CHAPTER 1: Introduction

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The road to a pivotal new climate treaty was laid out in Durban at the 17th Conference of the Parties to the United Nations Framework Convention on Climate Change (UNFCCC) in 2011, where countries agreed to work towards a "new protocol, ... another legal instrument, or an agreed outcome with legal force". Now countries are moving along this road with the aim of adopting a new climate agreement in Paris at the 21st Conference of the Parties to UNFCCC, scheduled for December 2015.

Although the time to the Paris Conference is short, the list of issues to be decided is long. Most are political, but some have an important scientific aspect. Among these are: "will current pledges and commitments in 2020 be enough to stay within temperature targets?" and "what long-term emissions are consistent with a 2 °C temperature limit?" Since 2010 the United Nations Environment Programme (UNEP) has produced an annual *Emissions Gap Report* to address these and other science-related issues of critical importance to the climate change negotiations. These reports have shown that an emissions gap is expected in 2020 between the level of global emissions consistent with the 2 °C limit and the level of ambition of countries. Nonetheless, they have also shown that the gap can be bridged through a wide range of policies and measures that will not only reduce emissions but also advance the sustainable development agenda.

Since the publication of the first report in 2010, many parties to the UNFCCC and other stakeholders have asked for annual updates. This year the report not only updates the estimate of the emissions gap, but also has a new focus in response to the changing context of the climate negotiations, as governments look beyond 2020. Moreover, previous reports have concentrated on findings from least-cost scenarios that begin in 2010 or earlier. Using these, however, has become problematic because they do not take account of recent emission levels, which have been consistently higher than the scenarios. In preparing this report scientists have also been able to benefit from the work of the Intergovernmental Panel on Climate Change (IPCC), which has just published its *Fifth Assessment Report* (AR5; IPCC, 2014).

The focus of this year's report is on the implications of the global emissions budget for staying within the 2 °C limit, a concept explored in the IPCC's AR5 (IPCC, 2014). As noted by the IPCC, scientists have found that an increase in global temperature is proportional to the accumulation of carbon dioxide and other greenhouse gases that persist in the atmosphere. Building on this insight the IPCC has assessed the maximum amount of carbon dioxide that could be emitted to the atmosphere over time while keeping global warming below 2 °C. This is termed the "carbon dioxide emissions budget" because if the world manages to stay within it, it should be possible to stay within the 2 °C global warming limit.

Considering a theoretical situation in which carbon dioxide is the only anthropogenic greenhouse gas, the IPCC (IPCC, 2013) estimated a maximum total carbon budget of 3 670 gigatonnes (Gt) of carbon dioxide for a "likely chance" of staying within the 2 °C limit[1]. However, since emissions began growing rapidly in the late 19th century, we have already emitted about 1 900 Gt carbon dioxide (IPCC, 2013). In addition, a variety of other substances that have an impact on global

[1] A "*likely*" chance denotes a greater than 66% chance, as specified by the IPCC.

warming are also emitted and further reduce the remaining budget to about 2 900 Gt CO_2, leaving less than about 1 000 Gt carbon dioxide to emit in the future[2]. The key questions are: how can these emissions be best spread out over time; by which year should we target to be budget-neutral, that is, sequester as much as we emit; and, what is the maximum we can emit at different points in the future to stay on track?

To tackle these questions, this year's report takes an emissions budget approach and analyses the scenarios published in the latest IPCC reports. Estimates are presented for future years in which carbon neutrality and net zero total emissions need to be reached to stay within the 2 °C temperature limit[3]. Here global carbon neutrality means that, globally, anthropogenic carbon dioxide emissions are net zero. Net zero implies that some remaining carbon dioxide emissions could be compensated by the same amount of carbon dioxide uptake (negative emissions), as long as the net input of carbon dioxide to the atmosphere due to human activities is zero.

The report is organised into four chapters, including this introduction. Chapter 2 presents an update of current global emissions and business-as-usual projections, introduces the budget approach and presents emission levels consistent with temperature limits, as well as estimates of the timing of carbon neutrality and net zero emissions. Chapter 3 presents global emission projections under various cases of implementation of pledges and commitments. An update of the 2020 emissions gap is given, as well as a first estimate of the 2030 gap.

While reporting on targets and gaps is useful, it is also important to provide guidance on how they can be reached or bridged. With this in mind, previous 'emissions gap' reports have given great attention to policies and measures that have the dual effect of reducing emissions of greenhouse gases and promoting sustainable development. Chapter 4 in this year's report continues in this tradition and reviews a cross-cutting approach to mitigation that has clear, positive impacts on development. Chapter 4 shows that energy efficiency improvements not only reduce greenhouse gas emissions and energy consumption, but also deliver multiple benefits, such as increased economic growth and job creation; improved health, by reducing air pollution; higher disposable income, by saving on energy costs; and other payoffs. Improving energy efficiency in combination with the many other mitigation approaches reviewed in previous reports can move the sustainable development agenda forward while reducing emissions and protecting the climate system.

As in previous editions, this year's report has been put together by an international team of top scientists. This year 38 scientists from 22 scientific groups in 14 countries have contributed to the report.

[2] Working Group III of IPCC AR5 indicated that scenarios that have a likely chance of staying within the 2 °C limit have remaining carbon dioxide budgets between the years 2011 and 2100 of about 630 –1180 Gt CO_2. The IPCC AR5 Synthesis Report highlights that limiting total human-induced warming to less than 2 °C relative to the period 1861–1880 with a probability greater than 66% would require cumulative CO_2 emissions from all anthropogenic sources since 1870 to remain below about 2 900 Gt CO_2.

[3] The results in this report are fully consistent with those from the IPCC's AR5. However, the two reports give different types of projections. This report presents estimates of the timing of carbon neutrality and net zero total emissions, as well as emission levels consistent with temperature targets. Meanwhile the IPCC report focuses on estimates of cumulative carbon dioxide emissions for the periods 2011–2050 and 2011–2100. As a result, the estimates from the two reports are consistent, but not identical.