



Accelerating Climate Action

REFOCUSING POLICIES THROUGH A WELL-BEING LENS

HIGHLIGHTS



ACCELERATING CLIMATE ACTION

**Refocusing Policies
through a Well-being Lens**

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Preface

At the very moment when we need strong, co-ordinated and far-sighted action to safeguard our collective future, the willingness and ability to act for the common good is in very short supply. This deficiency hinders international efforts to tackle climate change and biodiversity loss, on which our current and future well-being depend. While there undoubtedly has been – sometimes impressive – progress in tackling greenhouse gas emissions, it is clearly insufficient. Moreover, powerful interests remain that continue to oppose stronger climate action.

With global warming currently at around 1°Celsius, we are witnessing many damaging extreme weather events. Worldwide, July 2019 was the hottest month ever on record, and 9 out of the 10 hottest Julys have occurred since 2005, according to the National Oceanic and Atmospheric Administration (NOAA). The current projected pathways set out by national governments will take us to a world that will be around 3°Celsius warmer by 2100. This is a dangerous prospect, and people – particularly young people – around the world are increasingly voicing their frustration.

The climate goals agreed upon in 2015 in Paris, while challenging and ambitious, are also achievable and necessary. This report

aims to provide both a changed perspective and the underpinning analysis to support an acceleration of climate mitigation action and to halt the increase in the global average temperature to well-below 2°C. In doing so, it takes an explicit political economy approach to the transitions needed across five economic sectors: electricity, heavy industry, the residential sector, surface transport and agriculture. They are responsible for more than 60% of global greenhouse gas emissions. This changed perspective is in line with the recent IPCC Special Report, Climate Change and Land, which shows the interlinkages across climate change mitigation, food security, and land degradation issues.

Limiting climate risks is fundamental to our collective well-being. The synergies between mitigation policy and other well-being goals can be leveraged around jobs, income, health, education and wider environmental quality. In many cases however, concerns about the affordability of energy and the impact of climate policies on jobs may limit policy action, either pre-emptively or through policy roll-back. There is also an increasing need to reverse a trend of growing economic and social inequalities, within and between countries, that influence many dimensions of well-being.

Reframing climate policies through a well-being lens is necessary in order to make these synergies and trade-offs systematically visible, thus enabling decision-makers to increase the former and anticipate, manage and minimise the latter. This requires us to rethink our societal goals in terms of well-being, reframe our measures of progress

and refocus policy-making accordingly. Such a fresh perspective is essential if we are to make our climate goals a reality.

A handwritten signature in black ink, appearing to read 'Angel Gurría', with a stylized flourish at the end.

Angel Gurría
Secretary-General, OECD

Foreword

Insufficient progress in climate change mitigation is driving the climate system into uncharted territory with severe projected consequences. The report builds on the OECD well-being framework and applies a new perspective, the **well-being lens**. This new perspective analyses synergies and trade-offs and creates two-way alignment between climate change mitigation and broader well-being goals across five economic sectors (electricity, heavy industry, residential, surface transport, and agriculture) that are responsible for more than 60% of global greenhouse gas emissions.

This report is divided into two parts, which together touch on three specific actions identified as central to generating a two-way alignment between climate and other well-being goals. Namely, rethinking societal goals, refocusing measures of progress, and reframing climate policies through a well-being lens.

An opening chapter “Increasing incentives for climate action using a well-being lens” is dedicated to discussing the general climate context and setting out the main rationale of the report.

Part I, published in September 2019 ahead of the UN Climate Action Summit, contains five sector-specific chapters that address the change in perspective, through:

- **Rethinking policy goals:** For each sector, the report reassesses current policy

priorities, discussing the need for these to effectively guide the sector towards climate and other well-being and sustainability goals.

- **Reframing the measurement system:** A more comprehensive set of indicators can help monitor and set criteria to ensure progress on multiple policy priorities, making synergies and trade-offs between them systematically visible. A number of new and complementary indicators are introduced and discussed in relation to existing indicators, including those included in the SDGs and the OECD well-being framework.

Part II will be published in early 2020, and will be dedicated to policy applications:

- **Refocusing climate policies through a well-being lens:** Drawing on the changed perspectives and measurement system (i.e. Part I), the chapters in this second part will analyse and evaluate how different climate policies can support or hinder the achievement of wider well-being goals in each economic sector. Policy analysis will be illustrated through the chapters with examples of how cities and countries have been able to realise the benefits of using a well-being lens.

This Highlights brochure contains Chapter 1 and summary extracts from the sectoral chapters in Part I (Chapters 2-6).



INCREASING INCENTIVES FOR CLIMATE ACTION USING A WELL-BEING LENS

ABSTRACT

This chapter argues that approaching climate change mitigation through a well-being lens can help countries identify and implement measures to reverse rising greenhouse gas emissions, avoid lock-in of carbon-intensive technologies and reduce long-lived carbon dioxide emissions to zero on a net basis by the middle of the 21st century, or shortly thereafter. The implications of this approach are likely to differ across jurisdictions, reflecting their levels of development and the particular challenges and opportunities they face. Adopting and adapting a well-being approach will put governments in a better position to reach their climate and broader well-being goals.

INCREASING INCENTIVES FOR CLIMATE ACTION USING A WELL-BEING LENS

The world has already warmed by an average of 1°Celsius and July 2019 was the hottest July ever recorded. Extreme weather events are taking their toll across the globe. Without accelerated mitigation action, risks to human health and food and water security will continue to grow, threatening our ability to meet the Sustainable Development Goals (SDGs). We need to reverse and then rapidly reduce global CO₂ emissions to zero on a net basis by 2050 or shortly thereafter.

The low-emissions transition requires an unprecedented scale of transformation in our societies but this is not happening quickly enough to achieve international goals. Investments in renewable technologies such as wind and solar have stalled, despite being cheaper than fossil-fuel alternatives in many places. Coal plants, particularly young plants in Asia, are still responsible for 30% of energy-related CO₂ emissions, which according to the IEA are increasing faster (2.9% in 2018) than the overall growth in such emissions (1.7%).

Systematically placing people's well-being at the centre of decision-making is necessary to increase the political and social support for more ambitious mitigation action and to overcome the barriers to change. The concept of well-being goes beyond economic welfare and incorporates such aspects as political and social rights, health, education, security and environmental quality. This report refers to present and future well-being and is a synonym of sustainable development.

Climate change mitigation has the potential to deliver wider well-being benefits for current generations and to underpin the resources needed for future

well-being. Importantly, the potential trade-offs between climate policy and other goals such as affordability, competitiveness and jobs constrain the ambition of climate action. Using a well-being lens helps make these synergies and trade-offs visible, allowing decision-makers to increase “two-way alignment” between climate change mitigation and broader well-being objectives.

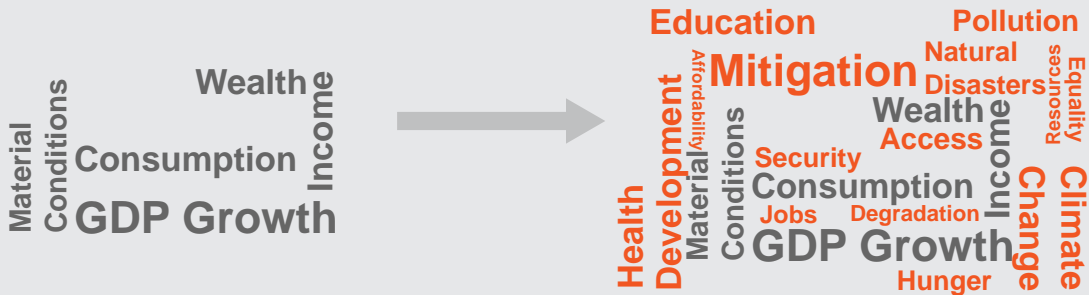
Adopting a well-being lens means ensuring that decisions aim to deliver simultaneously on multiple well-being objectives, including climate. It also requires an economy-wide perspective, rather than focusing on a single or very narrow range of output-related objectives, independently of others. For example, tackling damaging air pollution problems by eliminating fossil-fuel combustion takes advantage of one of the major synergies between climate action and health. In terms of trade-offs, addressing in advance the potential impacts on the affordability of transport from increased fuel prices through targeted compensatory measures or investments in public transport infrastructure, makes such price increases more acceptable and effective.

We can improve our collective chances of limiting climate change, while securing important well-being improvements, by applying a well-being lens to key sectors. This report examines five economic sectors (electricity, heavy industry, residential, surface transport, and agriculture), which together represent over 60% of global GHG emissions. It explains how reassessing policy priorities and adapting the set of indicators used to track progress and guide decisions in each sector can support governments in creating “two-way alignment” between climate and a number of other well-being benefits, such as public health and safety, affordability, reliability, natural resource management, and new employment opportunities. It also discusses how climate policies in these sectors can be implemented, designed and evaluated while taking into account potential synergies and trade-offs.

Strong climate action is the foundation of our **future economic and wider well-being**.

with a **production lens**:

with a **well-being lens**:



There are synergies between **climate policies** and **larger societal goals** that can be leveraged around jobs, income, health, education, environmental resources...



Focusing on **5 sectors responsible for 60% of GHG emissions**, we can meet ambitious climate goals while also delivering wider societal benefits.



Electricity



Heavy industry



Residential



Surface transport



Agriculture

We need an **enhanced measurement system** that can help improve policy design.

1.1. The climate context

Climate change is happening now. Without accelerated efforts to reduce greenhouse gas (GHG) emissions, it will transform the world in which society has evolved over several millennia. The global average surface temperature has already increased by around one degree Celsius (°C) relative to pre-industrial levels, largely driven by higher atmospheric concentrations of GHGs and the complex effects of atmospheric aerosols resulting from human activities (Berkeley Earth, 2017^[1]). The impacts of climate change on human well-being are increasingly being felt (Watts et al., 2015^[2]) and the risks of “severe, pervasive and irreversible” impacts will grow as the global temperature increases (IPCC, 2014^[3]). The recent Intergovernmental Panel on Climate Change (IPCC) report, Global Warming of 1.5°C (IPCC, 2018^[4]), highlights the significant benefits of restricting the global temperature increase stemming from GHG emissions to 1.5 degrees Celsius (°C) instead of 2°C or higher, particularly in terms of preventing impacts on unique and threatened systems (e.g. coral reefs), and reducing the impacts of extreme weather.

To meet individual countries’ climate mitigation goals, carbon dioxide (CO₂) emissions into the atmosphere – the major driver of climate change – will need to reach zero on a net basis in the early second half of the 21st century, i.e. in 30 years’ time or slightly later, depending on the stringency of the mitigation goal. This will require deep reductions in emissions across the whole economy in all countries, with differences in priorities and phasing depending on country circumstances and capabilities. High-income economies will need to reach zero net emissions earlier, to give low-income countries more time. The extent to which emissions of other non-CO₂ GHGs are reduced will influence the level of cumulative CO₂ emissions consistent with a given global temperature goal. State-of-the-art modelling suggests that recourse to large-scale atmospheric carbon dioxide removal

Just as any comprehensive well-being agenda must feature strong climate action as necessary to underpin human quality of life, we need to put people at the centre of climate policy to ensure equitable outcomes across countries, communities, individuals and generations.

– Angel Gurría, OECD Secretary-General

(CDR) technologies would be needed to achieve stringent mitigation goals, effectively relaxing the very tight limits on remaining cumulative CO₂ emissions consistent with such goals.¹ However, in the absence of large-scale demonstration and deployment of key technologies,² large uncertainty prevails about the availability of CDR technologies at a sufficient scale, as well as their cost and potential implications for land use and water resources. These uncertainties reinforce the need for much stronger near-term reductions in CO₂ emissions. “Hoping for the best” is not a policy the OECD recommends.

As a way to support greater near-term mitigation action, this report argues for approaching climate change mitigation through a well-being lens in order to increase the political and societal support for ambitious, early action to reduce GHG emissions. Adopting a well-being lens means that societal goals are defined in terms of well-being outcomes (including

the risks and impacts of climate change) and are systematically reflected in decision-making across the economy. Moreover, multiple well-being objectives need to be taken into account simultaneously and the interrelations between them are sufficiently well understood.

The report reviews efforts to move beyond gross domestic product, a key step for placing climate and wider well-being at the centre of decisions across the economy. Initiatives addressed include the Sustainable Development Goals (SDGs) and the OECD Framework for Measuring Well-being and Progress (henceforth the OECD well-being framework). The report propose a change in perspective on policy making for five different sectors: electricity, industry, residential, transport and agriculture, and identify key policy priorities that are central to promoting the wider sustainable and well-being goals captured by the SDGs and the OECD well-being framework. A key issue is the need to develop adequate measurement systems that allow policy makers to capture potential synergies and trade-offs between multiple priorities in each sector and across systems.

Adopting the well-being lens across sectors, and using more adequate indicators to track performance and set decision-making criteria, will greatly influence policy design and prioritisation. Where climate action is concerned, this new approach will result in policy packages that can tackle climate change more effectively and garner more consensus, by yielding several other benefits. These are the focus of Part II of this report, which examines policy practices to achieve this “two-way alignment” for each of the sectors mentioned above.

1.1.1. A decisive moment

The required transitions are of an unprecedented scale (IPCC, 2018_[4]). They will require significant new investment in low-emission technologies and infrastructure (OECD, 2017_[5]), as well as maintaining and restoring ecosystems that are important in drawing down and sequestering atmospheric

CO₂. The OECD, UN Environment and World Bank Group in their report *Financing Climate Futures: Rethinking Infrastructure*, further explore the transformative agenda governments must take in key areas including planning, innovation, public budgeting, private finance, development finance and cities (OECD/The World Bank/UN Environment, 2018_[6]).

At the same time, meeting the 17 Sustainable Development Goals (SDGs) – of which climate is just one, but one on which progress towards many of the others depends – is an urgent challenge. Achieving the goals of no poverty, zero hunger, quality education for all, gender equality, sustainable cities, and biodiversity on land and in the oceans depends on the collective ability to limit climate risks. Clearly, these agendas cannot be pursued separately, either financially or substantively. The SDGs are intimately interconnected, and well-designed action to address them can yield significant synergies across many different goals.³

The resource costs of making these simultaneous transitions in many different sectors will undoubtedly be large, but they can easily be overstated. In some areas, they will be outweighed by reduced fuel costs (OECD, 2017_[5]) and offset by (non-climate) benefits, even before the main benefits of reduced climate-risk become apparent. A recent World Bank study (World Bank, 2019_[6]) finds that achieving full decarbonisation by the end of the century in lower- and middle-income countries need not cost most than more emission-intensive development pathways.

Indeed, as recently highlighted by (Zenghelis, 2019_[7]), the costs of a transition in the energy sector are endogenous and depend on the pathway chosen. The radical and rapid reductions in the cost of renewables technologies over the past decade or so were not widely anticipated, but have completely overturned the traditional logic of decarbonisation in the electricity sector. Indeed, many projections for the share of solar energy in the energy mix by 2050

look set to be exceeded.⁴ Similar progress is both needed and achievable in other sectors, albeit more easily in some than in others. An effective response to climate change will require a step change in innovation and the diffusion of a wider range of technologies for sustainability. It will also require changes in financial systems and regulations, lifestyles and the management of ecosystems (to name just a few).⁵ At the core of these many changes is the need to rethink the priorities guiding decisions and policies across the economy, ensuring they are consistent with the ultimate goals set for the climate and other transitions needed to ensure human well-being, now and in the future. Encouraging and supporting the revision and rethinking of policy priorities across the economy is a central aim of this report.

The world stands at the junction between different alternative futures. Even if achieved in full, the stated scale of national action to reduce GHG emissions (the so-called nationally determined contributions [NDCs] for post-2020 action) does not yet in aggregate match the ambition of limiting warming to well-below 2°C or even 1.5°C (UNEP, 2018_[8]). Without additional mitigation efforts, emissions are expected to rise to levels that would result in temperature increases of 3°C above pre-industrial levels by the end of the century – yet G20 countries collectively are not yet on track to meet their NDCs (UNEP, 2018_[8]).

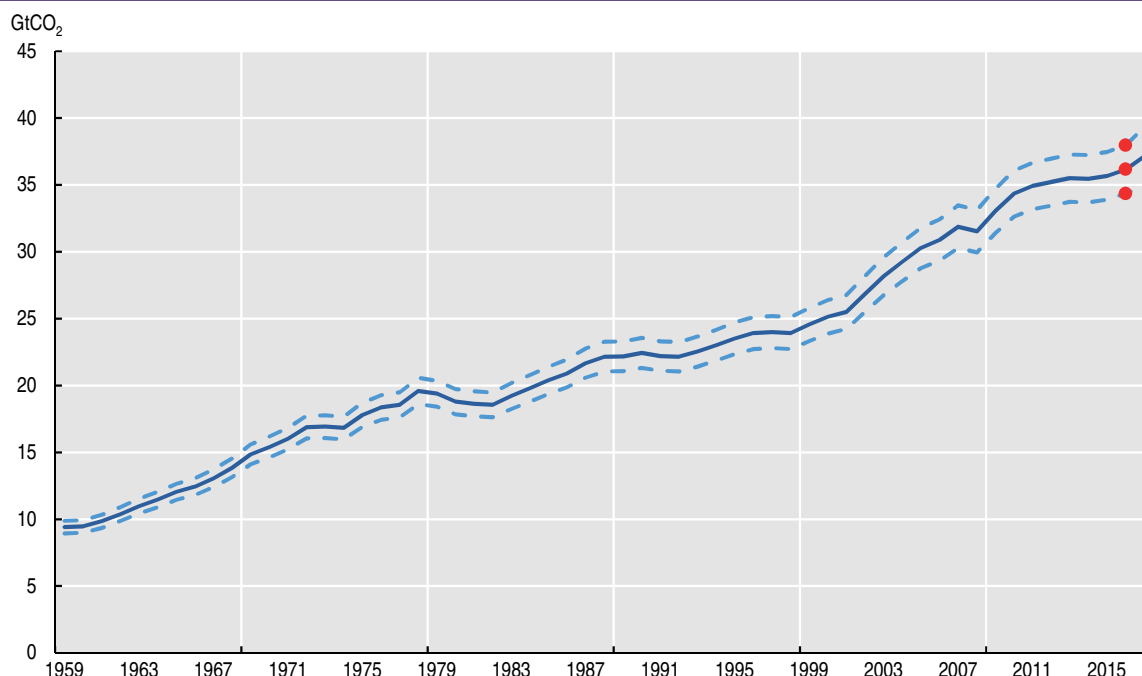
It is now known that an increase of such magnitude in global mean surface temperatures will have major systemic impacts. The recent IPCC special report, *Global Warming of 1.5°C* (IPCC, 2018_[4]), notes that “Climate-related risks to health, livelihoods, food security, water supply, human security, and economic growth are projected to increase with global warming of 1.5°C and increase further with 2°C.” Disadvantaged and vulnerable populations, and those dependent on agricultural or coastal livelihoods, are most exposed to these risks (IPCC, 2018_[4]). How can the broader range of SDGs be achieved against such a headwind?

To achieve either a 1.5°C or below 2°C goal, the IPCC assesses that global CO₂ emissions will need to fall by 20-45% by 2030 relative to 2010.⁶ Yet energy-related CO₂ emissions rose by an estimated 1.7% in 2018, driven by rapid increases in energy demand.⁷ Data compiled by the Global Carbon Project (Figure 1.1) show no sign that global CO₂ emissions are approaching a peak, a prerequisite for achieving zero net emissions early in the second half of the century. According to the International Energy Agency (IEA), the bulk of emission increases in 2018 came from coal power plants, with the majority located in Asia. These plants are only 12 years old on average, thus constituting a major lock-in of CO₂-intensive generation assets. Worryingly, recent OECD analysis suggested some 200 GW of coal capacity (equivalent to 10% of current installed coal-generation capacity) will be constructed over the next five years. In the absence of massive

There is a strong argument that, even from a purely national perspective, current NDCs are insufficiently ambitious... Incentives to reduce emissions should also be enhanced by the co-benefits of mitigation action, such as improved health from reduced air pollution and reduced traffic congestion from greater use of public transport.

– Angel Gurría, OECD Secretary-General

Figure 1.1. Global fossil CO₂ emissions: 36.2 ± 2 GtCO₂ in 2017, 63% over 1990



Note: The level of total emissions estimated by the Global Carbon Project differs from that used by the IEA, but provides a consistent picture of the trend. Red dot represents a projection for 2018: 37.1 ± 2 GtCO₂, 2.7% up on 2017 (range 1.8% to 3.7%).

Source: (Le Quéré et al., 2018_[13]).

StatLink  <https://doi.org/10.1787/888933992952>

deployment of carbon capture and storage (CCS) technologies, this is not compatible with a goal of well below 2°C, which would require coal capacity to fall rapidly in coming decades (Mirabile and Calder, 2018_[9]). Adding to these concerns is a flattening of investment in new renewables capacity and energy efficiency in 2018, despite continuing cost reductions in renewables (IEA, 2019_[10]). The evidence shows that the continued prevalence of fossil-fuel subsidies (OECD, 2018_[11]) significantly reduces investment in renewable generation capacity (Röttgers and Anderson, 2018_[12]).

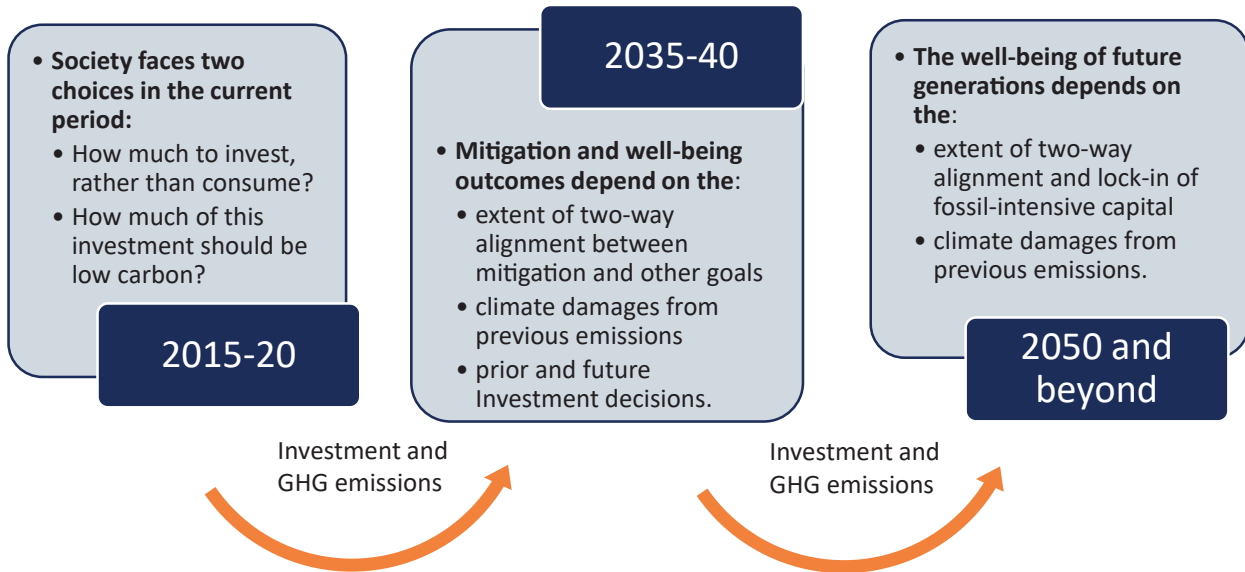
In his 2015 speech, the Governor of the Bank of England, Mark Carney, famously highlighted a key challenge facing climate action, the “tragedy of the horizon”, in which “the catastrophic impacts of climate change will be felt beyond the traditional horizons of most actors – imposing a cost on future generations that the current generation has no direct incentive to fix” (Carney, 2015_[14]). Building on this seminal contribution, the

OECD Secretary-General, Angel Gurría, in his 2017 climate lecture, highlighted a further challenge, namely, overcoming a purely national horizon in addressing what is actually a global challenge (OECD, 2017_[15]). Underlining the importance of subnational and other non-state actors for climate action, Mr Gurría also stressed that action on issues (such as local air pollution) with important shorter-term benefits can help align short-term national incentives with longer-term goals for climate action, and that adopting an inclusive approach is essential to this agenda.

A conceptual model can help illustrate how these different effects play out at different timescales, abstracting from the challenges of co-ordination and co-operation across different countries (Figure 1.2). The model consists of two periods in which the current generation lives and a long term in which a new generation will make its own decisions. The model captures the fact that the world is only one investment cycle away from

Figure 1.2. Conceptual model of climate action

Today's choices impact tomorrow's livelihoods and the well-being of future generations



Source: Based on the model developed in (Buckle et al., 2014_[16]).

locking in severe climate damages.⁸ Box 1.1 discusses the model further, highlighting some critical issues in determining the scale and timing of climate action. These include that initial income and the emissions intensity of the production technology is important in shaping the mitigation response, while the weight placed on long-term outcomes and the nature of climate damages will also influence the extent of mitigation action.

This stylised model does not capture the political economy issues surrounding the impact of the transition on incumbent firms and workers – and yet these are also critical in determining the ambition of mitigation action. One of the key advantages of applying a well-being lens (see below) to climate change mitigation is that it helps identify synergies and trade-offs between mitigation and other well-being goals. It also helps build a broader political constituency for mitigation action and addresses the concerns of individuals who might otherwise face adverse consequences, e.g. workers in industries that may disappear during a

transition to a low-emission economy - an issue addressed by the 2015 ILO guidelines (ILO, 2015_[17]) for a just transition. Other complementary approaches – e.g. adopting the recommendations of the Financial Stability Board’s Task Force on Climate-related Financial Disclosures – will also be important to drive changes in financial and corporate strategies, governance, risk management and metrics.⁹ Over time, as more companies focus on the benefits and opportunities of strong climate action, these will change the dynamics of the political economy.

In light of the troubling emission and investment trends mentioned above, and the implications of the aggregate level of ambition in the first round of NDCs under the United Nations Framework Convention on Climate Change (UNFCCC) process, what can be done to improve society’s collective chances of limiting climate change to well-below 2°C? Much analysis and commentary has focused on the extent to which decision-making should and does factor in the long term. In itself, moral exhortation to care

BOX 1.1. CRITICAL ISSUES IN DETERMINING THE SCALE AND TIMING OF CLIMATE ACTION

Each of the periods in the stylised model illustrated in Figure 1.2 can be thought of as relatively long – perhaps lasting 20 years – reflecting the long lifetime of infrastructure investments. The current generation in Period 1 (starting around 2015-20) inherits a capital stock with a given CO₂ emission intensity and makes decisions about the share of production it will either consume or invest. It also decides to what extent investment in future production is composed of low-carbon rather than carbon-intensive technologies. This, in turn, determines both the level of production and the extent to which emissions are locked in for Period 2 (2035-40). Period 2 production is shared between consumption in that period and a bequest to the future generation, reflecting the policy weighting placed on the long term during the initial investment decisions. The value of any bequest is affected not just by investment levels but also, critically, by the cumulative CO₂ emissions from production in both of the preceding periods.¹⁰

While presented only in a stylised way, the model highlights some of the critical issues and incentives facing decision makers with regard to climate action, including:

- **Starting points matter.** The initial income and emission intensity of the production technology is important in shaping the mitigation response: the higher the level of locked-in emissions from current production relative to desired cumulative CO₂ emissions, the higher the incentive to mitigate from a social welfare perspective. Locked-in emissions, in turn, depend on both the level of production (gross domestic product [GDP]) and emission intensity of the economy. Other things being equal, in a very low-income world – or one with very clean technology – the incentives for mitigation would therefore be lower than in an economy with a higher GDP and a dirtier technology. The initial level of atmospheric CO₂ also matters: with lower atmospheric CO₂ concentrations, the incentives are lower than with higher concentrations, as climate damages would be lower. Current atmospheric CO₂ concentrations are far higher than at any time in the last 800 000 years, and CO₂ emissions continue to rise rapidly.
- **Current income determines levels of investment and mitigation.** According to the well-known inter-temporal effect, future consumption from an investment today is discounted relative to current consumption, owing to a component related to time preferences and another reflecting aversion to risk or income inequality. It follows that the marginal cost of investment in terms of foregone Period 1 consumption influences its extent. All things being equal, a lower initial income would tend to make investment in any technology more costly in terms of foregone consumption. To the extent that cleaner technologies are more (or less) expensive than carbon-intensive alternatives, this effect would be augmented (or reduced). However, if there exist other social costs from production (e.g. air pollution impacts on health), these would increase the incentive to invest in clean versus dirty technologies. Significant social and economic adjustment costs are also likely to exist in real-life; these might reduce investments in clean technologies relative to established technologies.
- **The value placed on the long-term is an important determinant of the stringency of mitigation action.** This is essentially the tragedy of the horizon: conventional economic decision-making frameworks, and political and economic actors, may underweigh the long term. Cost-benefit analysis can address concerns about undervaluing the long term by using discount rates that decline over time. (Stern, 2006_[18]) argued for strong climate action based on a low discount rate, but a case for stringent mitigation action can be made even with higher discount rates (e.g. (Stern and Persson, 2008_[19])).
- **The nature and severity of climate damages.** The level and degree to which climate damages increase with rising CO₂ concentrations also significantly influence a country's incentive to mitigate. There exist strong arguments suggesting countries have not adequately factored into their decision-making the full range of climate damages or the “likelihood of severe, pervasive, and irreversible impacts” (IPCC, 2014_[20]). Countries are intimately linked through intricate trade and global value chains. Hence, damages elsewhere in the world can have impacts that countries may not fully understand or value if they evaluate investments on the basis of purely national climate damages and do not consider the risks transmitted through such value chains.

Source: Authors, based on (Buckle et al., 2014[16]).

more about future generations will only have limited impact. In many, particularly low-income countries, it will be met with the understandable reaction that the poor of the current generation need to be prioritised. Institutional mechanisms to enshrine a duty to future generations could change the nature and dynamics of decision-making. Arguably, the United Kingdom's Climate Change Committee fulfils this role, Wales has a Future Generations Commissioner, and New Zealand has a Parliamentary Commissioner for the Environment.¹¹ The recent youth protests about climate inaction also have the potential to change the political calculus. Like efforts to enhance firms' climate disclosure, these mechanisms could address the tragedy of the horizon, increasing the priority placed on future generations in current decisions.

1.2. Two-way alignment and the well-being lens

Mitigation policies are likely to be easier to implement politically, economically and socially – and more cost-effective – when there is **two-way alignment** between climate action and the broader goals of human well-being and sustainable development. The first imperative is that action in non-climate policy areas should support rather than undermine the pursuit of climate change mitigation goals. This was a major theme of the OECD publication *Aligning Policies for the Low-carbon Economy* (OECD/IEA/NEA/ITF, 2015_[21]). Examples of misalignments needing to be resolved include lower tax rates for company cars or a faster depreciation rate for tax purposes for fossil-fuel infrastructure compared to renewables, which incentivises perpetuating emission-intensive activities. The *Investing in Climate, Investing in Growth* report (OECD, 2017_[15]) examined transition pathways that are inclusive, progressive and good for business.

The second imperative is that to be more attractive, climate change mitigation should also meet other important societal goals, or at least not have negative impacts on key

dimensions of well-being. Any well-being effects will often be realised on a shorter timescale than those of climate change mitigation policies, which accrue over the longer term. In the case of well-being benefits, their greater immediacy will help counter the short-termism pervasive in decision-making at all levels, from individuals to governments, that inhibits climate mitigation action. Where there are negative well-being impacts, e.g. on jobs in certain sectors or affordability of key services such as energy or transport, these are likely to inhibit further or even roll back action on climate change mitigation.

Two-way alignment is a condition that is currently not sufficiently achieved, constituting a major obstacle for governments and society to accelerate mitigation action. This report argues for the systematic inclusion in decision-making of the wider well-being impacts of climate change mitigation as a central step to making potential synergies and trade-offs visible and manageable, and thus contributing to generating the two-way alignment and putting mitigation action back on track. It refers to this change in perspective to policy making as **adopting a well-being lens**, which in this report means that:¹²

- Policy goals are defined in terms of well-being outcomes (including the risks and impacts of climate change) and are systematically reflected in decision-making across the economy.
- The decisions taken consider multiple well-being objectives, rather than focusing on a single (or very narrow range of) objective(s) independently of others.
- The interrelations between the different economic sectors and systems in which a policy intervenes are sufficiently well understood.

Viewed through a well-being lens, climate change mitigation has the potential both to deliver wider well-being benefits for current

generations and underpin the resources needed for future well-being.¹³ The most obvious is perhaps that of improved health from reduced air pollution (see Box 1.2 in this chapter) from reduced emissions from electricity generation (Chapter 2), transport (Chapter 4) and agriculture (Chapter 6). Reducing fossil-fuel combustion will cut CO₂ emissions but will also reduce levels of air pollution due to fine particulate matter and chemical compounds, some of which are precursors of highly damaging tropospheric ozone. As documented in (Perera, 2017_[22]), children and the developing foetus are more vulnerable to many of the effects of toxic air pollutants than adults. Thus, fossil-fuel combustion doubly impacts on future

generations, not only through future climate damages, but also through current health and developmental potential. That both of these impacts disproportionately affect the poor only amplifies the injustice. But there are many other benefits that can be realised throughout the economy that would justify a far greater level of mitigation action than is currently undertaken at an aggregate level. For instance, earlier and stronger mitigation action targeting long-lived GHGs (such as CO₂) will also limit the inevitable increases in sea level that could threaten major concentrations of economic and social capital in both coastal cities and rural communities forced to retreat in the face of rising seas (OECD, 2019_[23]).

BOX 1.2. AIR POLLUTION AND CLIMATE CHANGE MITIGATION

CO₂ and other GHG emissions are strongly linked to air pollution. Reducing energy use and emissions could increase well-being through improved air quality, environmental quality and health. Exposure to outdoor air pollution from combustion engines (i.e. PM2.5, PM10 and ozone) is associated with premature mortality, cardiorespiratory disease, lung cancer and asthma (WHO, 2015_[35]).

The burden of disease from ambient outdoor PM2.5 contributed to 3.7 million premature deaths globally in 2012, 88% of which occurred in low- and middle-income countries (WHO, 2015_[35]). Without additional action, the market and non-market costs of outdoor air pollution reported in (OECD, 2016_[36]) will grow rapidly, reaching an estimated 1% of GDP by 2060 (market) and USD 18-25 trillion in 2060 (non-market), compared to USD 3 trillion in 2015. Indoor air pollution from the use of polluting fuels for basic cooking, heating and lighting is estimated to have caused 4.3 million premature deaths, mostly of women and children (WHO, 2015_[35]). The deployment of modern forms of energy could reduce emissions and improve the health of the world's 3 billion poorest people (Shindell et al., 2017_[37]).

Children suffer the most from the health impacts of air pollution, which impairs their development (WHO, 2018_[38]) and can diminish their educational outcomes substantially and lastingly (Heissel, Persico and Simon, 2019_[39]). Air pollution is also linked to the incidence of dementia (Bishop et al., 2018_[40]). Finally, it reduces worker productivity, lowering agricultural yields (OECD, 2016_[36]).

These health benefits highlight the important potential for action on short-lived climate pollutants (SLCPs), which include methane, black carbon and hydrofluorocarbons. Although the major health benefits of such action are unambiguous, the climate benefits of SLCP reductions are context-dependent (Pierrehumbert, 2014_[42]). SLCP mitigation will be most effective when CO₂ emissions are already decreasing rapidly and the most stringent mitigation pathways require achieving net-zero CO₂ emissions and deep reductions in non-CO₂ forcing agents. However, reductions in SLCPs will be largely irrelevant to the scale of longer-term climate change if CO₂ emissions continue to increase and do not reach zero on a net basis. Many CO₂ mitigation measures will also reduce emissions of SLCPs, and some action on SLCPs may also reduce CO₂ emissions (Shindell et al., 2017_[38]).

Equally important, a well-being approach also brings into sharp focus the need to consider potential trade-offs between climate change mitigation and wider well-being goals. Trade-offs between policy goals cannot always be avoided, but adopting a *well-being lens* is key to identifying and assessing them, thus improving policy design and prioritisation of mitigation actions across the economy. For instance, to the extent that mitigation action raises household costs for key energy and transport services, distributional issues affecting the political feasibility and sustainability of such actions may arise in the absence of compensating measures or alternatives (e.g. public transport). In each such case, a detailed analysis of the issues is required. Overall, such trade-offs may be related to socio-economic inequalities, but non-income aspects are also important. The discussion in (OECD, 2019^[24]) about the recent “Gilets Jaunes” protests in France emphasises that redistributive policies may not always be the answer to problems more deeply rooted in societal exclusion – an important dimension of a well-being approach.

The character of the resulting two-way alignment is likely to differ across jurisdictions, reflecting their development levels as well as the particular challenges and opportunities they face. By adopting this approach, governments will be in a better position to secure both their climate and broader well-being goals in a way that is appropriate to their situation. Looking at climate action through a well-being lens is therefore necessary to assess and better manage political economy factors. With respect to employment, there are clear similarities between this approach and the discussion of opportunities, challenges and guiding principles for the Just Transition (ILO, 2015^[17]).

An international consensus is emerging on some key ingredients of a well-being approach. The concept of well-being goes beyond economic welfare: it incorporates such aspects as political and social rights,

health, education, security and environmental quality (OECD, 2014^[25]). In broad terms, reaching well-being “requires meeting various human needs, some of which are essential (e.g. being in good health), as well as the ability to pursue one’s goals, to thrive and feel satisfied with [one’s] life” (OECD, 2011^[26]). Throughout this report, the term “well-being” refers to present and future well-being. As such, it is a synonym of sustainable development (Brundtland, 1987^[27]).

The OECD well-being framework comprises both current well-being outcomes and the resources that help sustain it over time. It acknowledges that maximising current well-being could come at the cost of depleting future resources and recognises the need to monitor both dimensions in parallel. Ultimately, policy must be able to balance the sometimes differing interests of current and future generations, addressing both the tragedy of the horizon and issues of two-way alignment. The well-being framework is also part recent progress in improving measurement systems “beyond GDP”, including through the SDGs and a number of country initiatives (Exton and Shinwell, 2018^[28]). The next section describes efforts to underpin this change in perspective with changes in measurement systems at an economy-wide level and provides more detail on the OECD well-being framework. The following chapters illustrate how adopting a well-being lens could be done in the five economic sectors selected for this report, including discussions on how measurement systems at sector specific level would also need to be adapted.

1.2.1. Measuring progress: Moving beyond GDP

GDP is a measure of the production of goods and services in a given country and period,¹⁴ but is widely used as a proxy for well-being. Although criticisms on the relevance of GDP as a measure of well-being are as old as the measure itself, GDP has maintained

its position as the main metric to gauge societal progress or “success”, which can be problematic (Durand et al., 2018^[29]) (Boarini and Mira D’ercole, 2013^[30]). The correlation between GDP and certain well-being dimensions can also be negative depending on the chosen well-being dimension, e.g. air pollution (see Box 1.2). Hence, focusing on GDP outcomes alone can lead to suboptimal outcomes, particularly where major externalities exist.

Van den Bergh (2009^[31]) argues that while positive correlations exist between certain well-being dimensions, they change over time and depend on country characteristics. Additionally, approaches that are limited to GDP completely obscure income, spatial and social differences. That said, better measures of well-being will come with an extra level of complexity, which will be need to be justified if they are to gain acceptance. The contention here is that climate change mitigation is one of those areas where the benefits should far outweigh the costs of adopting a more sophisticated approach. The need for urgent and effective action to address a number of major intra- and intergenerational externalities simultaneously and in an integrated manner demands a step change in the sophistication of the policy tools used.

Macroeconomic policy making is always going to depend on economic indicators such as the components of GDP, if not the aggregate measure itself. The real issue is when GDP is misused and the growth maximisation doctrine spills over into all aspects of policy, regardless of the quality of GDP growth and distributional issues. Some of the key problems in this regard are (Van Den Bergh, 2008^[32]):

- GDP is a flow and not a stock measure. It does not directly capture the change over time of the different types of capital or “wealth” (environmental, economic and social), although measures of physical capital can be constructed from its investment component. Therefore, GDP does not directly provide information about the sustainability

of the economic activity or the possibility of achieving well-being over time (Boarini and Mira D’ercole, 2013^[30]) (Fleurbaey, 2009^[33]).

- GDP does not provide information on factors beyond the material conditions that affect well-being, such as security, social rights, health or leisure time (OECD, 2011^[26]).
- GDP has nothing to say on the distribution of “income” across society, which is an important feature for individual and societal well-being, particularly at a time of intentional structural change.
- GDP includes activities that can negatively affect well-being or that remediate the social or environmental costs generated by the production of goods and services (“regrettables”), rather than increasing well-being. Examples include higher transportation costs due to congestion, the costs of remediating environmental destruction (e.g. the cleaning of coastal areas after an oil spill) and increased consumption stemming from reduced ecosystem services (e.g. bottled water or masks due to undrinkable water and unbreathable air) (OECD, 2011^[26]), (Fleurbaey, 2009^[33]).
- GDP generally values the supply of goods and services at market prices, which may reflect marginal costs but not the welfare derived from it, as in the case of cheap food staples.
- GDP excludes non-market activities potentially contributing to well-being, such as services produced by households (e.g. childcare) (OECD, 2011^[26]) (Giannetti et al., 2015^[34]).

These considerations have important policy implications, particularly for addressing climate change through public policy approaches that avoid stark trade-offs between climate and economic policy. Among others, (OECD, 2017^[5]) has demonstrated that such trade-offs are avoidable. In specific cases where a pro-growth policy could be harmful to well-being, policy makers should look for ways to improve policy design so that negative well-being impacts are neutralised

or even turned into positive impacts. The same is true for mitigation activities that reduce GHG emissions, but have significant negative impacts on wider well-being goals. Conversely, some mitigation policies may improve well-being, while reducing or changing the composition of GDP, which may be wrongly valued precisely because of deficiencies in GDP as a well-being indicator. For example, policies promoting a modal shift from motor vehicles to bicycles may be undervalued if analysed solely in terms of economic output, as their positive impacts on health, air quality, equity and reduced emissions may be only partially captured and may also reduce GDP. Furthermore, GDP does not provide the information needed for efficient management of natural resources and waste (i.e. in a circular economy).

Growth and well-being are inextricably linked through factors such as income, earnings, jobs and economic capital. Clearly, a well-being lens would provide a much stronger rationale for a policy with compelling well-being gains and neutral growth impacts than a strategy with a simple growth objective. This is a very important concrete advantage of adopting a well-being approach. It focuses on the quality of economic growth and its well-being outcomes, rather than just the magnitude of that growth. Additionally, a well-being approach explicitly forces attention on those things (e.g. social connections and a clean environment) that money alone cannot buy, and GDP does not value. Perpetuating the current model of economic activity (i.e. with insufficient regard for environmental, distributional and social impacts) would ultimately put everyone's long-term well-being at risk.

Rethinking societal goals and the definition of progress is increasingly recognised as crucial to putting well-being and sustainability at the centre of policy decisions (e.g. when considering the criteria for implementing policies) (EUROSTAT, 2010_[42]). In recent years, significant efforts have been made to improve measurement systems to go

“beyond GDP” (see Box 1.3). In January 2019, the Prime Minister of New Zealand, Jacinda Ardern argued at the World Economic Forum that well-being should be the metric used to gauge societal progress, instead of GDP. On 30 May 2019, New Zealand launched its Well-being Budget, explicitly contrasting this new approach with traditional measures of success such as GDP. The budget required new governmental spending to be directed towards five social goals: taking mental health seriously; improving child well-being; supporting the aspirations of indigenous people; building a productive nation; and transforming the economy (including climate change mitigation). All new spending will be assessed against 61 indicators to measure well-being. The approach aims to foster cross-government co-operation to achieve these goals, while addressing fiscal sustainability, infrastructure investment and support for the economy.¹⁵

Globally, the SDGs adopted in 2015 are a list of internationally agreed policy commitments aiming to address global challenges and acknowledging they are all interconnected. The SDGs include poverty and inequality reduction, climate change mitigation, environmental conservation and justice. The OECD well-being framework is an analytical tool aiming to assess societal progress through the lens of well-being. It is structured around both current well-being and the resources needed for future well-being (see Figure 1.3).¹⁶ All these approaches recognise that societal progress is about improving people's present and future well-being, moving away from a sole focus on GDP to include multiple well-being dimensions. As argued above, such approaches are important to increase the ambition of climate change mitigation policies.

1.2.2. The OECD well-being framework

The OECD recognises that promoting better policies for better lives requires rethinking societal goals and shifting from the current focus on economic growth to

BOX 1.3. GLOBAL INITIATIVES FOR WELL-BEING

Initiatives focusing on the development of alternative measures of progress or well-being have increased and accelerated over the last decade in the wake of the (so-called) Stiglitz-Sen-Fitoussi report (Stiglitz, Sen and Fitoussi, 2009_[43]) and the EU communication entitled “GDP and Beyond: Measuring progress in a changing world” (European Commission, 2009_[44]).

The Stiglitz-Sen-Fitoussi report highlighted the need for a “shift of emphasis from a production-oriented measurement system to one focused on the well-being of current and future generations, towards broader measures of social progress”. It described the limitations of GDP as an indicator of progress, and provided 30 recommendations for data collection to move beyond GDP and improve measures of well-being and progress (Stiglitz, Sen and Fitoussi, 2009_[43]).

The European Commission outlined a set of actions – captured in a roadmap – to improve progress indicators to better respond to citizens’ concerns, as well as capture the complexity of a globalised world with environmental constraints and a population of over 7 billion (European Commission, 2009_[44]). Motivated by numerous academic publications calling on Europe to end “growth dependency”, ten Members of the European Parliament organised a Post growth Conference in 2018 (EEB, 2018_[45]).

In 2009, the Conference of European Statisticians, jointly with the United Nations Economic Commission for Europe, the OECD and Eurostat, established the Task Force for Measuring Sustainable Development (TFSD), with the goal to develop a broad conceptual framework (Europe, 2014_[47]).

In 2011, the OECD launched the OECD Better Life Initiative, following many of the recommendations issued by the Stiglitz-Sen-Fitoussi report, the TFSD, and national and international initiatives (Durand et al., 2018_[29]). The resulting OECD well-being framework provides an analytical tool to study the multidimensional concept of both current and future well-being.

In 2013, as a response to the United Nations Conference on Sustainable Development outcome document The Future We Want (United Nations, 2012_[47]), an Open Working Group was established and developed the SDGs, which country leaders officially adopted in 2015.

In parallel, various countries have developed national well-being frameworks involving diverse agencies and institutions (e.g. environmental agencies, and finance and health ministries). In 2011, for example, New Zealand presented the Living Standards Framework, aiming to achieve higher living standards and sustainable well-being for New Zealanders. The framework follows a capital approach: natural, human, social, and financial/physical capital, described as interdependent, are the basis for the country’s achievement of well-being outcomes. Many other countries, including Italy (Measures of Equitable and Sustainable Well-being), Germany (Well-being in Germany) and Sweden (New Measures for Prosperity) have developed well-being metrics, as described in Table 1.1 of the New Zealand Economic Survey 2019 (OECD, 2019_[48]).

a focus on improving people’s well-being (OECD, 2018_[49]). The OECD well-being framework provides an analytical tool to examine the multidimensional concept of well-being beyond its purely economic aspects. Focusing on individuals and households – rather than aggregating them at the level of the economy – it allows analysis of the distribution of well-being across the population. The framework also looks into both current and future well-being, a

particularly relevant distinction for climate change mitigation policies (Boarini and Mira D’ercole, 2013_[30]).

Figure 1.3 presents the conceptual framework proposed by the OECD. In line with a large body of research¹⁷, **current well-being** is defined as falling into two domains, material conditions and quality of life, broken down into 11 dimensions. **Future well-being** is assessed in terms of the availability of the natural, economic, human and social capital

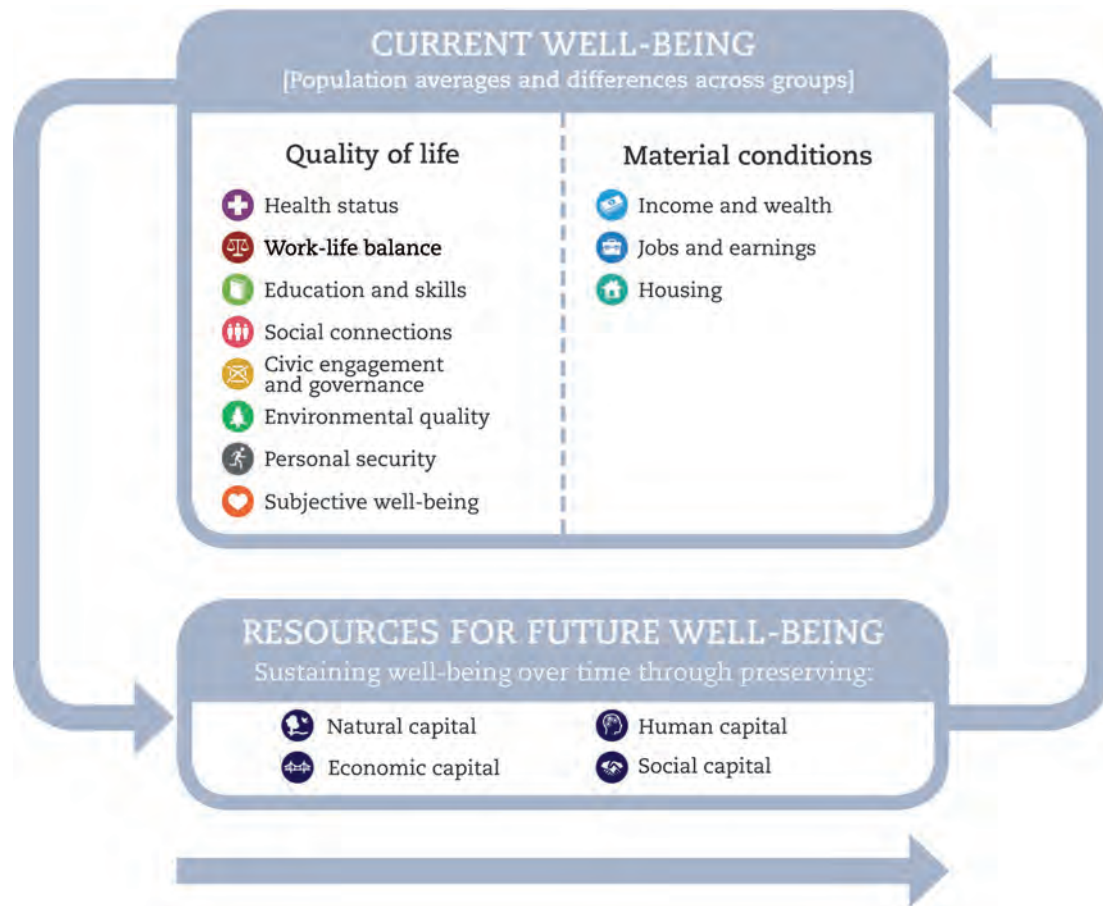
Powerful interests continue to resist the transition towards a low-carbon economy, even as the old model is dying. Now is the time to accelerate our efforts. Our response today will define our collective future for generations to come...

— Angel Gurría, OECD Secretary-General





Figure 1.3. The OECD well-being framework



Source: (OECD, 2013_[50]).

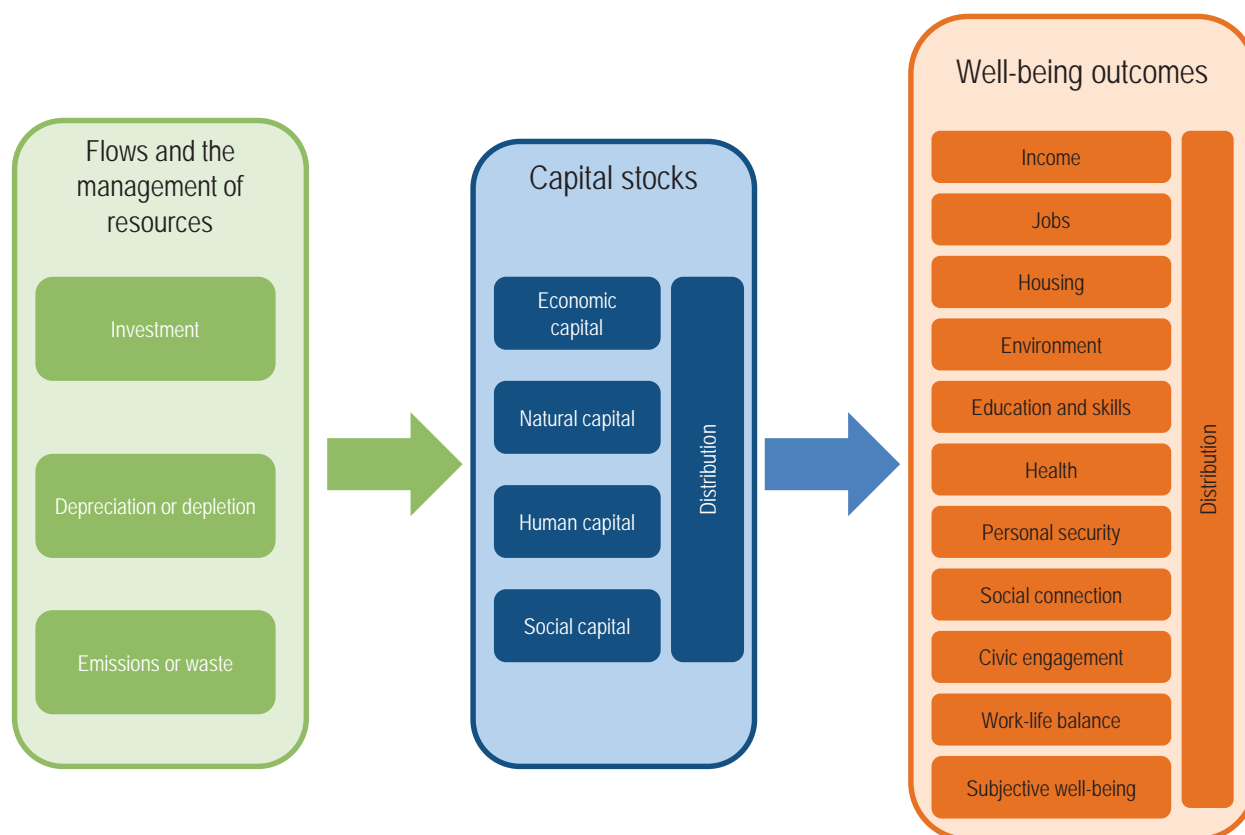
stocks necessary to maintain well-being for current and future generations. Figure 1.4 illustrates the capital stocks (middle column) needed to sustain the different dimensions of well-being over time (right column), as well as the drivers that may influence these stocks. The drivers – represented in the left column – include investments (e.g. to increase the stock), depreciation or depletion (e.g. loss of soil quality for farming, or deforestation), and emissions and waste (OECD, 2013_[50]). Current well-being is related to the long-term sustainability of well-being, because current consumption and production decisions have an impact on investment and hence the productive base of future well-being.

The OECD well-being framework – as well as other “beyond GDP” alternative measures, such as the SDGs or the country initiatives

described in Box 1.3 – can provide the evidence and language for politicians and policy makers to explain the rationale behind more ambitious climate change mitigation policies. Analysing policies through a well-being lens has the potential to inform policy makers on three important aspects that are not reflected in the measure of GDP, as follows:

- How do policies affect the different dimensions of well-being today?
- How do policies affect the distribution of well-being across society (e.g. are they key for ensuring an inclusive transition to a low-carbon economy)?
- How do policies incentivise a sustainable utilisation of resources (to ensure future generations can achieve well-being)?

Figure 1.4. Capital stocks and their drivers in relation to well-being outcomes



Source: Extracted from (OECD, 2013_[50]).

How do policies affect the different dimensions of well-being today? Analysing policy actions through a well-being lens allows examination of trade-offs and synergies between the different well-being dimensions. Using this perspective, policies can be assessed according to their potential impact on the different dimensions of well-being, rather than simply their economic impact. For example, the negative impacts of fossil-fuel subsidies on present well-being, due to increased air pollution, and on future well-being, due to the depletion of non-renewable resources and increased likelihood of climate change, would be more visible through a well-being lens. In this light, policies that increase quality of life or resources for future well-being would be valued more positively than policies focusing more narrowly on GDP. The well-being

framework still requires policy makers to weigh the implications for income, wealth, jobs and earnings. It will provide them with greater incentive to design better policies that offer more win-win outcomes, or at least win-neutral outcomes. While the well-being approach can reveal, clarify - and ideally quantify - the synergies and trade-offs, it does not of itself deliver the synergies or resolve the trade-offs; that remains the job of governments.

How do policies affect the distribution of well-being across society? A poor distribution of well-being has present and future impacts across the whole of society, through reduced economic development; risks of political instability stemming from people's low trust in institutions or perceptions of injustice, intolerance and discrimination; and limited connections to others owing to "social

barriers". Analyses of GDP do not capture the increasing levels of inequality, including in OECD countries over the last 30 years ((OECD, 2015_[52]); (OECD, 2016_[52])). Inequalities are often analysed in terms of income distribution, through indicators such as the Gini coefficient. Although a balanced income distribution is a key element for societal well-being, it is not the only "type" of inequality that matters in terms of achieving a good life. Looking at inequality through a well-being lens allows expanding the measurement to outcomes such as life expectancy, exposure to air pollution, education and skills, and health status.

Information on the distribution of the different dimensions of well-being can help policy makers understand the interaction of the impacts of specific policy decisions on different parts of society. This information is particularly relevant to ensuring that climate change mitigation policies result in an equitable transition to a low-emission economy, rather than increasing existing inequalities.

Designing policies to ensure the costs and benefits of the transition are fairly shared across society also reduces the likelihood of political resistance to climate change mitigation policies. For example, identifying the impact of mitigation action on different regions or job categories can help governments design policies that take into account the adverse impacts of these policies on specific regions and job types. There are clear similarities here with the approach advocated in (ILO, 2015_[17]). Similarly, carbon-pricing instruments that typically put a higher burden on lower-income households can be designed in a non-regressive manner. This type of approach could avoid exacerbating pre-existing economic inequalities; with proper design, it could even benefit lower-income households, eventually prompting them to support transition (Van Dender and Marten, 2019_[53]).

How do policies incentivise a sustainable utilisation of resources? The notion of capital is helpful to assessing sustainability. One generation's choices regarding the

accumulation or depletion of capital stocks influence the next generation's opportunities to achieve well-being (OECD, 2013_[50]). For example, failure to mitigate the current unsustainable levels of GHG emissions will affect the livelihoods and subsistence of future generations, which will bear the impact of climate change on their economic, natural, social and human capital.

Thus, informing policy by viewing it through a well-being lens can help governments develop more comprehensive policy packages that exploit synergies between the different well-being dimensions, duly considering the potential trade-offs and barriers to policy implementation. As such, the OECD well-being framework, as well as the other frameworks introduced in Box 1.3 and the sector-specific analysis offered in this report (linking to the SDG and OECD well-being frameworks throughout), can be useful tools for developing long-term low-emission development strategies (LT-LEDS), briefly described in Box 1.4. The following section briefly discusses the relationship between carbon pricing and the well-being approach.

1.2.3. The well-being approach and carbon pricing

The well-being framework aims to increase the incentives for mitigation by aligning them as much as possible with other well-being goals that may weigh more heavily in cost-benefit analyses and other decision frameworks. It also acknowledges and helps identify potential trade-offs between mitigation and broader well-being goals, and highlights the need to manage these trade-offs.

Focusing on carbon pricing and fossil-fuel subsidy reform remains an essential component of any effective approach to climate change mitigation, including applying a well-being lens. However, low-emission pathways require profound transformations rather than changes at the margin, entailing a political economy perspective to navigate the transition(s). In some sectors, carbon pricing alone is not going to drive the

BOX 1.4. AN OPPORTUNITY FOR SUSTAINABLE DEVELOPMENT AND MORE AMBITIOUS CLIMATE CHANGE MITIGATION POLICIES: LONG-TERM LOW-EMISSION DEVELOPMENT STRATEGIES (LT-LEDS)

LT-LEDS are a powerful planning instrument that allows countries to deliver on climate change mitigation while improving the well-being of current and future generations. Article 4.19 of the Paris Agreement calls on signatory countries to formulate “long-term low greenhouse gas emission development strategies, mindful of Article 2 taking into account their common but differentiated responsibilities and respective capabilities, in the light of different national circumstances” (UNFCCC, 2015^[55]). While the Paris Agreement provides no methodological insights about how LT-LEDS should be developed, a rapidly developing literature identifies several key characteristics and requirements for such strategies to generate the structural change needed to reach the well-below 2°C goal.

The Institute for Sustainable Development and International Relations (IDDRI) defines LT-LEDS as “structured strategy exercises [should be] embedded in the national policy process and represent a useful way of structuring national policy debates in a transparent, productive and ambitious way. The point of departure should be national socio-economic objectives, alongside the well below 2°C objective” (IDDRI, 2016^[56]).

IDDRI defines a set of principles for developing a multi-stakeholder framework. In line with the two-way alignment outlined above, it aims to: i) review climate and non-climate policies that deliver on climate-change mitigation and other dimensions of well-being; and ii) explore cross-sector linkages, as well as the need for meeting mitigation, adaptation and other SDGs. This report discusses these linkages in more detail for each sector (Electricity; Heavy Industry; Residential; Surface Transport; and Agriculture).

Developing LT-LEDS is not a straightforward process. Adequate mechanisms for interactions between all parts of the government (e.g. between ministries and different levels of government), as well as between government and other stakeholders, will be necessary. Governments may also need to expand their technical capacity (e.g. by developing adequate modelling tools or improving interactions between the different models used) and address numerous political economy factors, such as government revenues’ dependence on fossil fuel and vested interests. The rest of the report examines a range of political economy factors in each of the five sectors, notably those related to affordability and acceptability, which are central to guaranteeing an equitable transition.

LT-LEDS are likely to be one of many planning instruments in national frameworks (e.g. sectoral plans, local plans and strategies focusing on the delivery of other policy goals, such as improved health through reducing air pollution). If efforts to develop LT-LEDS are in line with the set of principles introduced above, this process could become an opportunity to rethink economy-wide policy priorities, and align other planning instruments at the national and subnational levels with these priorities. Designing effective and coherent policies for meeting multiple goals related to well-being outcomes and the SDGs is the major purpose of the OECD Framework for Policy Coherence for Sustainable Development.

Source: OECD (2016), *Better Policies for Sustainable Development 2016: A New Framework for Policy Coherence*, OECD Publishing, Paris, <https://doi.org/10.1787/9789264256996-en>.

necessary changes, e.g. in terms of coherent approaches to urban development and transport infrastructures. Effective carbon rates are highest in the transport sector, but elasticities are such that carbon pricing may not change behaviour and technologies that much. Moreover, while the right pricing is vital to encourage both investment and

innovation in cleaner technologies, concerns about the implications for well-being (e.g. affordability, competitiveness and jobs) are likely to be important factors inhibiting more stringent policy settings.

The well-being approach is used to assess “two-way alignment” between climate and other well-being goals in order to better

identify and manage the synergies and trade-offs. In this context, it calls for full cost accounting – including through (e.g. carbon) pricing – or at least factoring in the (sometimes uncertain) costs of externalities. It embraces and stresses the importance of pricing externalities, but looks at this critical policy component from the broader perspective of supporting the transition to a low-emission development pathway while achieving broader well-being goals and avoiding some of the negative trade-offs that may arise from a sole focus on carbon pricing and other climate policy instruments.

1.3. Moving from theory to practice

This report aims to encourage and support governments in meeting their national and international climate change mitigation goals. It explains how adopting a well-being lens could lead to different policy approaches and change the overall perspective on policy making in specific economic sectors, namely, electricity, heavy industry, residential, surface transport and agriculture, which together represent over 60% of global GHG emissions (IPCC, 2014_[3]). It highlights that setting priorities across sectors to deliver multiple well-being and sustainability outcomes both enhances the potential benefits, and helps identify the opportunities and needs for co-operation and co-ordination in order to meet stringent mitigation goals.

For policy makers to be able to adopt a well-being lens for policy making, the measurement system used to track progress, set criteria for decision-making frameworks and evaluate policy outcomes needs to capture multiple well-being objectives. Decisions are often based on a single objective or a very limited number of objectives; the associated measurement and monitoring systems often have limited ability to capture broader well-being impacts, often conflating outputs with well-being outcomes. In transport, for example, measurement focuses on the number of passengers and

tonne-kilometres, instead of the access to opportunities and services provided by transport. A measurement system that better monitors diverse well-being outcomes can also be a crucial step for setting shared goals and targets across governments, where co-operation and co-ordination are key to delivering climate and other well-being goals.

Without political commitment to act on them, the development of indicators is a symbolic exercise.

While some of the indicators proposed in this report are relatively new, many are not. The novelty lies in the recognition that they need to be widely available (since only a few countries or databases may have them), and considered simultaneously and with the same level of priority, rather than viewed in isolation and with a hierarchical order (e.g. focus on GHG emissions, regardless of the impacts on agricultural soils). In addition, a change in the measurement system can be a significant step towards more ambitious climate change mitigation policies only if the new approach is effectively used to inform policy decisions, as “without political commitment to act on them, the development of indicators is a symbolic exercise” (Winston and Eastaway, 2008_[54]). The evidence base that enables this to happen still needs to be built, including by embedding well-being indicators in policy evaluations. Discussions across sectors focus on these three points and provide examples of good practice where available.

The report discusses how the well-being lens could be applied in different sectors and the type of measurement system that could support the shift in perspective needed to decarbonise that particular sector while

achieving two-way alignment. While chapters have a sectoral focus, they also make linkages across sectors, where this is important (e.g. for electricity, and for the residential and transport sectors in particular).

The second part of this report addresses a range of policy practices in each of these sectors, as well as carbon pricing as an

overarching element of an effective approach to climate change mitigation. It illustrates how different climate policies can be implemented, designed and evaluated while taking into account potential synergies and trade-offs, thereby better aligning incentives towards climate change mitigation and wider well-being benefits.



IN BRIEFS

Extracted from Chapters 2 to 6

Catalysing change through a sustainable electricity sector

Moving to sustainable industrial production

Building sustainable dwellings, neighbourhoods
and communities

Delivering accessible and sustainable mobility

Creating a sustainable food system

CATALYSING CHANGE THROUGH A SUSTAINABLE ELECTRICITY SECTOR

Electricity is at the heart of human well-being since the energy it delivers supports a broad range of basic services, economic infrastructure and activities, and facilitates education and gender equality among other things. Despite improvements in energy efficiency, global electricity demand grew by 115% between 1990 and 2016, much faster than the increase in population over the same period (41%). This trend will likely continue due to economic growth and increasing access and electrification of end-uses.

Current electricity generation, notably through the combustion of fossil fuels, is the single largest contributor to global GHG emissions, pollutes the air, damaging public health and ecosystems, all of which harms current and future well-being. While decarbonisation of the electricity sector has become a policy priority, the sector is still off-track to meet global mitigation goals. Worryingly, electricity-related GHG emissions rose by 2.5% in 2018, due to large increases in gas and coal generation, a problematic trend for decarbonising industry, transport and housing that increasingly rely on a supply of low-carbon electricity. Coal-fired electricity accounted for 30% of global energy-related CO₂ emissions in 2018, mostly due to relatively young plants in Asia that could lock-in high-levels of emissions for the next 30 years.

Exploiting synergies and addressing trade-offs between climate and other priorities is an opportunity to accelerate decarbonisation while bringing other well-being benefits. For example, phasing out coal reduces GHG emissions and air pollution, creating immediate health benefits that can increase the social and political acceptability of more stringent climate action. Coal phase out, however, impacts employment opportunities and people's livelihoods, creating difficulties for some communities.

These difficulties can be addressed by appropriate policy design to mitigate negative impacts on particular population groups.

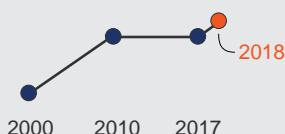
Adopting a well-being lens entails incorporating objectives beyond the energy trilemma (affordability, reliability, decarbonisation), and looking at the entire power system. Setting priorities like ensuring public health and safety, sustainably managing natural resources, preserving ecosystems and providing high-quality employment opportunities is central for shifting to a sustainable energy sector. Delivering these multiple priorities requires looking beyond the plant level, examining the network infrastructure and the demand side (e.g. households, industry). For example, activating and transforming the demand side through energy efficiency improvements (e.g. using efficient household appliances and electric motors in industry) and active demand management can reduce energy bills for households and industrial consumers while enhancing system flexibility and improving the integration of variable renewable energy sources such as wind and solar photovoltaic into the grid.

Systematically monitoring all areas of electricity-related well-being is essential to supporting this shift. For example, indicators allowing to better identify households at risk of energy poverty will enable policy makers to better target income transfers and allocate infrastructure costs. These and other indicators that monitor other priorities (e.g. health, safety, ecosystems) are needed for identifying synergies and trade-offs. In addition, complementing current measurement of production-based carbon intensity with consumption-based metrics, and monitoring the extent to which governments are unlocking the potential of demand management, provides better information for setting priorities. Policy packages will need to include carbon pricing, renewable energy support and unabated coal phase-out (plant level), network planning and electricity market design (network level), and the creation of adequate regulatory conditions to activate the demand-side.

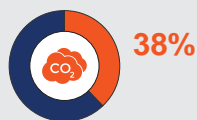
Infographic 2. Catalysing change through a sustainable electricity sector



Electricity supports a broad range of services and economic infrastructure across sectors. It is the **highest emitting sector** but it is not on track to meet global mitigation goals.



Electricity-related CO₂ emissions are on the rise again

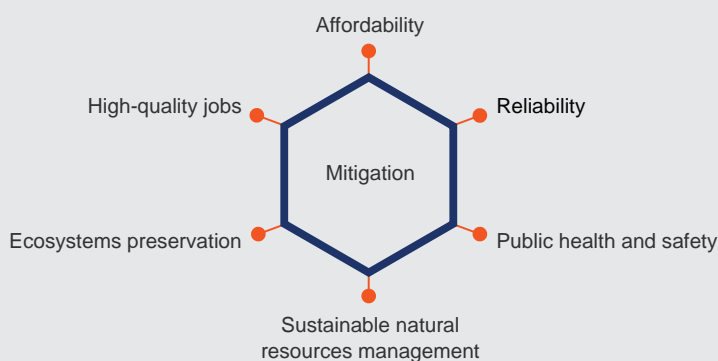


In 2018, the electricity sector contributed to 38% of global energy-related CO₂ emissions



With major impacts on health, biodiversity and natural resources

Looking beyond affordability and reliability, we can **accelerate decarbonisation** by exploiting wider synergies across all levels of the power system.



To accelerate climate action, we urgently need to:

Reframe **measurement**



Identify households at risk of energy poverty

Monitor impacts on health, ecosystems and jobs

Apply consumption-based carbon intensity

Refocus **policies**



Integrate well-being objectives into renewable energy support

Price carbon and phase out coal

Democratise electricity generation to include households and industry

MOVING TO SUSTAINABLE PRODUCTION BY HEAVY INDUSTRY

For the last century, heavy industry has been maximising production to meet the demands of a growing global population, rising standards of living and increasing urbanisation. In this sense, it touches on nearly every facet of our lives since it produces nearly all the materials and chemicals in use (e.g. iron and steel, cement, aluminium). The world is producing billions of tons of primary materials annually, more than twice as fast as population growth.

The problem, however, is that **current industrial production is damaging our health and that of the planet, polluting the air we breathe, contaminating soil and water, using up the planet's resources, and in the midst, exacerbating climate change.** The heavy industry sector emitted approximately 36% of global energy-related CO₂ emissions in 2016 including electricity and heat.

The choices made today, with respect to building or retrofitting plants, will be in place for the next 20 to 40 years, locking in heavy industry into either sustainable or unsustainable production until mid-century. However, only a subset of heavy industry processes can be cheaply and directly electrified; hence, new processes will be required to decarbonise. Many of the existing options are expensive or technically difficult. Demonstration and deployment to establish the commercial viability of such new technologies is vital, since the next few decades will bring more people, increased urbanisation, and higher standards of living.

Sustainable production means decarbonising heavy industry and adopting circular and resource-efficient production processes. Firms will need to modify plants to become more energy efficient, shut down especially "dirty" ones, use more recycled

materials, and develop and deploy new production processes since decarbonising some material and chemical processes presents unresolved challenges. Many of these options not only reduce greenhouse gases, but also improve environmental quality and help to sustainably manage the planet's resources. For example, for some materials, like steel, using more scrap means less energy, water, and land usage, in addition to less GHGs. To realise these possibilities, governments will need to shift away from the linear economy – where raw materials are extracted, processed, consumed and disposed – and mainstream decarbonisation, circularity and resource efficiency across the entire economy.

For this shift to happen, the sector will need to pursue sustainable productivity that incorporates social and environmental impacts into decision-making, thereby broadening its policy priorities. This can be done, for instance, by using indicators that show whether production is increasing at the expense of air, land, water, soil and materials pollution and GHGs. These and other indicators capturing the diverse impacts of heavy industry on well-being will need to be used systematically.

Policy packages to decarbonise heavy industry should encompass a set of core policies like carbon pricing, and enabling policies like enhancing the availability of scrap for heavy industry. *Policies that attenuate any adverse impacts on well-being*, such as active labour management programmes and revenue recycling, will also be needed. Targeted RD&D will be necessary to develop new processes, and resource efficiency programmes will be important. Overall, shifting the mind-sets of policy makers to consider wider social and environmental impacts will help accelerate the deployment of these policies, since, for instance, shifting to a notion of productivity that accounts for the environment (as discussed above) can make the case for decarbonisation as a way to catalyse productivity gains.



Today heavy industry produces the materials and chemicals needed for:



Infrastructure



Housing



Vehicles



Packaging

But the sector has been **maximising production** for a fast growing population, rising living standards and increasing urbanisation, causing:

- Pollution
- Waste
- Loss of biodiversity
- Major stress on natural resources



36%

of CO₂ emissions from energy-use

Heavy industry needs to **transition** to net-zero, circular and resource-efficient production.



Circular



Net-zero emitter



Resource-efficient

To accelerate climate action, we urgently need to:

Reframe **measurement**

Refocus **policies**



Adjust productivity to account for the environment

Detect at-risk regions for jobs losses

Track and valorise waste streams for scrap



Price carbon and support sustainable industry

Innovate and invest in green technologies

Advance energy efficiency and adopt resource efficiency

BUILDING SUSTAINABLE DWELLINGS, NEIGHBOURHOODS AND COMMUNITIES

The residential sector is central to the low-emissions transition and also to public health, safety, security, comfort, affordability and equity outcomes.

Buildings generated some 28% of global GHG emissions in 2017, and the residential sector accounted for 60% of these. The provision of services within buildings is a central driver of energy demand and emissions, mainly from space and water heating, cooling and cooking. These services are linked to other aspects of well-being, including clean energy access (SDG 7), which is necessary to prevent health risks. But many other characteristics of housing are also relevant. Its location, the availability and connections to services and opportunities (e.g. education, jobs), the surrounding environment (e.g. green spaces), and the form of a city (e.g. whether it is compact and fosters mixed land-use) all play a role in the sector's wider contribution to well-being and GHG emission reductions. These conditions help in particular to avoid sprawl, car dependence and transport emissions.

Decision-makers often have limited visibility across multiple scales or may pursue their goals in silos. Consequently, inappropriate policies create numerous unintended effects and miss important opportunities to improve quality of life and make ambitious contributions to climate change mitigation. Policies addressing housing affordability are often focused solely on dwellings, overlooking the availability of nearby opportunities and the affordability of other services (e.g. transport, energy, health care). This can perpetuate social segregation while increasing car dependency and transport

emissions. At the city scale, densification strategies can overlook implications at the dwelling and neighbourhood level. Some examples are space reductions beyond minimum standards, limitations in water and transport infrastructure, or reductions in green space across the city. This could lead to detrimental impacts to well-being (e.g. health, equity) as well as off-setting any GHG emission reductions from densification.

By better capturing GHG mitigation, health, and equity benefits, a well-being approach can make a stronger case for solutions that align climate and other goals. For instance housing developments that are transit-friendly, and redevelopment projects that modernise and green deprived neighbourhoods, provide educational, leisure and employment facilities, and safer streets.

Developing new indicators to track progress and guide decisions is a key step towards redefining “good sustainable housing”. Measuring accessibility from housing to different opportunities and mainstreaming it into decisions is crucial to developing a holistic view of equity and affordability that can unlock synergies between equity and climate goals. Moreover, there is a need to develop indicators that can help measure and monitor urban ecosystem services, as well as tools for eco-positive thinking and design, to support planning of nature-based solutions (NBS).

Policies, including stringent building standards and better schemes for building refurbishment, can encourage a move from marginal improvements to the use of best available practices, avoiding locking-in future emission levels that are incompatible with global climate goals.

Equally important are actions at the level of neighbourhoods (e.g. eco-districts) and cities (e.g. land-use regulations and fiscal policies), which can have significant reinforcing effects, both positive and negative, with respect to one another and with respect to dwellings.



The residential sector is central to a **climate neutral future**. But we need to look **beyond buildings** to ensure wider societal benefits such as public health, safety, comfort and security.



A well-being approach can make a stronger case for **sustainable solutions** like:



To accelerate climate action, we urgently need to:

Reframe measurement



- Incorporate accessibility and neighbourhood quality when defining “good housing”
- Expand monitoring of urban ecosystem services
- Create tools for eco-positive thinking and design

Refocus policies



- Shift from marginal improvements to best available practices
- Prioritise nature-based solutions
- Link dwelling-, neighbourhood- and city-level actions

DELIVERING ACCESSIBLE AND SUSTAINABLE MOBILITY

Mobility systems connect people and places, increasing quality of life as well as adding social and economic value to communities. The transport sector underpins peoples' well-being by enabling them to travel between their home and work, delivering food to our grocery stores, and transporting products around the world and within countries, regions and cities to meet our daily needs.

However, emissions from transport have grown faster than any other sector over the last 50 years, accounting for approximately 23% of global CO₂ emissions. This largely stems from the fact that mobility systems over the last century have aimed to increase physical movement, are heavily reliant on fossil fuels, and are centred on private ownership, which has in turn led to cities planned around cars. Today's mobility systems also lower our air quality, entrench social inequalities, exclude vulnerable groups, deteriorate natural habitats and exacerbate climate change. If our mobility systems do not change, then transport CO₂ emissions could increase by 60% globally by 2050.

The solution is to re-design mobility systems around accessibility - ensuring that people are able to easily reach jobs, opportunities, goods, services and amenities - instead of physical movement. This would mean giving priority to sustainable transport modes, such as walking, cycling, public transport and other forms of shared mobility, and even new modes (e.g. electric scooters known as micro-mobility), which can bring relevant value to society, particularly in cities. It would also entail giving priority to creating proximity between people and places. Such an approach will lead to a

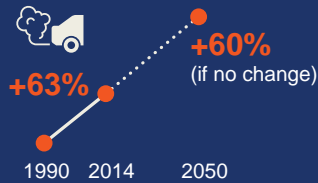
redistribution of budgets and public space in a way that can improve life quality by contributing to equity, health, the economy, climate and other environmental goals.

An important next step is developing and using the right indicators to make the focus on accessibility a reality. The use of physical accessibility indicators for planning transport networks and city development has allowed some cities to reach important modal shift targets- i.e. incentivising people to bike, walk, and use public transport instead of the car. Indicators incorporating transport affordability as criteria for supporting social and affordable housing development have also allowed cities to improve both housing and transport affordability for poorer households while achieving climate change mitigation goals. Governments will also need to set criteria according to safety and security, air quality, noise reduction, and impacts on natural habitats, in order to transform mobility systems.

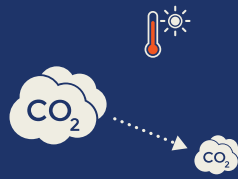
Policies for improving technologies, but also for avoiding unnecessary trips and shifting trips from cars to bikes, public transport, and walking, will be necessary for decarbonising the sector while bringing multiple other benefits. But the transport sector needs to co-ordinate closely with land-use and housing sectors to ensure access through sustainable modes of transport that provide a high-quality alternative to cars. This involves investment on sustainable transport modes but also policies that can make explicit links between land-use and transport (e.g. transport-inclusive development standards). Overall, policy design that takes multiple priorities into account can lead to more acceptable, feasible and effective mitigation action, and will make a relevant difference in how new technologies, such as electrification, automated vehicles and shared mobility play out in terms of climate and other well-being outcomes.



Mobility systems **connect people and places** but CO₂ emissions from transport have grown faster than any other sector over the past few decades:



Transport accounted for 23% of global energy related CO₂ emissions in 2014



Achieving the 1.5 °C goals would require drastic cuts in transport emissions by 2050 (-25% to -75%)



Today's systems worsen air quality, entrench social inequalities and deteriorate natural habitats

Systems will need to be redesigned around **accessibility**, ensuring that people can easily reach jobs, opportunities, services and amenities. This will entail:



Shifting away from current model based on private ownership and heavy reliance on fossil fuels



Giving priority to sustainable transport modes and creating proximity between people and places

To accelerate climate action, we urgently need to:

Reframe **measurement**



- Integrate accessibility criteria in transport planning and city development
- Incorporate and improve affordability metrics
- Set criteria around safety and security, air quality, noise reduction, and impacts on natural habitats

Refocus **policies**



- Improve technologies, avoid unnecessary trips and shift to sustainable modes
- Invest in sustainable transport modes
- Ensure access by co-ordinating land-use, transport and housing

CREATING A SUSTAINABLE FOOD SYSTEM

Agriculture has achieved major success in fighting hunger, feeding the world and contributing to economic development, including by providing employment to 28% of workers worldwide. Agriculture also provides agro-environmental services to society, such as flood risk mitigation, and resilience to droughts. However, this success has come at a price. Many of the undesirable impacts on the environment and on human health stem from the intensification of farming practices to meet growing global food demand (e.g. excessive use of fertilisers, pesticides and antibiotics).

The food system is a major contributor to climate change, responsible for around 30% of global GHG emissions, including methane from ruminants' digestion and paddy rice cultivation, nitrous oxide emissions arising from fertilisers and animal waste and indirect emissions from land-use change. Agriculture uses one-third of the land surface and is a major driver of deforestation. If unchecked, climate change impacts such as heatwaves, droughts and floods will threaten food security and the viability of current agricultural production patterns.

Furthermore, the current food system does not provide a healthy diet for everyone, even if it has the necessary capacity and produces sufficient total calories. Malnutrition remains a global issue and obesity rates are growing: 159 million children under the age of 5 suffer from stunted growth; 1.9 billion adults are overweight or obese. Meanwhile, one-third of the produced food is wasted or lost.

Importantly, agriculture and forestry have the potential to remove carbon dioxide from the atmosphere, which could significantly increase the feasibility of stringent mitigation goals. The most efficient options include

afforestation, land restoration and the development of sustainable bioenergy. The latter can contribute to mitigation in other sectors but require rigorous life-cycle assessment to avoid damaging land-use changes and associated GHG emissions and biodiversity loss.

A shift in perspective is needed to better integrate growing challenges to the sustainability of the food system.

Economic criteria (GDP, trade, farmers' income) are currently the main drivers for decisions in agriculture and associated food systems. Integrating wider social objectives (e.g. healthy diets, climate, sustainable resource management) as priorities is key. Addressing the sustainability of the food sector also requires examining the whole food value chain, including the demand side as well as the institutions and markets in which these are embedded.

Applying a well-being lens can help governments make visible the hidden costs of the current food system and identify the potential to achieve synergies (i.e. health, improved environment, carbon storage) and better manage potential trade-offs (e.g. jobs, food access and affordability) between climate and broader well-being goals. For instance, a particular focus on workers' protection and training might facilitate the sector's transition.

New indicators will be needed to measure and monitor performance and to facilitate the achievement of two-way alignment between climate and other well-being goals. For example, the development of reliable indicators on food accessibility and affordability, especially for lower-income households, would help decision-makers to address relevant trade-offs, thus improving two-way alignment. To inform policy development, performance measurement also needs to evolve towards full-cost accounting. This shift in perspective offers a framework for designing more efficient and more comprehensive policies for the food system.

Infographic 6. Creating a sustainable food system



Although we now produce enough food to feed the world, **the food system is not sustainable** and contributes to:



30% of GHG



Air and water pollution



Biodiversity loss

In addition, **malnutrition** remains a global issue, as does **food waste** along the value chain.



1.9 billion adults are overweight or obese



159 million children under 5 suffer from stunted growth



Nearly one-third of the food produced is lost

A well-being approach allows us to look at the **whole food system**, delivering multiple benefits while **reducing emissions** throughout the economy as well as **removing CO2 from the atmosphere**.



Farming



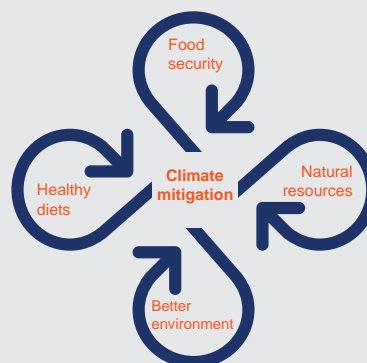
Agro-industry



Retail



Consumers



To accelerate climate action, we urgently need to:

Reframe **measurement**



Adjust accounting to include well-being impacts in agriculture productivity measures

Include life-cycle assessment of bioenergies

Incorporate food accessibility and affordability criteria

Refocus **policies**



Deploy sustainable land-use practices

Set the proper price signal to encourage good practices

Move from animal-based proteins to plant-based proteins

REFERENCES

- Berkeley Earth (2017), *Global Temperature Report for 2017*, <http://berkeleyearth.org/global-temperatures-2017/>. [1]
- Bishop, K. et al. (2018), *Hazed and confused: the effect of air pollution on dementia*, <http://www.nber.org/papers/w24970> (accessed on 3 July 2019). [40]
- Boarini, R. and M. Mira D'ercole (2013), *Going beyond GDP: An OECD Perspective*, <http://www.bls.gov/iif> (accessed on 25 August 2018). [30]
- Brundtland, G. (1987), *Our Common Future (The Brundtland Report)*, <http://dx.doi.org/10.1080/07488008808408783>. [27]
- Buckle, S. et al. (2014), "Prospects for Paris 2015: do major emitters want the same climate ?", *CORE Discussion Papers*, <https://ideas.repec.org/p/cor/louvco/2014008.html> (accessed on 3 July 2019). [16]
- Carney, M. (2015), *Speech: Breaking the tragedy of the horizon – climate change and financial stability*, <https://www.bis.org/review/r151009a.pdf> (accessed on 12 December 2017). [14]
- Durand, M. et al. (2018), "Countries' Experiences with Well-being and Happiness Metrics", https://s3.amazonaws.com/ghc-2018/GHC_Ch8.pdf (accessed on 5 June 2018). [29]
- Durand, M. and C. Exton (2019), *Adopting a Well-Being Approach in Central Government: Policy Mechanisms and Practical Tools*, https://s3.amazonaws.com/ghwbpr-2019/UAE/GH19_Ch8.pdf (accessed on 3 July 2019). [60]
- EEB (2018), "Beyond-gdp-growth-debate-at-postgrowth-conference.". [45]
- European Commission (2009), *GDP and beyond : measuring progress in a changing world*, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52009DC0433> (accessed on 3 October 2018). [44]
- Europe, U. (2014), *Conference of european statisticians recommendations on measuring sustainable development*, https://www.unecce.org/fileadmin/DAM/stats/publications/2013/CES_SD_web.pdf (accessed on 3 July 2019). [46]
- EUROSTAT (2010), "Sigma the bulletin of european statistics: gdp and beyond", <http://www.pixelio.de> (accessed on 19 September 2018). [42]
- Exton, C. and M. Shinwell (2018), "Policy use of well-being metrics: Describing countries' experiences", *SDD working paper.*, No. 94, OECD, Paris, http://www.oecd.org/sdd/publicationsdocuments/working_papers (accessed on 6 November 2018). [28]
- Fleurbaey, M. (2009), "Beyond GDP: The Quest for a Measure of Social Welfare", <http://dx.doi.org/10.1257/jel.47.4.1029>. [33]
- Giannetti, B. et al. (2015), "A review of limitations of GDP and alternative indices to monitor human wellbeing and to manage eco-system functionality", *Journal of Cleaner Production*, Vol. 87, pp. 11-25, <http://dx.doi.org/10.1016/j.jclepro.2014.10.051>. [34]
- Heissel, J., C. Persico and D. Simon (2019), *Does Pollution Drive Achievement? The Effect of Traffic Pollution on Academic Performance*, <https://www.nber.org/papers/w25489.pdf> (accessed on 3 July 2019). [39]
- IDDR (2016), *Long-term low emissions development strategies and the Paris Agreement – Why, what and how?*, <https://www.iddri.org/en/publications-and-events/policy-brief/long-term-low-emissions-development-strategies-and-paris> (accessed on 6 September 2018). [56]
- IEA (2019), *World Energy Investment 2019*, <https://webstore.iea.org/download/direct/2738?fileName=WEI2019.pdf> (accessed on 3 July 2019). [10]
- ILO (2015), *Guidelines for a just transition towards environmentally sustainable economies and societies for all*, <http://www.ilo.org/publns> (accessed on 8 August 2019). [17]
- IPCC (2018), *Global Warming of 1.5 C*, <https://ipcc.ch/report/sr15/> (accessed on 17 October 2018). [4]
- IPCC (2018), *Global warming of 1.5°C - Summary for Policymakers*, https://report.ipcc.ch/sr15/pdf/sr15_spm_final.pdf (accessed on 3 July 2019). [57]
- IPCC (2014), *Climate Change 2014 - Summary for Policymakers*, https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf (accessed on 20 August 2018). [20]
- IPCC (2014), *Climate Change 2014 - Synthesis Report*, Gian-Kasper Plattner, <http://www.ipcc.ch>. (accessed on 3 July 2019). [3]

- Le Quéré, C. et al. (2018), "Global Carbon Budget 2018", *Earth System Science Data*, Vol. 10/4, pp. 2141-2194, <http://dx.doi.org/10.5194/essd-10-2141-2018>. [13]
- Liebreich, M. (2018), *Scenarios for a solar singularity*, <https://www.linkedin.com/pulse/scenarios-solar-singularity-michael-liebreich/>. [58]
- Loorbach, D., N. Frantzeskaki and F. Avelino (2017), "Sustainability Transitions Research: Transforming Science and Practice for Societal Change", *Annual Review of Environment and Resources*, Vol. 42/1, pp. 599-626, <http://dx.doi.org/10.1146/annurev-environ-102014-021340>. [59]
- Mirabile, M. and J. Calder (2018), "Clean power for a cool planet (forthcoming)". [9]
- OECD (2019), *OECD Economic Surveys: New Zealand 2019*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/b0b94dbd-en>. [48]
- OECD (2019), *OECD Regional Outlook 2019: Leveraging Megatrends for Cities and Rural Areas*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264312838-en>. [24]
- OECD (2019), *Responding to Rising Seas: OECD Country Approaches to Tackling Coastal Risks*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264312487-en>. [23]
- OECD (2018), *Meeting of the Council at Ministerial Level. Strategic orientations of the secretary-general*, [http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=C/MIN\(2018\)1&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=C/MIN(2018)1&docLanguage=En) (accessed on 29 August 2018). [49]
- OECD (2018), *OECD Companion to the Inventory of Support Measures for Fossil Fuels 2018*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264286061-en>. [11]
- OECD (2017), *Climate Action -Time for implementation*, <http://www.oecd.org/canada/munk-school-climate-action-time-for-implementation-canada-2017.htm> (accessed on 1 October 2018). [15]
- OECD (2017), *Investing in Climate, Investing in Growth*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264273528-en>. [5]
- OECD (2016), *Income inequality remains high in the face of weak recovery*, <http://www.oecd.org/social/OECD2016-Income-Inequality-Update.pdf> (accessed on 3 July 2019). [52]
- OECD (2016), *The Economic Consequences of Outdoor Air Pollution*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264257474-en>. [36]
- OECD (2015), *In It Together: Why Less Inequality Benefits All*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264235120-en>. [51]
- OECD (2014), *Understanding National Accounts*, <https://www.oecd-ilibrary.org/docserver/9789264214637-16-en.pdf?expires=1533575592&id=id&accname=ocid84004878&checksum=811571AB6B21D2670BA3ED9BE8F33A46> (accessed on 6 August 2018). [25]
- OECD (2013), *How's life? 2013: measuring well-being*, OECD Publishing. [50]
- OECD (2011), *How's Life?: Measuring Well-being*, OECD Publishing, Paris, <https://dx.doi.org/10.1787/9789264121164-en>. [26]
- OECD/IEA/NEA/ITF (2015), *Aligning Policies for a Low-carbon Economy*, <http://www.oecd-ilibrary.org/docserver/download/0315021e.pdf?expires=1510835480&id=id&accname=ocid84004878&checksum=CAF8D360F2C9DCED4002CAE73DD7F463> (accessed on 16 November 2017). [21]
- Perera, F. (2017), "Multiple Threats to Child Health from Fossil Fuel Combustion: Impacts of Air Pollution and Climate Change.", *Environmental health perspectives*, Vol. 125/2, pp. 141-148, <http://dx.doi.org/10.1289/EHP299>. [22]
- Pierrehumbert, R. (2014), "Short-Lived Climate Pollution", *Annual Review of Earth and Planetary Sciences*, Vol. 42/1, pp. 341-379, <http://dx.doi.org/10.1146/annurev-earth-060313-054843>. [41]
- Röttgers, D. and B. Anderson (2018), "Power struggle: Decarbonising the electricity sector", https://www.oecd-ilibrary.org/environment/power-struggle_900f4c72-en (accessed on 2 July 2019). [12]
- Shindell, D. et al. (2017), "A climate policy pathway for near- and long-term benefits", *Science*, Vol. 356/6337, pp. 492-493, <http://dx.doi.org/10.1126/science.aaj2350>. [37]
- Stern, T. and U. Persson (2008), "An Even Sterner Review: Introducing Relative Prices into the Discounting Debate", <http://dx.doi.org/10.1093/reep/rem024>. [19]
- Stern, N. (2006), *The economics of climate change: The Stern Review*, Cambridge University Press, <http://dx.doi.org/10.1017/CBO9780511817434>. [18]

- Stiglitz, J., A. Sen and J. Fitoussi (2009), "Measurement of Economic Performance and Social Progress", <http://ec.europa.eu/eurostat/documents/118025/118123/Fitoussi+Commission+report> (accessed on 2 May 2018). [43]
- UNEP (2018), *Emissions Gap Report 2018*, <http://www.un.org/Depts/Cartographic/english/htmain.htm> (accessed on 2 July 2019). [8]
- UNFCCC (2015), *Adoption of the paris agreement - Paris Agreement text English*. [55]
- United Nations (2012), *The future we want*, <https://sustainabledevelopment.un.org/content/documents/733FutureWeWant.pdf> (accessed on 3 July 2019). [47]
- Van Den Bergh, J. (2008), "The GDP paradox", <http://dx.doi.org/10.1016/j.joep.2008.12.001>. [32]
- van den Bergh, J. (2009), "The GDP paradox", *Journal of Economic Psychology*, Vol. 30/2, pp. 117-135, <http://dx.doi.org/10.1016/j.joep.2008.12.001>. [31]
- Van Dender, K. and X. Marten (2019), "The Use of Revenues from Carbon Pricing", *OECD Tax and Environment Working Paper Series*, OECD. [53]
- Watts, N. et al. (2015), "Health and climate change: policy responses to protect public health", *The Lancet*, Vol. 386/10006, pp. 1861-1914, [http://dx.doi.org/10.1016/s0140-6736\(15\)60854-6](http://dx.doi.org/10.1016/s0140-6736(15)60854-6). [2]
- WHO (2018), "Air pollution and child health: prescribing clean air", *WHO*, <https://www.who.int/ceh/publications/air-pollution-child-health/en/> (accessed on 3 July 2019). [38]
- WHO (2015), *Reducing global health risks Through mitigation of short-lived climate pollutants Scoping report for policymakers*, <https://apps.who.int/iris/bitstream/handle/10665/189524/9789241565080?sequence=1> (accessed on 3 July 2019). [35]
- Winston, N. and M. Eastaway (2008), *Sustainable Housing in the Urban Context: International Sustainable Development Indicator Sets and Housing*, Springer, <http://dx.doi.org/10.2307/27734657>. [54]
- World Bank (2019), *Beyond the Gap – How Countries Can Afford the Infrastructure They Need while Protecting the Planet*, <https://www.worldbank.org/en/topic/publicprivatepartnerships/publication/beyond-the-gap---how-countries-can-afford-the-infrastructure-they-need-while-protecting-the-planet> (accessed on 3 July 2019). [6]
- Zenghelis, D. (2019), "Endogenous Growth, Convexity of Damage and Climate Risk: How Nordhaus' Framework Supports Deep Cuts in Carbon Emissions", Vol. 125/583, pp. 574-620, <http://dx.doi.org/10.1111/eoj.12188>. [7]

NOTES

1. See the discussion in (IPCC, 2018_[57]), “Summary for Policymakers”.
2. Such as carbon capture and sequestration, which could be combined with biomass combustion to deliver so-called negative emissions.
3. See for example, <https://sdgindex.org/news/behind-the-numbers-joint-research-centre-audit-of-the-sdg-index-and-dashboards/>.
4. See the discussion in (Liebreich, 2018_[58]).
5. Loorbach (2017_[59]) notes that “The energy transition is thus much more than merely a technological shift; it is a power struggle and a socio-cultural change having a deep effect on incumbent institutions, routines, and beliefs.”
6. The 45% reduction for a 1.5°C goal assumes little overshoot of CO₂ emissions and therefore limited requirement for atmospheric CO₂ removal. The 20% figure corresponds to a 66% chance of keeping the temperature change below 2°C.
7. See: <https://www.iea.org/geco/emissions/>.
8. It should be noted, however, that this simple framework does not capture the dynamic nature of innovation in the context of climate modelling.
9. For more information, see: <https://www.fsb-tcf.org/>.
10. In reality, of course, generations overlap. But the sharpness of this distinction helps make clear the different inter-generational incentives at play. In this model, everything is determined by the initial investment decisions, assuming that subsequent social welfare is maximised in the light of preferences.
11. Hungary had a Parliamentary Commissioner for Future Generations during 2008-12.
12. See also the discussion in (Durand and Exton, 2019_[60]), outlining that “Putting people’s well-being at the heart of policy requires better data, but this alone is not enough. It also requires building well-being into the machinery of government, and the tools used to take decisions.”
13. A point highlighted in the OECD Secretary-General’s 2017 speech and related to the way in which current income determines levels of investment and mitigation in the description of the conceptual model.
14. Or equivalently, a measure of income and expenditure.
15. See <https://treasury.govt.nz/sites/default/files/2019-05/b19-wellbeing-budget.pdf>.
16. There exists a significant overlap in how well-being is defined in the SDGs and the OECD well-being framework (as well as in many individual country initiatives). A key difference between the two frameworks is that the OECD framework is an analytical tool, while the SDGs are a set of goals and targets agreed internationally, with the aim of achieving sustainable development. As such, the SDGs are a concrete example of a move towards improving well-being in practice.
17. See (Stiglitz, Sen and Fitoussi, 2009_[43]) for a literature review.

For more information

Part I of the report is available at <https://doi.org/10.1787/2f4c8c9a-en>.

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