Introduction

It is, by now, beyond dispute that climate change presents the single greatest environmental challenge of our times. It is equally likely that this challenge will only be met by sustained and iterative cycles of global policy formation, administrative rule-making, regulatory action, and impact assessment. The second and third of these steps, broadly speaking, constitute the process of *policy implementation.* While the scholarly study of policy implementation is not new, it has yet to receive serious attention in the area of climate change regulation. The reasons for this are relatively simple.

First, the policy formation stage is still ongoing. As the recent meeting of the Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in Dubai vividly demonstrates, major outstanding disagreements on the basic structure of global climate policy remain. Different countries have indeed embraced climate commitments to a different extent. In the last 20 years, the European Union has consistently followed an ambitious sustainable climate policy, centred on the emissions trading system under Directive 2003/87/EC, and the European Green Deal now sets the aim of carbon neutrality by 2050.[1] The same cannot be said of all countries, although there is currently a broad convergence on carbon neutrality by the United States, Japan, and the People's Republic of China (PRC) by 2060 at the latest.[2]

Second, public attention is only intermittently focused on climate policy per se. The climate problem, in all of its videogenic variations, is part of our everyday media experience. Everyone knows about climate change. Everybody wants something done about it. Everybody is frustrated by the lack of progress. But virtually nobody has turned their attention to what would happen tomorrow if a stunning diplomatic breakthrough swept away the political chaos and gave us a global policy agreement today.

Third, and perhaps most insidiously, neither the public, our politicians nor the media have ever been nearly as interested in the unglamorous details of policy implementation as they are (at least occasionally) with the stylised combat of policymaking. This general tendency is particularly noticeable and difficult to overcome when the policymaking arena in question is international. On that distant and obscure stage, only an emphasis on vivid colours of nationalism and personality seems able to sustain our attention for even a short time.

[1] European Commission, Communication to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions, The European Green Deal, COM(2019) 640 final, 11 December 2019.

[2] J. Murray, Which countries have committed to legally binding net zero carbon emissions?, NS Energy, 5 November 2020. www.nsenergybusiness.com/news/countries-net-zero-emissions; USA, International Climate Finance Plan, 7 January 2021; Our World in Data, Status of Net-Zero Carbon Emissions Targets. 2024. https://ourworldindata.org/grapher/net-zero-targets.

This volume explores the problem of divergence in climate policies and outlines prospects to establish effective enforcement mechanisms and achieve the sustainable development goals embedded in several international instruments; first and foremost, the UNFCCC. The book brings together the expertise of contributors from the areas of climatology, economics, politics, law, and cultural studies, and is divided into two parts, including: (1) a comparative analysis of key elements of climate policies in select countries on a regional basis; and (2) an assessment of the viability of climate policy implementation mechanisms and ways forward.

The first part of the volume commences with an analysis of the divergence between climate science and climate policy by Roberto Buizza, and continues with an assessment of select essential initiatives of the EU and other States aiming to achieve carbon neutrality by 2050–2060. Ilaria Conti, Nicolò Rossetto, Pierre Scholsser, and Stefano Verde show that the EU's policy for carbon pricing, electrification, clean molecules and sustainable finance make the EU the main testbed for measures steering capitalist economies towards carbon neutrality. Walter Baber demonstrates that reconciling the civil law and common law traditions that underpin the EU legal construct is essential to the implementation of the Green Deal and the achievement of carbon neutrality. Ottavio Quirico assesses the position of the EU *vis-à-vis* Russia as a major energy exporter and emitter of greenhouse gases, and argues that the current conflict in Ukraine discloses for the EU the possibility of diversifying energy sources, accelerating the green transition by invoking security of supply as a justification to abandon consolidated long-term energy contracts with Russian providers. According to Robert Bartlett, effective U.S. climate policies towards net zero emissions by 2050 are unlikely in the absence of a triggering event that coalesces a fragmented normative domestic landscape in U.S. politics. In the view of Pablo Cristóbal Jiménez Lobeira, partnerships with regions that have advanced more in the area of climate policies, notably the EU, are essential to advancing incipient climate policies in Latin America and the Caribbean. Wenting Cheng shows a progression in the PRC's policies towards a concrete greening of Belt and Road implementation measures, including guidance for key industries, life-cycle management of projects, and stopping the building of new coal-fired power stations, as the net zero carbon objective by 2060 became a domestic policy priority in 2020. According to Alexandria Feruglio and Aaron Tang, cooperative water policy and resource management is crucial to effective climate mitigation and adaptation in a divided political scenario in the Middle East and Northern Africa. A chapter by Joshua Woodyatt and Broneal Sarkosh-Nejad concludes the section by interrogating the focus of energy investment from the PRC and EU in Africa, in terms of both stated aims and actual outcomes, positing that much of the success of Africa's energy transition will depend on the PRC's sincerity about its domestic and international climate ambition.

The second part of the volume develops institutional design and focuses on singling out and overcoming essential governance problems that impede the achievement of sustainable greenhouse gas reduction targets, along the lines of the basic distinction between public actors (macro level) and private actors (micro level). Within this framework, Ottavio Quirico argues that overcoming the regulatory clash between the duty to make finance flows consistent with net zero carbon policies under the Paris Agreement and investment protection under the Energy Charter Treaty requires the implementation of a dual regulatory track that may lead to excluding compensation in the case of expropriation of unsustainable investment. Assessing holistic approaches to digitalisation as a means to achieve climate neutrality, Ottavio Quirico and Walter Baber suggest a 'learn-by-doing' approach, setting a variety of real-world experiments across supply chains to test the viability of digital policies, in close collaboration with stakeholders. Patrizia Vigni focuses on the issue of carbon sequestration via the sea as a test case and pleads in favour of a cooperative approach, in the context of a radical rethinking of the law of the sea. Oran Young underscores the fundamental role of Arctic processes for the dynamics of the Earth's climate, including ice-melting and hydrocarbon exploitation, and pleads for an improved role of the Arctic Council in addressing such challenges. Dealing with carbon border adjustment mechanisms, Ottavio Quirico envisages the possibility of approaching such tools as lawful *erga omnes contractantes* countermeasures under the auspices of the World Trade Organisation, and the twin General Agreement on Tariffs and Trade and General Agreement on Trade in Services. Radu Mares shows that the notion of 'corporate social responsibility' has evolved significantly in the light of climate change, which has led to the implementation of the new concept of 'responsible business conduct', involving a regulatory mix of legal obligations and market incentives. In the view of Alfredo Ferrante, achieving climate neutrality necessitates an extension of future ecolabelling schemes from non-food to food products, guaranteeing adequate consumer information. Underscoring a divide between the United States and the EU, Ivano Alogna, Natalie Arnould, and Alina Holzhausen plead in favour of a reconceptualisation of the doctrine of the separation of powers, allowing the judiciary to effectively adjust ineffective climate policies. In the light of the decision of the Hague District Court in *Milieudefensie v. Shell*, Andreas Hösli notes the growing role of private climate litigation in addressing climate change and the necessity of accelerating adjudication procedures and enforcing effective sanctions. Laura Magi, by contrast, focuses on public climate litigation and urges the International Court of Justice to provide a targeted advisory stance on the nature of the duty to curb carbon emissions via nationally determined contributions, its extraterritorial effects and implications for future generations. The section is concluded with a chapter from Katarzyna Williams, who shows that, besides scientific data, climate policies are fundamentally shaped by communication, advocating on this footing for new ways of conceptualising, understanding and imaging transformations and the green transition.

Overall, along the lines of an intensively interdisciplinary analysis, this volume identifies a set of discrepancies between climate policies on the global scale and outlines ways forward for key regulatory mechanisms to improve convergence among such policies. Amid fundamental divergences between different policy frameworks, efficient remedial and enforcement mechanisms emerge as a key tool to limit fragmentation and realign climate policies, with a view to carbon neutrality.

The volume is concluded by three different types of sources; a Bibliography, which includes academic sources; a section on Case Law, reporting the jurisprudence of domestic and international jurisdictions; and a section on Additional Documents, covering information sources from domestic and international institutions and bodies.

Ottavio Quirico and Walter Baber

978-1-009-34151-6 — Implementing Climate Change Policy
Edited by Ottavio Quirico, Walter Baber
Excerpt
More Information

Part I

Comparing Climate Policies

1
The Earth's Climate and Ongoing Global Change

ROBERTO BUIZZA

1.1 Introduction

The aim of this chapter is to provide a solid, objective, and quantitative review of the key aspects of climate change. Before beginning this analysis, it is worth noting that the fact that Planet Earth has a greenhouse effect is not, in and of itself, negative. Indeed, this effect has directly facilitated the evolution of complex forms of life – the Earth's temperature would be about 30°C colder were it not for the atmospheric greenhouse effect.

The problem of climate change that we are experiencing now is caused by the amplification of the greenhouse effect due to emissions from human activities. As greenhouse gases have been accumulating in the atmosphere since pre-industrial times, and more rapidly after World War II, the Earth has been experiencing global warming on a very fast timescale, which has caused profound environmental changes across tens of years instead of tens of thousands of years as occurred in the distant past.

After this short introduction, in the first section we will analyse observed trends in greenhouse gases, before in Section 1.2 discussing observed climate change and its impacts. In Section 1.3, we will review the total and per-capita greenhouse gas emissions of principal emitters (that is, major countries or groups of countries such as Europe). In Section 1.4, we will look at the quasi-linear link between the greenhouse gases accumulated in the atmosphere and global warming, and investigate the emission limits required if we are to contain global average warming below 1.5°C or 2.0°C. Finally, we will summarize and link all these topics, and discuss the level of global average warming that we could face in 2050 under four possible emission scenarios – one with a continuous future increase of greenhouse gas emissions of 1% per year, and three with a continuous future decrease of greenhouse gas emissions by 1%, 3%, or 5%, respectively. We will also point out that if we want to reach net zero emissions by 2050, we actually need to be even more drastic in our reductions, and aim for an average 8% annual decrease.

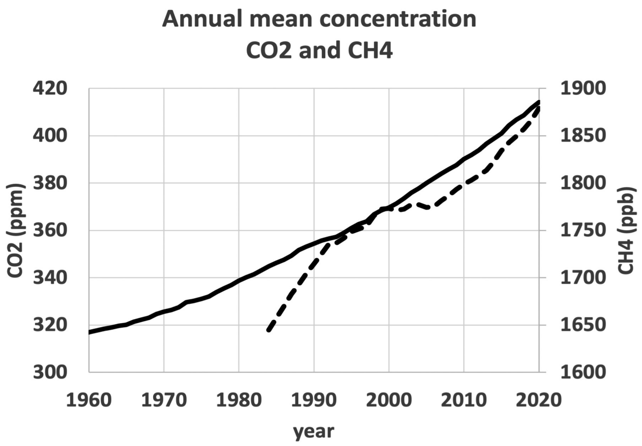

Figure 1.1 Annual mean concentration of carbon dioxide (CO_2, solid line; in parts per million, ppm) and of methane (CH_4, dashed line; in parts per billion, ppb), measured at the Mauna Loa Observatory. *Source*: Carbon dioxide data provided by Dr Pieter Tans, NOAA Global Monitoring Laboratory, Boulder, USA (gml.noaa.gov/ccgg/trends/) and Dr Ralph Keeling, Scripps Institution of Oceanography (scrippsco2.ucsd.edu/). Methane data provided by Ed Dlugokencky, NOAA Global Monitoring Laboratory, Boulder, USA (gml.noaa.gov/ccgg/trends_ch4).

1.2 Growing Concentrations of Carbon Dioxide and Methane

The concentration of greenhouse gases has been increasing since the start of the industrial revolution. Figure 1.1 shows the annual mean concentrations of atmospheric carbon dioxide (CO_2) and methane (CH_4) since 1960.[1]

In 2015, the concentration of carbon dioxide passed the 400 parts per million (ppm) mark, a value that the Earth last saw about two and a half million years ago.[2] Note also that the increase follows an exponential curve, and that the annual percentage increase has been continuously growing. For example, while in the 1960s and 1970s the annual percentage increase was between 0.2% and 0.4%, in the last two decades it has been above 0.5% (Figure 1.2). Further consider that the last two decades have seen a positive trend, with the growth rate increasing by about 0.01 every year, from about 0.47% in 2000 to about 0.65% in 2020.

Methane concentrations have also been increasing from about 1,645 ppb in 1985 (figures from before 1985 are not available) to 1,879 ppb in 2020 (Figure 1.1). Figure 1.2 shows that the annual growth rate had been decreasing between 1985 and 2000, but since then values

[1] Data collected at the Mauna Loa Observatory (Hawaii) of the United States National Oceanic and Atmospheric Administration (NOAA).

[2] See, for example, J. M. Wallace and P. V. Hobbs, *Atmospheric Science: An Introductory Survey*, 2nd ed. (Academic Press, 2006), p. 484; D. L. Hartmann, *Global Physical Climatology*, 2nd ed. (Elsevier, 2015), p. 470; Summary for Policymakers, in V. Masson-Delmotte et al. (eds.), *Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change* (IPCC, 2021).

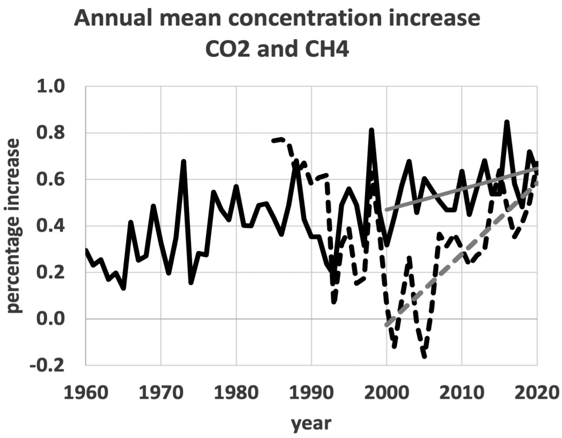

Figure 1.2 Annual percentage increase in the concentration of carbon dioxide (CO_2, solid line) and of methane (CH_4, dashed line), computed from the Mauna Loa Observatory data shown in Figure 1.1. The two lines show the best linear-fit straight lines that fit the data between 2000 and 2020. *Source*: Data provided by NOAA Global Monitoring Laboratory, Boulder, USA (https://gml.noaa.gov).

have been growing at a very rapid rate. The last two decades have seen a clear trend, with the growth rate increasing by about 0.03% every year, from about 0% in 2000 to 0.60% in 2020. This increase could be linked to the fact that, beginning in 2000, many countries began switching to methane as a means of electricity production. This increase can also be attributed to the melting of the permafrost – a layer of subsurface soil that is typically frozen year-round, especially near the poles – which has released yet more stored methane into the atmosphere.[3]

1.3 Observed Global Warming

As the concentration of greenhouse gases has steadily increased, the atmosphere has been absorbing more long-wave radiation emitted by the Earth, with the result that its lower layers have been warming, causing more long-wave radiation to be redirected back towards the Earth's surface, warming it as well.

Figure 1.3 shows the anomaly of the global annual mean temperature with respect to the pre-industrial value (that is, for each year, the figure shows the difference between the global annual mean temperature of that year and the global annual mean temperature in the period 1850–1900). The solid line shows the annual values, and the linear-fitted straight line with a slope of ~0.02°C/year (degree centigrade per year) shows the long-term warming trend. Note that superimposed upon this linear warming trend of ~0.2°C per decade are natural oscillations of about 0.1–0.2°C. These natural oscillations are due to natural changes in the

[3] M. R. Turetsky, B. W. Abbott, M. C. Jones, et al., Permafrost collapse is accelerating carbon release. *Nature* 2019, 569: 32–24.

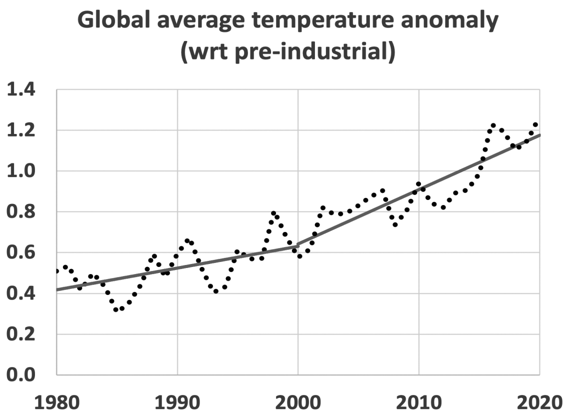

Figure 1.3 Land-surface global warming with respect to the pre-industrial level between 1980 and 2020. The dotted line shows the annual average anomalies of the land two-metre temperature, where the anomaly has been computed with respect to the pre-industrial level. The two straight lines show the best linear fit lines between 1980–2000 and 2000–2020. *Source*: Generated using Copernicus Climate Change Service information (2022) available at https://climate.copernicus.eu.

Earth's ocean, and atmospheric conditions linked, for example, to the occurrence of large-scale episodes in the tropical Pacific that are associated with warmer (during El Niño events) or colder (during La Niña events) ocean temperatures. Exceptionally large volcanic eruptions have also resulted in temperature variations in the following 1–3 years.

This figure has been created using a very recent data set produced by the EU Copernicus Service, the ERA-5 reanalysis, constructed by assimilating all available observations of the Earth system with the European Centre for Medium-Range Weather Forecasts' (ECMWF) state-of-the-art model.[4] It covers the satellite era, that is, the period from 1980 onwards during which satellite data have allowed a more accurate monitoring of the Earth. Because ERA-5 spans an era during which the number and quality of observations have not varied in such a way as to affect estimates of Earth's climate, and as it processes all available observations using a state-of-the-art Earth-system model, it provides a very valuable and high-quality estimate of how the Earth's climate has been evolving in this period.

Figure 1.3 shows that in 2020 the global average temperature was about 1.2°C warmer than the pre-industrial level, up from about 0.5°C in 1980, and that the six years from 2015 to 2020 were the six warmest years since 1980. Figure 1.3 also shows that the warming trend of the last two decades, 2000–2020, has been higher than that between 1980 and2000, increasing from 0.01°C per year (that is, 0.1°C every 10 years), to 0.026°C per year (0.26°C every 10 years). Table 1.1 reports the trends computed for the two periods, 1980–2000 and 2000–2020, expressed in terms of variations over 10 years, for several key climate surface variables.

[4] H. Hersbach, B. Bell, P. Berrisford, et al., The ERA5 global reanalysis. *Quarterly Journal of the Royal Meteorological Society* 2020, 146(730): 1999–2049.

Table 1.1 *Linear trends over 10 years, computed over two periods – 1980–2000 and 2000–2020 – for a few key surface climate variables: global annual average two-metre temperature (2mT; second row), global annual average sea-surface temperature (SST; third row), Arctic minimum sea-level extension (fourth row), and global average sea-level rise (fifth row). Trends have been computed using data from Copernicus for SST and 2mT, and from* Our World in Data *(Arctic extension and sea-level)*

	Linear trend over 10 years	
Variable	1980–2000	2000–2020
Global annual average two-metre temperature	0.10°C	0.26°C
Global average sea-surface temperature	0.14°C	0.18°C
Arctic annual minimum sea-ice extension	−6.21%	−13.1%
Global average sea-level rise	1.76 cm	3.6 cm

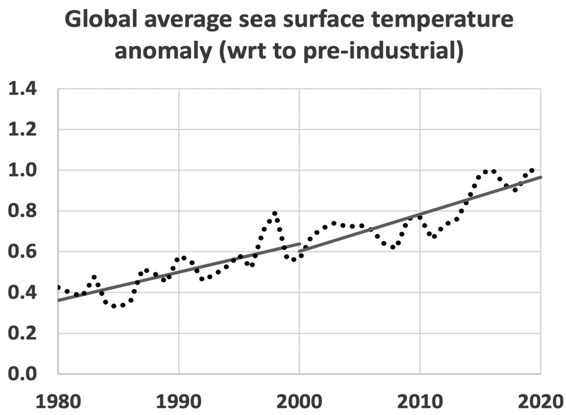

Figure 1.4 Ocean global warming with respect to the pre-industrial level. The dotted line shows the annual average anomalies of the sea-surface temperature, where the anomaly has been computed with respect to the pre-industrial level. The two straight lines show the best linear fit lines between 1980–2000 and 2000–2020. *Source*: Data from *Our World in Data*: https://ourworldindata.org.

It is interesting to compare global warming measured over land with that computed over sea. Figure 1.4 shows the equivalent of Figure 1.3, but for the global ocean. Note that in 2020 the global average sea-surface temperature was about one degree warmer than pre-industrial levels, up from about 0.4°C in 1980, and that the six years from 2015 to 2020 were also the six warmest years for the ocean since 1980. If we compare the warming trend of the two periods, 1980–2000 and 2000–2020, results (Table 1.1) indicate that it also increased, albeit by a smaller amount than on land surfaces, from 0.014°C per year (that is, 0.14°C every 10 years), to 0.018°C per year (0.18°C every 10 years).

Average global warming is not the only evidence that the climate is changing, as was summarized by the report by the Intergovernmental Panel on Climate Change (IPCC) published in August 2021, notably the Summary for Policy Makers (SPM) of the IPCC Working Group I.[5] The water cycle also intensifies, bringing with it in some regions more intense rainfall and flooding, as well as more intense drought in other regions. Concerning rainfall, precipitation has been concentrating in fewer, more intense events, especially at high latitudes. Some areas, such as the Mediterranean region, have seen, on average, a decrease in the average amount, and more frequent and longer dry periods.

Climate change-induced sea-level rise has been accelerating particularly in the past decade, with sea levels rising by an average of 3.4 mm per year, so much so that extreme sea-level events that previously occurred once in 100 years could conceivably happen every year by the end of the twenty-first century. Permafrost thawing, the loss of seasonal snow cover, the melting of glaciers and ice sheets, and a more substantial melting of Arctic sea ice (which is projected to be ice-free in summer before the end of the century) have also appeared more frequently. Climate change has also induced ocean warming, ocean acidification, and reduced oxygen levels, which have been affecting the ocean ecosystems.

For cities, some aspects of climate change have been amplified, including heat waves (as urban areas are usually warmer than their surroundings), flooding from heavy precipitation events, and sea-level rise in coastal areas.

Figure 1.5 shows how the Arctic sea-ice minimum extension has decreased from 1980 to 2020. It bears noting that in 2020, the minimum extension was about 50% smaller than the

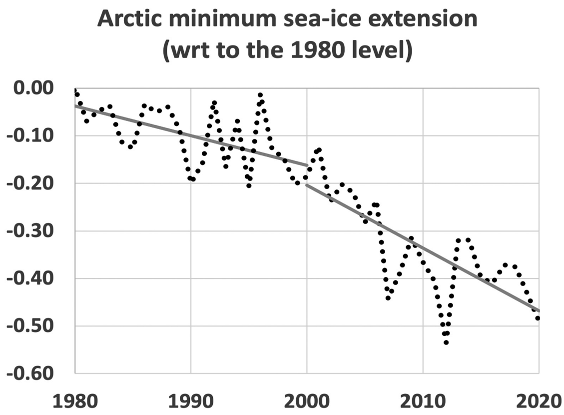

Figure 1.5 Arctic minimum sea-ice extension, compared to the 1980 level (in 1980, the minimum extension was about 7.7 million km^2; a value of –0.1 indicates that the minimum extension has decreased by 10%, to about 6.8 million km^2). The dotted line shows the annual average decrease of the minimum extension, computed with respect to the 1980 value. The two straight lines show the best linear fit lines between 1980–2000 and 2000–2020. *Source*: Data from *Our World in Data*: https://ourworldindata.org.

[5] Summary for Policymakers, in Masson-Delmotte et al., *Climate Change 2021: The Physical Science Basis.*