Executive summary

The emissions gap in 2020 is the difference between emission levels in 2020 consistent with meeting climate targets, and levels expected in that year if country pledges and commitments are met. As it becomes less and less likely that the emissions gap will be closed by 2020, the world will have to rely on more difficult, costlier and riskier means after 2020 of keeping the global average temperature increase below 2° C. If the emissions gap is not closed, or significantly narrowed, by 2020, the door to many options limiting the temperature increase to 1.5° C at the end of this century will be closed.

Article 2 of the United Nations Framework Convention on Climate Change ('Climate Convention') declares that its "*ultimate objective*" is to "*[stabilize] greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*". The parties to the Climate Convention have translated this objective into an important, concrete target for limiting the increase in global average temperature to 2° C, compared to its pre-industrial levels. With the aim of meeting this target, many of the parties have made emission reduction pledges, while others have committed to reductions under the recent extension of the Kyoto Protocol.

Since 2010, the United Nations Environment Programme has facilitated an annual independent analysis of those pledges and commitments, to assess whether they are consistent with a least-cost approach to keep global average warming below 2° C [1]. This report confirms and strengthens the conclusions of the three previous analyses that current pledges and commitments fall short of that goal. It further says that, as emissions of greenhouse gases continue to rise rather than decline, it becomes less and less likely that emissions will be low enough by 2020 to be on a least-cost pathway towards meeting the 2° C target[2].

As a result, after 2020, the world will have to rely on more difficult, costlier and riskier means of meeting the target – the further from the least-cost level in 2020, the higher these costs and the greater the risks will be. If the gap is not closed or significantly narrowed by 2020, the door to many options to limit temperature increase to 1.5° C at the end of this century will be closed, further increasing the need to rely on accelerated energy-efficiency increases and biomass with carbon capture and storage for reaching the target.

1. What are current global emissions?

Current global greenhouse gas emission levels are considerably higher than the levels in 2020 that are in line with meeting the 1.5° C or 2° C targets, and are still increasing. In 2010, in absolute levels, developing countries accounted for about 60 percent of global greenhouse gas emissions.

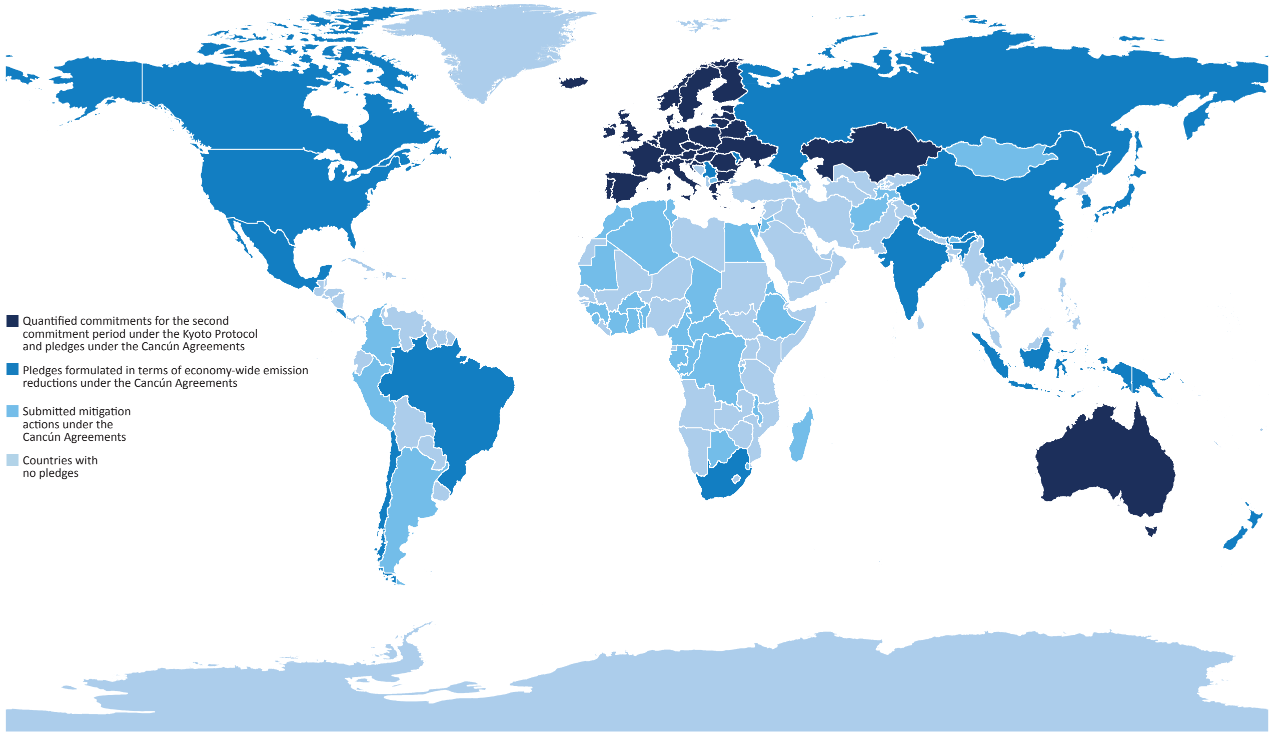
The most recent estimates of global greenhouse gas emissions are for 2010 and amount to 50.1 gigatonnes of carbon dioxide equivalent ($GtCO_2e$) per year (range: 45.6–54.6 $GtCO_2e$ per year). This is already 14 percent higher than the median estimate of the emission level in 2020 with a likely chance of achieving the least cost pathway towards meeting the 2° C target (44 $GtCO_2e$ per year)[3]. With regards to emissions in 2010, the modelling groups report a median value of 48.8 $GtCO_2e$, which is within the uncertainty range cited above. For consistency with emission scenarios, the figure of 48.8 $GtCO_2e$ per year is used in the calculation of the pledge case scenarios.

Relative contributions to global emissions from developing and developed countries changed little from 1990 to 1999. However, the balance changed significantly between 2000 and 2010 – the developed country share decreased from 51.8 percent to 40.9 percent, whereas developing country emissions increased from 48.2 percent to 59.1 percent. Today developing and developed countries are responsible for roughly equal shares of cumulative greenhouse gas emissions for the period 1850-2010.

[1] For this report, a least-cost approach means that emissions are reduced by the cheapest means available.

[2] For this report, a least-cost pathway or a least-cost emissions pathway or least-cost emission scenarios mean the same thing – the temporal pathway of global emissions that meets a climate target and that also takes advantage of the lowest-cost options available for reducing emissions.

[3] See footnote 2.



Note:
Following the 2012 conference of the parties to the Climate Convention in Doha, a group of countries has adopted reduction commitments for the second commitment period under the Kyoto Protocol
Source: United Nations Framework Convention on Climate Change

2. What emission levels are anticipated for 2020?

Global greenhouse gas emissions in 2020 are estimated at 59 $GtCO_2e$ per year under a business-as-usual scenario. If implemented fully, pledges and commitments would reduce this by 3–7 $GtCO_2e$ per year. It is only possible to confirm that a few parties are on track to meet their pledges and commitments by 2020.

Global greenhouse gas emissions in 2020 are estimated at 59 $GtCO_2e$ per year (range: 56–60 $GtCO_2e$ per year) under a business-as-usual scenario – that is, a scenario that only considers existing mitigation efforts. This is about 1 $GtCO_2e$ higher than the estimate in the 2012 emissions gap report.

There have been no significant changes in the pledges and commitments made by parties to the Climate Convention since the 2012 assessment. However, both rules of accounting for land-use change and forestry, and rules for the use of surplus allowances from the Kyoto Protocol's first commitment period have been tightened.

Implementing the pledges would reduce emissions by 3–7 $GtCO_2e$, compared to business-as-usual emission levels.

A review of available evidence from 13 of the parties to the Climate Convention that have made pledges or commitments indicates that five – Australia, China, the European Union, India and the Russian Federation – appear to be on track to meet their pledges. Four parties – Canada, Japan, Mexico and the U.S. – may require further action and/or purchased offsets to meet their pledges, according to government and independent estimates of projected national emissions in 2020. A fifth party – the Republic of Korea – may also require further action but this could not be verified based on government estimates. However, new actions now being taken by all five of these parties many enable them to meet their pledges, although the impact of these actions have not been analyzed here. Not enough information is available concerning Brazil, Indonesia and South Africa. It is worth noting that being on track to implement pledges does not equate to being on track to meet the 1.5° C or 2° C temperature targets.

3. What is the latest estimate of the emissions gap in 2020?

Even if pledges are fully implemented, the emissions gap in 2020 will be 8–12 $GtCO_2e$ per year, assuming least-cost emission pathways. Limited available information indicates that the emissions gap in 2020 to meet a 1.5° C target in 2020 is a further 2–5 $GtCO_2e$ per year wider.

Least-cost emission pathways consistent with a likely chance of keeping global mean temperature increases below 2° C compared to pre-industrial levels have a median level of 44 $GtCO_2e$ in 2020 (range: 38–47 $GtCO_2e$)[4]. Assuming full implementation of the pledges, the emissions gap thus amounts to between 8–12 $GtCO_2e$ per year in 2020 (Table 1).

Governments have agreed to more stringent international accounting rules for land-use change and surplus allowances for the parties to the Kyoto Protocol. However, it is highly uncertain whether the conditions currently attached to the high end of country pledges will be met. Therefore, it is more probable than not that the gap in 2020 will be at the high end of the 8–12 $GtCO_2e$ range.

Limiting increases in global average temperature further to 1.5° C compared to pre-industrial levels requires emissions in 2020 to be even lower, if a least-cost path towards achieving this objective is followed. Based on a limited number of new studies, least-cost emission pathways consistent with the 1.5° C target have emission levels in 2020 of 37–44 $GtCO_2e$ per year, declining rapidly thereafter.

[4] See footnote 2.

4. What emission levels in 2025, 2030 and 2050 are consistent with the 2° C target?

Least-cost emission pathways consistent with a likely chance of meeting a 2° C target have global emissions in 2050 that are 41 and 55 percent, respectively, below emission levels in 1990 and 2010.

Given the decision at the 17th Conference of the Parties to the Climate Convention in 2011 to complete negotiations on a new binding agreement by 2015 for the period after 2020, it has become increasingly important to estimate global emission levels in 2025 and thereafter that are likely to meet the 2° C target. In the scenarios assessed in this report, global emission levels in 2025 and 2030 consistent with the 2° C target amount to approximately 40 $GtCO_2e$ (range: 35–45 $GtCO_2e$) and 35 $GtCO_2e$ (range: 32–42 $GtCO_2e$), respectively. In these scenarios, global emissions in 2050 amount to 22 $GtCO_2e$ (range: 18–25 $GtCO_2e$). These levels are all based on the assumption that the 2020 least-cost level of 44 $GtCO_2e$ per year will be achieved.

5. What are the implications of least-cost emission pathways that meet the 1.5° C and 2° C targets in 2020?

The longer that decisive mitigation efforts are postponed, the higher the dependence on negative emissions in the second half of the 21st century to keep the global average temperature increase below 2° C. The technologies required for achieving negative emissions may have significant negative environmental impacts.

Scenarios consistent with the 1.5° C and 2° C targets share several characteristics: higher-than-current emission reduction rates throughout the century; improvements in energy efficiency and the introduction of zero- and low-carbon technologies at faster rates than have been experienced historically over extended periods; greenhouse gas emissions peaking around 2020; net negative carbon dioxide emissions from the energy and industrial sectors in the second half of the century[5] and an accelerated shift toward electrification[6].

The technologies required for achieving negative emissions in the energy and industrial sectors have not yet been deployed on a large scale and their use may have significant impacts, notably on biodiversity and water supply. Because of this, some scenarios explore the emission reductions required to meet temperature targets without relying on negative emissions. These scenarios require maximum emissions in 2020 of 40 $GtCO_2e$ (range: 36–44 $GtCO_2e$), as compared to a median of 44 $GtCO_2e$ for the complete set of least-cost scenarios.

6. What are the implications of later action scenarios that still meet the 1.5° C and 2° C targets?

Based on a much larger number of studies than in 2012, this update concludes that so-called later-action scenarios have several implications compared to least-cost scenarios, including: (i) much higher rates of global emission reductions in the medium term; (ii) greater lock-in of carbon-intensive infrastructure; (iii) greater dependence on certain technologies in the medium-term; (iv) greater costs of mitigation in the medium- and long-term, and greater risks of economic disruption; and (v) greater risks of failing to meet the 2° C target. For these reasons later-action scenarios may not be feasible in practice and, as a result, temperature targets could be missed.

The estimates of the emissions gap in this and previous reports are based on least-cost scenarios, which characterize trends in global emissions up to 2100 under the assumption that climate targets will be met by the cheapest combination of policies, measures and technologies. But several new studies using a different type of scenario are now available – later-action scenarios, which assume that a least-cost trajectory is not followed immediately, but rather forwards from a specific future date. Like least-cost scenarios, later-action scenarios chart pathways that are consistent with the 2° C target. Contrary to least-cost scenarios, later-action scenarios assume higher global emissions in the near term, which are compensated by deeper reductions later, typically, after 2020 or 2030.

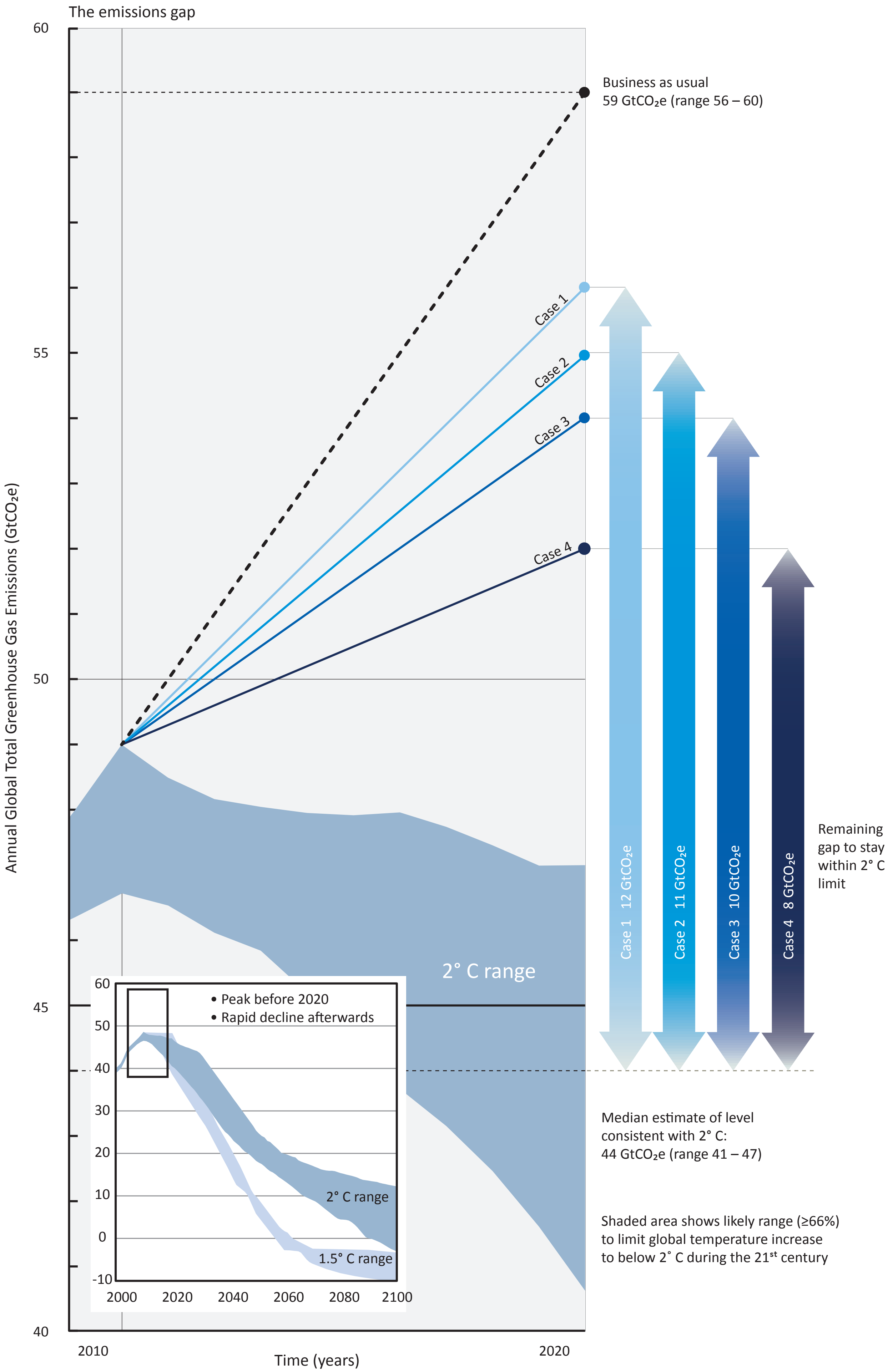
For least-cost scenarios, emission reduction rates for 2030–2050 consistent with a 2° C target are 2–4.5 percent per year. Historically, such reductions have been achieved in a small number of individual countries, but not globally. For later-action scenarios, the corresponding emission reduction rates would have to be substantially higher, for example, 6–8.5 percent if emission reductions remain modest until 2030. These emission reduction rates are without historic precedent over extended periods of time. Furthermore, and because of the delay between policy implementation and actual emission reductions, achieving such high rates of change would require mitigation policies to be adopted several years before the reductions begin.

Apart from assuming higher global emissions in the near term, later-action scenarios also have fewer options for reducing emissions when concerted action finally begins after 2020 or 2030. This is because of carbon lock-in – the continued construction of high-emission fossil-fuel infrastructure unconstrained by climate policies. Because technological infrastructure can have life-times of up to several decades, later-action scenarios effectively lock-in in these high-emission alternatives for a long period of time.

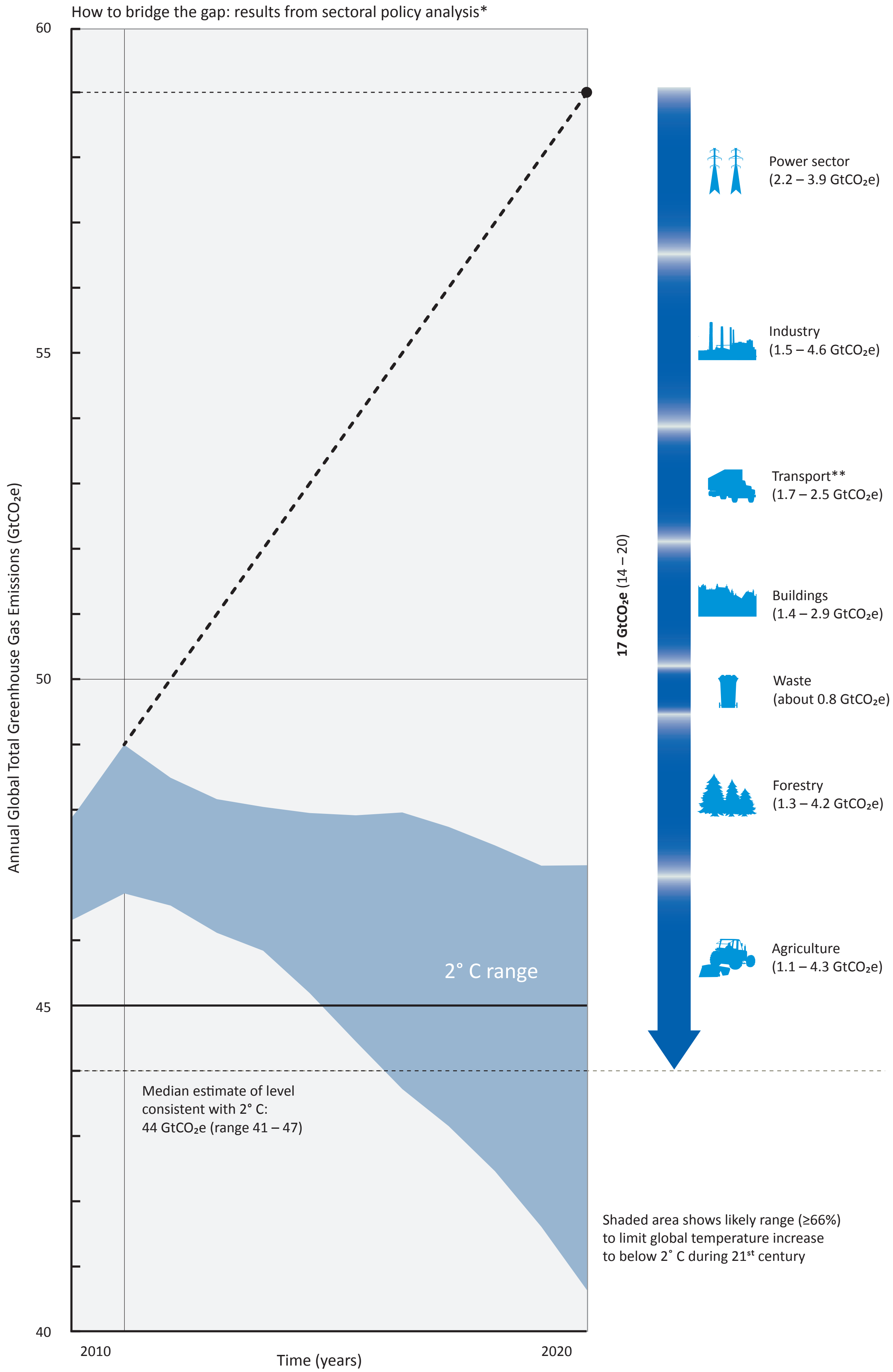
By definition, later-action scenarios are more expensive than least-cost scenarios. The actual cost penalty of later action depends on the future availability of technologies when comprehensive mitigation actions finally begin, as well as on the magnitude of emission reductions up to that point. Finally, although later-action scenarios might reach the same temperature targets as their least-cost counterparts, later-action scenarios pose greater risks of climate impacts for four reasons. First, delaying action allows more greenhouse gases to build-up in the atmosphere in the near term, thereby increasing the risk that later emission reductions will be unable to compensate for this build up. Second, the risk of overshooting climate targets for both atmospheric concentrations of greenhouse gases and global temperature increase is higher with later-action scenarios.

[5] For most scenarios.

[6] Net negative carbon dioxide emissions from the energy and industrial sectors refers to the potential to actively remove more carbon dioxide from the atmosphere than is emitted within a given period of time. Negative emissions can be achieved through, among other means, bioenergy in combination with carbon capture and storage.



The emissions gap
Annual Global Total Greenhouse Gas Emissions ($GtCO_2e$)
60
55
50
45
40
2010
2020
Time (years)
Business as usual
59 $GtCO_2e$ (range 56 – 60)
Case 1
Case 2
Case 3
Case 4
Case 1 12 $GtCO_2e$
Case 2 11 $GtCO_2e$
Case 3 10 $GtCO_2e$
Case 4 8 $GtCO_2e$
Remaining gap to stay within 2° C limit
2° C range
Median estimate of level consistent with 2° C: 44 $GtCO_2e$ (range 41 – 47)
Shaded area shows likely range (≥66%) to limit global temperature increase to below 2° C during the 21st century
• Peak before 2020
• Rapid decline afterwards
2° C range
1.5° C range
60
50
40
30
20
10
0
-10
2000
2020
2040
2060
2080
2100



*based on results from Bridging the Emissions Gap Report 2011
**including shipping and aviation

Third, the near-term rate of temperature increase is higher, which implies greater near-term climate impacts. Lastly, when action is delayed, options to achieve stringent levels of climate protection are increasingly lost.

7. Can the gap be bridged by 2020?

The technical potential for reducing emissions to levels in 2020 is still estimated at about 17 ± 3 $GtCO_2e$. This is enough to close the gap between business-as-usual emission levels and levels that meet the 2° C target, but time is running out.

Sector-level studies of emission reductions reveal that, at marginal costs below US $50–100 per tonne of carbon dioxide equivalent, emissions in 2020 could be reduced by 17 ± 3 $GtCO_2e$, compared to business-as-usual levels in that same year. While this potential would, in principle, be enough to reach the least-cost target of 44 $GtCO_2e$ in 2020, there is little time left.

There are many opportunities to narrow the emissions gap in 2020 as noted in following paragraphs, ranging from applying more stringent accounting practices for emission reduction pledges, to increasing the scope of pledges. To bridge the emissions gap by 2020, all options should be brought into play.

8. What are the options to bridge the emissions gap?

The application of strict accounting rules for national mitigation action could narrow the gap by 1–2 $GtCO_2e$. In addition, moving from unconditional to conditional pledges could narrow the gap by 2–3 $GtCO_2e$, and increasing the scope of current pledges could further narrow the gap by 1.8 $GtCO_2e$. These three steps can bring us halfway to bridging the gap. The remaining gap can be bridged through further national and international action, including international cooperative initiatives. Much of this action will help fulfil national interests outside of climate policy.

Minimizing the use of lenient land-use credits and of surplus emission reductions, and avoiding double counting of offsets could narrow the gap by about 1–2 $GtCO_2e$. Implementing the more ambitious conditional pledges (rather than the unconditional pledges) could narrow the gap by 2–3 $GtCO_2e$. A range of actions aimed at increasing the scope of current pledges could narrow the gap by an additional 1.8 $GtCO_2e$. (These include covering all emissions in national pledges, having all countries pledge emission reductions, and reducing emissions from international transport). Adding together the more stringent accounting practices, the more ambitious pledges, and the increased scope of current pledges, reduces the gap around 6 $GtCO_2e$ or by about a half.

The remaining gap can be bridged through further national and international action, including international cooperative initiatives (see next point). Also important is the fact that many actions to reduce emissions can help meet other national and local development objectives such as reducing air pollution or traffic congestion, or saving household energy costs.

9. How can international cooperative initiatives contribute to narrowing the gap?

There is an increasing number of international cooperative initiatives, through which groups of countries and/or other entities cooperate to promote technologies and policies that have climate benefits, even though climate change mitigation may not be the primary goal of the initiative. These efforts have the potential to help bridge the gap by several $GtCO_2e$ in 2020.

International cooperative initiatives take the form of either global dialogues (to exchange information and understand national priorities), formal multi-lateral processes (addressing issues that are relevant to the reduction of GHG emissions), or implementation initiatives (often structured around technical dialogue fora or sector-specific implementation projects). Some make a direct contribution to climate change mitigation, by effectively helping countries reduce emissions, while others contribute to this goal indirectly, for example through consensus building efforts or the sharing of good practices among members.

The most important areas for international cooperative initiatives appear to be:

- Energy efficiency (up to 2 $GtCO_2e$ by 2020): covered by a substantial number of initiatives.
- Fossil fuel subsidy reform (0.4–2 $GtCO_2e$ by 2020): the number of initiatives and clear commitments in this area is limited.
- Methane and other short-lived climate pollutants (0.6–1.1 $GtCO_2e$ by 2020); this area is covered by one overarching and several specific initiatives. (Reductions here may occur as a side effect of other climate mitigation.)
- Renewable energy (1–3 $GtCO_2e$ by 2020): several initiatives have been started in this area.

Based on limited evidence, the following provisions could arguably enhance the effectiveness of International Cooperative Initiatives: (i) a clearly defined vision and mandate with clearly articulated goals; (ii) the right mix of participants appropriate for that mandate, going beyond traditional climate negotiators; (iii) stronger participation from developing country actors; (iv) sufficient funding and an institutional structure that supports implementation and follow-up, but maintains flexibility; and (v) and incentives for participants.

10. How can national agricultural policies promote development while substantially reducing emissions?

Agriculture now contributes about 11 percent to global greenhouse gas emissions. The estimated emission reduction potential for the sector ranges from 1.1 $GtCO_2e$ to 4.3 $GtCO_2e$ in 2020. Emission reductions achieved by these initiatives may partly overlap with national pledges, but in some cases may also be additional to these.

Not many countries have specified action in the agriculture sector as part of implementing their pledges. Yet, estimates of emission reduction potentials for the sector are high, ranging from 1.1 $GtCO_2e$ to 4.3 $GtCO_2e$ – a wide range, reflecting uncertainties in the estimate. In this year's update we describe policies that have proved to be effective

Table 1 Emissions reductions with respect to business-as-usual and emissions gap in 2020, by pledge case

Case	Pledge type	Rule type	Median emission levels and range ($GtCO_2e$ per year)	Reductions with respect to business-as-usual in 2020 ($GtCO_2e$ per year)	Emissions gap in 2020 ($GtCO_2e$ per year)
Case 1	Unconditional	Lenient	56 (54–56)	3	12
Case 2	Unconditional	Strict	55 (53–55)	4	11
Case 3	Conditional	Lenient	54 (52–54)	5	10
Case 4	Conditional	Strict	52 (50–52)	7	8

Note: In this report, an unconditional pledge is one made without conditions attached. A conditional pledge might depend on the ability of a national legislature to enact necessary laws, or may depend on action from other countries, or on the provision of finance or technical support. Strict rules means that allowances from land use, land-use change and forestry accounting and surplus emission credits will not be counted as part of a country's meeting their emissions reduction pledges. Under lenient rules, these elements can be counted.

in reducing emissions and increasing carbon uptake in the agricultural sector.

In addition to contributing to climate change mitigation, these measures enhance the sector's environmental sustainability and, depending on the measure and situation, may provide other benefits such as higher yields, lower fertilizer costs or extra profits from wood supply. Three examples are:

- Usage of no-tillage practices: no-tillage refers to the elimination of ploughing by direct seeding under the mulch layer of the previous season's crop. This reduces greenhouse gas emissions from soil disturbance and from fossil-fuel use of farm machinery.
- Improved nutrient and water management in rice production: this includes innovative cropping practices such as alternate wetting and drying and urea deep placement that reduce methane and nitrous oxide emissions.
- Agroforestry: this consists of different management practices that all deliberately include woody perennials on farms and the landscape, and which increase the uptake and storage of carbon dioxide from the atmosphere in biomass and soils.