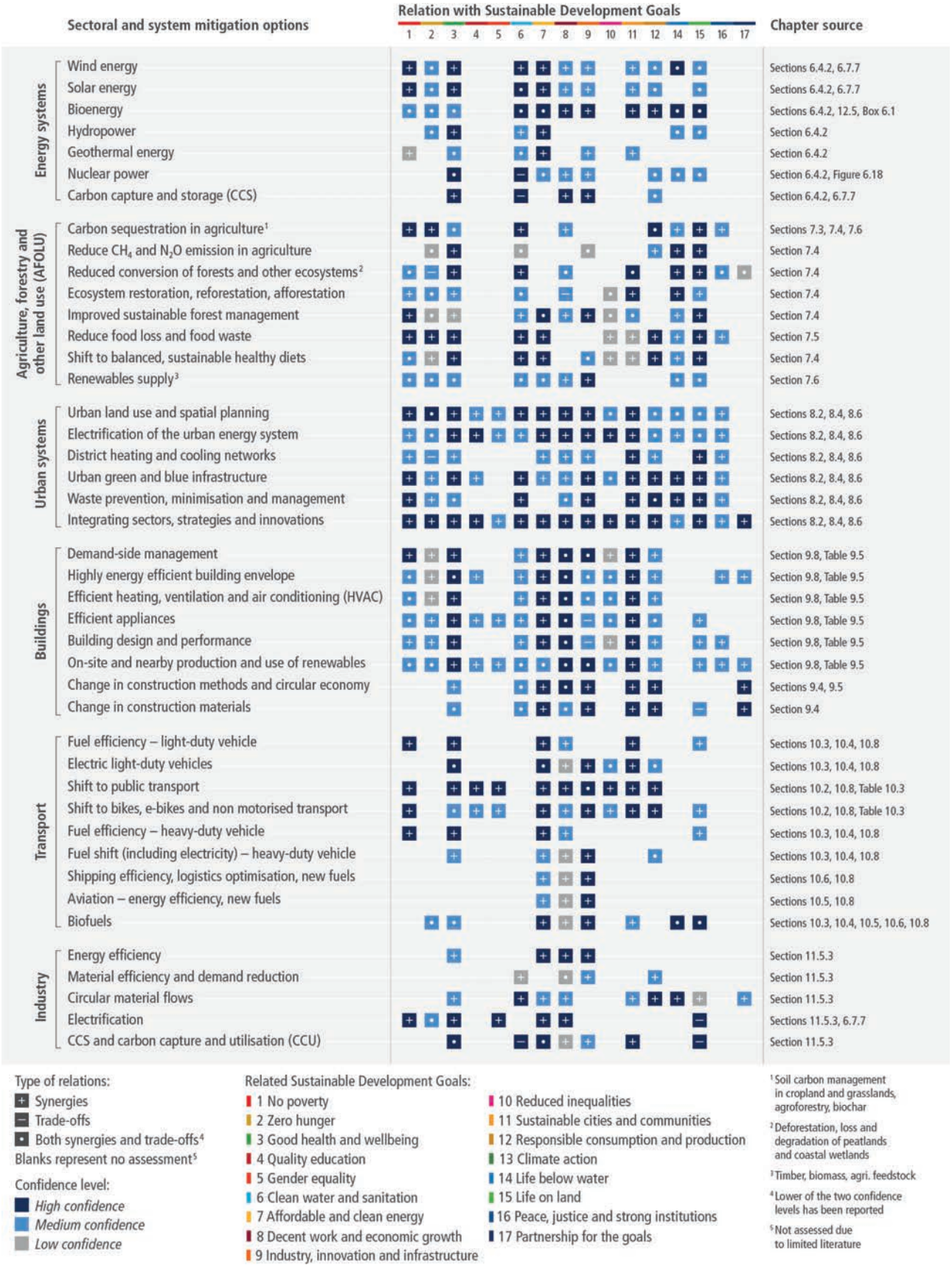


Figure 1.4 Synergies between sectoral and system mitigation options and the Sustainable Development Goals. Source: IPCC (2022d; their figure SPM.8).

1.5. Research gaps

Transformative change in the Irish context. Since 2005[7], literature on transformative change has undergone considerable development internationally (Moore et al., 2021). Literature that directly considers transformation in Ireland is at an early stage of development, as is the wider literature that considers related topics. This limits the specific conclusions that can be made for Ireland beyond general conclusions, that, in many cases, apply from international literature. The limited availability of research on transformative change for Ireland points to a huge gap in understanding related to (1) how transformative change can work in the Irish context, (2) how to optimise the benefits, opportunities and synergies associated with transformative change and (3) the role of transformative change in delivering a prosperous Ireland for all. Research will be required across all systems, and contributions from, and collaboration between, science, technology, engineering and mathematics (STEM) and arts, humanities and social sciences (AHSS) disciplines will be necessary if this research gap is to be addressed.

Role of wellbeing and equity in achieving intergenerational sustainability. Research is required to better understand the role of wellbeing and equity in achieving intergenerational sustainability in Ireland. What can be learnt from other countries where wellbeing and equity have become central to policymaking and long-term strategic decisions? How has this affected sustainability outcomes? How could wellbeing and equity become substantive as opposed to peripheral in Irish policymaking? How can progress on transformative change — that is rapid and systemic — be measured and assessed? These are all potential areas for investigation.

Underlying drivers. A better understanding of the connected underlying drivers (institutional, demographic, technological, economic, governance and sociocultural) of climate change and biodiversity loss in Ireland is necessary if these drivers are to be addressed and transformative change achieved.

Research will be necessary to identify drivers (behavioural, sociocultural, business and corporate, institutional and infrastructural) that act to maintain the status quo, in relation to mitigation and adaptation, in Ireland and to deliver the solutions that turn those barriers into enablers of transformative change.

Synergies and trade-offs. A comprehensive mapping of synergies and trade-offs for climate change (mitigation and adaptation), biodiversity loss and sustainable development, in the Irish context, could highlight areas where synergies can be identified and enhanced to augment benefits and opportunities, while potential trade-offs can be identified and managed to reduce their impact.

Integration. Research is needed to support developing an integrated, across all domains, sectors and systems, long-term strategic plan for Ireland that puts sustainability (including climate change and biodiversity loss), equity and wellbeing at its core. Research on how near-term planning and actions can enhance benefits and opportunities and how long-term plans can influence planning and action in the near term is also necessary if the gap between climate ambition and action is to be closed.

[7] This is the year identified by Moore et al. (2021) as significant, as this is when transformation-related terms commenced growing exponentially in the literature.

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Chapter 1

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