Executive Summary

One of the fundamental questions in the global climate negotiations is: what level of "ambition", in terms of collective emission reductions, is needed to protect global climate? To help answer this question UNEP and the scientific community have published a series of reports on the "emissions gap[1]" since 2010. Of particular interest to the ambition question is the gap in 2020 between emission levels consistent with the 2°C climate target and emissions levels projected if country reduction pledges are fulfilled. If there is a gap, then there is doubt that the ambition of countries is great enough to meet the agreed-upon 2°C climate target

In the 2010 *Emissions Gap Report,* scientists indicated that there would likely be a substantial emissions gap in 2020, although estimates of this gap ranged widely, depending on assumptions about how country pledges would be complied with. In the 2011 *Bridging the Emissions Gap Report*, scientists noted that enough technical potential existed to close the gap in 2020, but fast action by countries was needed.

UNEP has now convened a group of 55 scientists and experts from 43 scientific groups across 22 countries to produce this third emissions gap report which covers the following:

- An update of global greenhouse gas emission estimates, based on a number of different authoritative scientific sources;
- An overview of national emission levels, both current (2010) and projected (2020) consistent with current pledges and other commitments;
- An estimate of the level of global emissions consistent with the two degree target in 2020, 2030 and 2050;
- An update of the assessment of the emissions gap for 2020;
- A review of selected examples of the rapid progress being made in different parts of the world to implement policies already leading to substantial emission reductions. These policies could contribute significantly to narrowing the gap if they are scaled up and replicated in other countries.

1 The "emissions gap" is the difference in 2020 between emission levels consistent with the 2°C limit and projected emission levels.

1. What are current global emissions?

Current global emissions are already considerably higher than the emissions level consistent with the 2°C target in 2020 and are still growing.

Current global greenhouse gas emissions, based on 2010 data from bottom-up emission inventory studies, are estimated at 50.1 $GtCO_2e$ (with a 95% uncertainty range of 45.6 - 54.6). This is already 14% higher than the median estimate (44 $GtCO_2e$) of the emission level in 2020 with a likely chance of meeting the 2°C target. This is also about 20% higher than emissions in 2000. Global emissions are now picking up again after their decline during the economic downturn between 2008 and 2009. Modeling groups use a median value of 49 $GtCO_2e$ for 2010, which is within the uncertainty range. The figure of 49 $GtCO_2e$ is used throughout the rest of the report unless otherwise noted.

2. What is the latest estimate of the Emissions Gap in 2020?

The estimated emissions gap in 2020 for a "likely" chance of being on track to stay below the 2°C target is 8 to 13 $GtCO_2e$ (depending on how emission reduction pledges are implemented), as compared to 6 to 11 $GtCO_2e$ in last years' Bridging the Emissions Gap Report. The gap is larger because of higher than expected economic growth and the inclusion of "double counting"[2] of emission offsets in the calculations.

The assessment clearly shows that country pledges, if fully implemented, will help reduce emissions to below the Business-as-Usual (BaU) level in 2020, but not to a level consistent with the agreed upon 2°C target, and therefore will lead to a considerable "emissions gap".

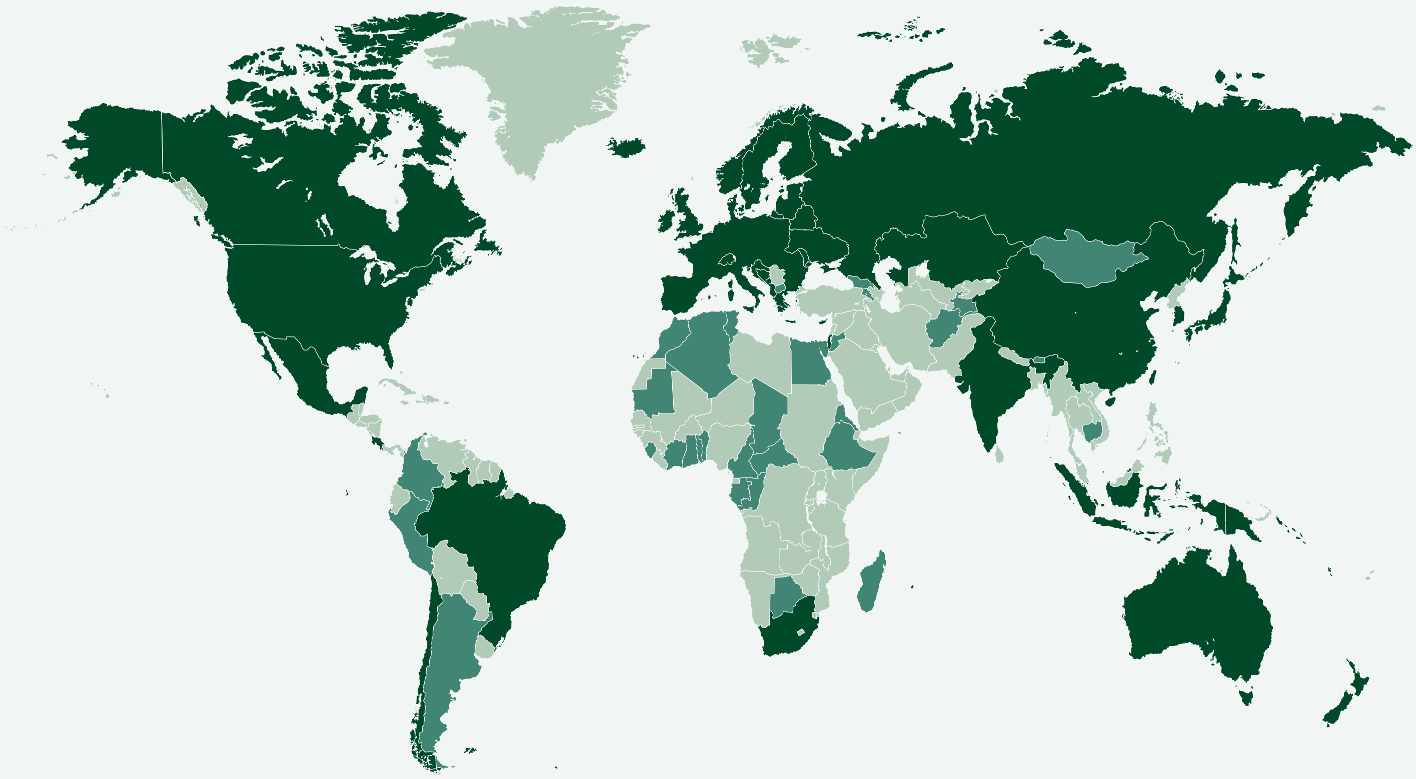
As a reference point, the emissions gap in 2020 between BaU emissions and emissions with a "likely" chance of meeting the 2°C target is 14 $GtCO_2e$.

As in previous reports, four cases are considered which combine assumptions about pledges (unconditional or

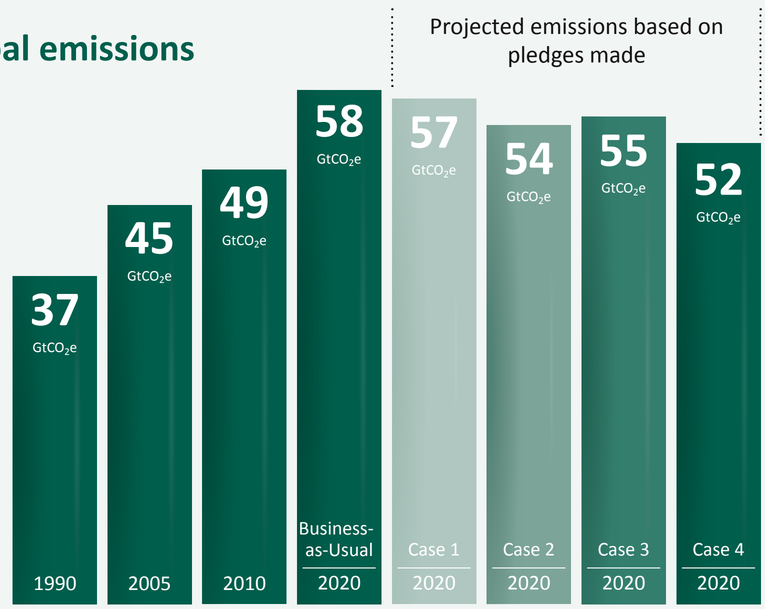
2 In the context of this report, "double counting" refers to a situation in which the same emission reductions are counted towards meeting two countries' pledges.

Global map showing the different categories of pledges

Pledges formulated in terms of GHG emissions · Submitted actions · No pledge



Estimated global emissions



Case 1 – Unconditional pledges, lenient rules

If countries implement their lower-ambition pledges and are subject to "lenient" accounting rules, then the median estimate of annual GHG emissions in 2020 is 57 $GtCO_2e$, within a range of 56 – 57 $GtCO_2e$.

Case 2 – Unconditional pledges, strict rules

This case occurs if countries keep to their lower-ambition pledges, but are subject to "strict" accounting rules. In this case, the median estimate of emissions in 2020 is 54 $GtCO_2e$, within a range of 54 – 55 $GtCO_2e$.

Case 3 – Conditional pledges, lenient rules

Some countries offered to be more ambitious with their pledges, but link that to conditions. If the more ambitious conditional pledges are taken into account, but accounting rules are "lenient", median estimates of emissions in 2020 are 55 $GtCO_2e$ within a range of 54 – 56 $GtCO_2e$.

Case 4 – Conditional pledges, strict rules

If countries adopt higher-ambition pledges and are also subject to "strict" accounting rules, the median estimate of emissions in 2020 is 52 $GtCO_2e$, within a range of 51 – 52 $GtCO_2e$.

Please note: All emission values shown in the text are rounded to the nearest gigatonne.

conditional) and rules for complying with pledges (lenient or strict) (See footnote[3] for an explanation).

- Under Case 1 – "Unconditional pledges, lenient rules", the gap would be about 13 $GtCO_2e$ (range: 9-16 $GtCO_2e$). Projected emissions are about 1 $GtCO_2e$ lower than the business-as-usual level.
- Under Case 2 – "Unconditional pledges, strict rules", the gap would be about 10 $GtCO_2e$ (range: 7-14 $GtCO_2e$). Projected emissions are about 4 $GtCO_2e$ lower than the business-as-usual level.
- Under Case 3 – "Conditional pledges, lenient rules", the gap would be about 11 $GtCO_2e$ (range: 7-15 $GtCO_2e$). Projected emissions are about 3 $GtCO_2e$ lower than the business-as-usual level.
- Under Case 4 – "Conditional pledges, strict rules", the gap would be about 8 $GtCO_2e$ (range: 4-11 $GtCO_2e$). Projected emissions are about 6 $GtCO_2e$ lower than the business-as-usual level.

There is increasing uncertainty that conditions currently attached to the high end of country pledges will be met and in addition there is some doubt that governments may agree to stringent international accounting rules for pledges. It is therefore more probable than not that the gap in 2020 will be at the high end of the 8 to 13 $GtCO_2e$ range.

On the positive side, fully implementing the conditional pledges and applying strict rules brings emissions more than 40% of the way from BaU to the 2°C target.

To stay within the 2°C limit global emissions will have to peak before 2020[4]

Emission scenarios analyzed in this report and consistent with a "likely" chance of meeting the 2°C target have a peak before 2020[5], and have emission levels in 2020 of about 44 $GtCO_2e$ (range: 41-47 $GtCO_2e$). Afterwards, global emissions steeply decline (a median of 2.5% per year, with a range of 2.0 to 3.0% per year)[6]. Forty percent of the assessed scenarios with a "likely" chance to meet the 2°C target have net negative total greenhouse gas emissions before the end of the century 2100. The implications of net negative emissions are discussed in Point 4.

Accepting a "medium" (50-66%) rather than "likely" chance of staying below the 2°C limit relaxes the constraints on emission levels slightly, but global emissions still peak before 2020.

The few studies available indicate that a 1.5°C target can still be met

Emissions in 2020 are lower in scenarios meeting the 1.5°C target compared with the 2°C level. The few scenarios available for this target indicate that scenarios consistent with a "medium" chance of meeting the 1.5°C limit have average emission levels in 2020 of around 43 $GtCO_2e$ (due to the limited number of studies no range was calculated), and are followed by very rapid rates of global emission reduction, amounting to 3% per year (range 2.1 to 3.4%). Some studies also find that some overshoot of the 1.5°C limit over the course of the century is inevitable.

3. What emission levels in 2030 and 2050 are consistent with the 2° and 1.5°C targets?

Scenarios that meet the 2°C limit show a maximum emission level in 2030 of 37 $GtCO_2e$

Given the Durban decision to complete negotiations on a new treaty by 2015 for the period after 2020, it has become increasingly important to know the global emission levels in 2030 that are likely to comply with the climate targets. The emission scenarios assessed in this report and consistent with a "likely" chance of meeting the 2°C target have global emissions in 2030 of approximately 37 $GtCO_2e$ (range: 33 to 44 $GtCO_2e$). This is around the same level of emissions as in 1990. It is important to emphasize that the 2030 range depends on where emissions are in 2020. The higher the emissions in 2020, the lower they must be by 2030.

Scenarios that meet the 2°C limit have global emissions in 2050 roughly 40% below 1990 emission levels and roughly 60% below 2010 emission levels.

Scenarios with a "likely" chance of complying with the 2°C target have global emissions in 2050 of approximately 21 $GtCO_2e$ (range: 18 to 25 $GtCO_2e$), if the 2020 and 2030 levels indicated above are met.

4. What are the implications of scenarios that meet the 2020 emission levels consistent with 1.5°C and 2°C?

As noted above, 40% of the assessed scenarios with a "likely" chance to meet the 2°C target have net negative total greenhouse gas emissions before the end of the century. The *majority* of scenarios have net negative CO_2 emissions at some point in the second half of this century in the global energy and industry sectors.

"Net negative emissions" means that on a global basis more greenhouse gases are taken up from the atmosphere by deliberate actions (e.g. by planting forests or through carbon capture and storage) than what is emitted by anthropogenic sources. Individual technologies or sectors may also generate a "net negative emission" specifically related to their actions.

To achieve such negative emissions is simple in analytical models but in real life implies a need to apply new and often unproven technologies or technology combinations at significant scale.

As an example, many studies that meet the 2°C target assume a significant deployment of bioenergy combined with carbon capture and storage (BioCCS), to achieve net

3 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, the provision of finance, or technical support. "Strict" rules mean that allowances from LULUCF accounting and surplus emission credits will not be counted as part of a country meeting its emissions reduction pledges. Under "lenient" rules, these elements can be counted.

4 This is the case for scenarios using least cost pathways; see Chapter 3 for detailed explanation.

5 Global annual emissions consist of emissions of the "Kyoto basket of gases" coming from energy, industry and land use.

6 Throughout this report average emission reduction rates from 2020 to 2050 are given for carbon dioxide emissions from energy and industry and expressed relative to 2000 emission levels except where explicitly otherwise stated.

negative CO_2 emissions in the industry and energy sectors or even net negative total global emissions. The feasibility and consequences of such large-scale bioenergy systems will need to be closely examined because of their possible impact on food production and biodiversity, the possible lack of sufficient land and water, and questions about the long-term productivity of biomass feedstocks. The application of carbon capture and storage (CCS) is still fraught with controversy and large scale application and safe CO_2 disposal has not yet been fully verified. If net negative CO_2 emissions at a significant scale are proven later to be infeasible, a radical shift to other mitigation options may come too late to stay within the 2°C target.

Policies that greatly accelerate energy efficiency improvements on both the demand- and supply-side can, if widely applied, reduce the need for net negative emissions and allow more time for a transition to a global economy with radically lower greenhouse gas emissions.

Some assessments, notably the IPCC *Special Report on Renewable Energy Sources and Climate Change Mitigation* and the *Global Energy Assessment* (GEA) emphasize the great importance of accelerating demand-side efficiency and conservation measures for future reductions of greenhouse gas emissions. A headline conclusion of the GEA scenario assessment is that a significantly lower level of global energy demand would make it possible to reach the 2°C and other sustainability targets without relying on a combination of nuclear energy and carbon capture and storage. But it must be emphasized that it would be necessary to greatly accelerate the current rate of energy efficiency improvements, and the feasibilty of doing so has been fully investigated.

5. What are the implications of scenarios that meet the 2°C target, but have higher global emissions in 2020?

Based on a very limited number of studies, it is expected that scenarios with higher global emissions in 2020 are likely to have higher medium- and long-term costs, and – more importantly – pose serious risks of not being feasible in practice.

The estimates of the emissions gap in this and previous reports are based on least cost scenarios which depict the trend in global emissions up to 2100 under the assumption that climate targets are met by the cheapest combination of policies, measures and technologies considered in a particular model.[7] There are now a few published studies on later action scenarios that have taken a different approach. These scenarios also seek to limit greenhouse gas emissions to levels consistent with 2°C, but assume less short-term mitigation and thus higher emissions in the near term. Because of the small number of studies along these lines, the question about the costs and risks of these later action scenarios cannot be conclusively quantified right now.

That being said, it is clear that later action will imply lower near-term mitigation costs. But the increased lock-in of carbon-intensive technologies will lead to significantly higher mitigation costs over the medium- and long-term. In addition, later action will lead to more climate change with greater and more costly impacts, and higher emission levels will eventually have to be brought down by society at a price likely to be higher than current mitigation costs per tonne of greenhouse gas.

Moreover, later action will have a higher risk of failure. For example, later action scenarios are likely to require even higher levels of "net negative emissions" to stay within the 2°C target, and less flexibility for policy makers in choosing technological options. Later action could also require much higher rates of energy efficiency improvement after 2020 than have ever been realised so far, not only in industrialized countries but also in developing countries.

6. Can the gap be bridged by 2020 – and how?

From a technical standpoint, the answer to this question is, yes. The technical potential for reducing emissions by 2020 is estimated to be about 17 ± 3 $GtCO_2e$, at marginal costs[8] below US$ 50-100/ t CO_2e reduced. This is enough to close the gap between BaU emissions and emissions that meet the 2°C or 1.5°C target.

Since the 2011 *Bridging the Emissions Gap* presented these numbers, there have been several new studies of the potential to reduce emissions, confirming that the estimate of the mitigation potential for 2020 of 17 ± 3 $GtCO_2e$ is still valid.

The challenge is the current pace of action. Even if the potential remains the same there is basically one year less to achieve this reduction, implying steeper and more costly actions will be required to potentially bridge the emissions gap by 2020.

At the same time current investments in buildings, transportation systems, factories, and other infrastructure are "locking in" high energy use patterns and associated emissions for decades, limiting future options for abating emissions.

The gap can be narrowed by resolving some immediate climate negotiation issues

Possible actions to narrow the gap include:

- Implementing the more ambitious "conditional" pledges. This would reduce the gap by 2 $GtCO_2e$.
- Minimizing the use of lenient Land Use, Land Use Change and Forestry (LULUCF) credits and surplus emission credits. This would reduce the gap by around 3 $GtCO_2e$.
- Minimizing the use of the surplus Assigned Amounts from the 2008-2012 Kyoto period. This would reduce the gap by 1.8 $GtCO_2e$.
- Avoiding the double-counting of offsets and improving the additionality of CDM projects. This would reduce the gap by up to 1.5 $GtCO_2e$.

Note that these numbers are not directly additive.

7 Some models impose further restrictions on the technologies they take into account.

8 Marginal costs are the costs of the last tonne of equivalent CO_2 removed. The average costs of all the reductions together are much lower.

Policy actions at the national and local level are being implemented in a growing number of countries and have shown to be effective in substantially reducing emissions. Replicating these successful policies and scaling them up would provide a way for countries to go beyond their current pledges and help to close the gap.

Most of these policies are now being carried out primarily for reasons other than climate change mitigation. It is clear, therefore, that countries can contribute to narrowing the emissions gap by enhanced action in line with their own national development priorities.

The following selected policies were reviewed in this report because they have been successful in reducing emissions and show promise in being scaled up nationally and internationally. However, they only represent a few of the many promising policies meriting further consideration:

- In the building sector promising policies include:
  - *(i) building codes* and
  - *(ii) appliance standards.*

  The motivation for these policies has been mostly to reduce residential and private sector energy use and costs and to increase safety.
- In the transport sector – A cluster of successful policies are described by the concept "Avoid-Shift-Improve". These include:
  - *(i) transportation-related land use policies,*
  - *(ii) bus rapid transit,* and
  - *(iii) vehicle performance standards for new light-duty vehicles.*

  The main objectives of transportation-related land use policies have been to increase the proximity of urban residents to their destination, and maximize the efficiency of public transportation, with the aim to reduce the need for private vehicles and their impacts. Meanwhile, bus rapid transit systems have been developed to reduce traffic congestion and urban air pollution, and vehicle performance standards to reduce vehicle energy use and thereby reduce passenger costs and enhance energy security.
- In the forestry sector promising policies include:
  - *(i) protected areas and other command-and-control measures;*
  - *(ii) economic instruments*
  - *(iii) policies affecting drivers and contexts.*

  The impetus for these policies includes the preservation of indigenous cultures, protection of biodiversity and endangered species, and protection of watersheds. The reduction of greenhouse gas emissions is also a main motivating factor in some cases.

While these policies differ substantively, they provide real life examples of how ambitious national or local policy instruments driven by priorities such as stimulating innovation and economic growth, bolstering national energy security or improving public health, can lead to large emission reductions. The potential for scaling up and replicating these policies is large and a number of common factors have been found to realize this potential:

- Successful scale-up requires policy instruments to be tailored to local economic, financial, social and institutional contexts. Codes and standards have shown the greatest success where government-led implementation and enforcement is generally accepted, particularly if market barriers make the use of economic instruments difficult. However, institutional capacity for monitoring and enforcement is also crucial for their effectiveness
- National and local interests, broader than climate considerations, are often key drivers for successful policies. Focus should therefore be on adoption of sound climate policies as an integrated part of comprehensive policy packages that focus on multiple benefits and support national development goals.
- Successful national and local policies typically combine market-based instruments with regulatory approaches.
- Continuously increasing the stringency of policies, such as codes, standards, labels and zoning, is central for their sustained effectiveness in reducing emissions and sends important long term signals to markets.

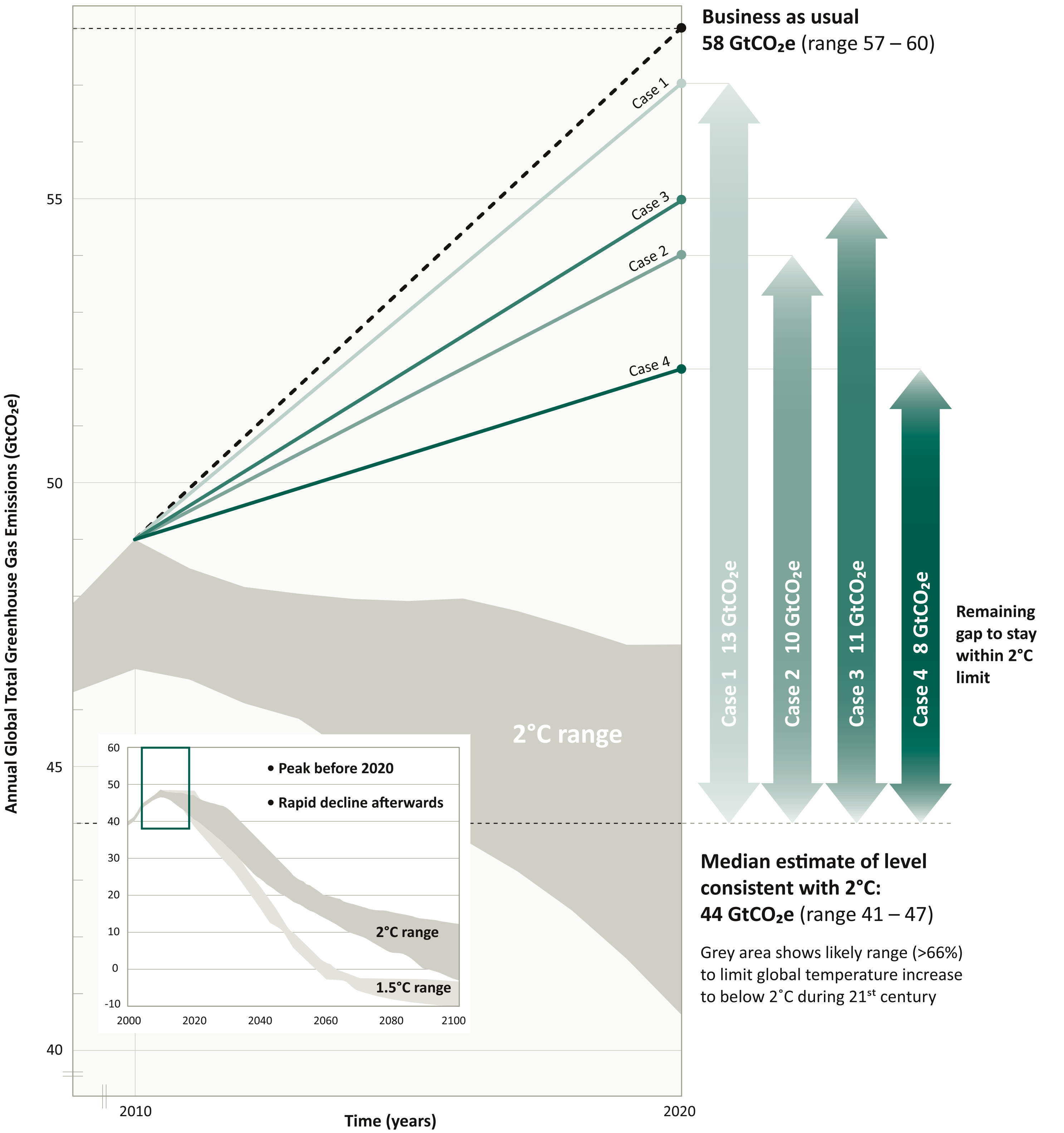
Summing up

This report shows that the estimated emissions gap in 2020 for a "likely" chance of staying below the 2°C target is large, but it is still technically possible to close this gap through concerted and rapid action.

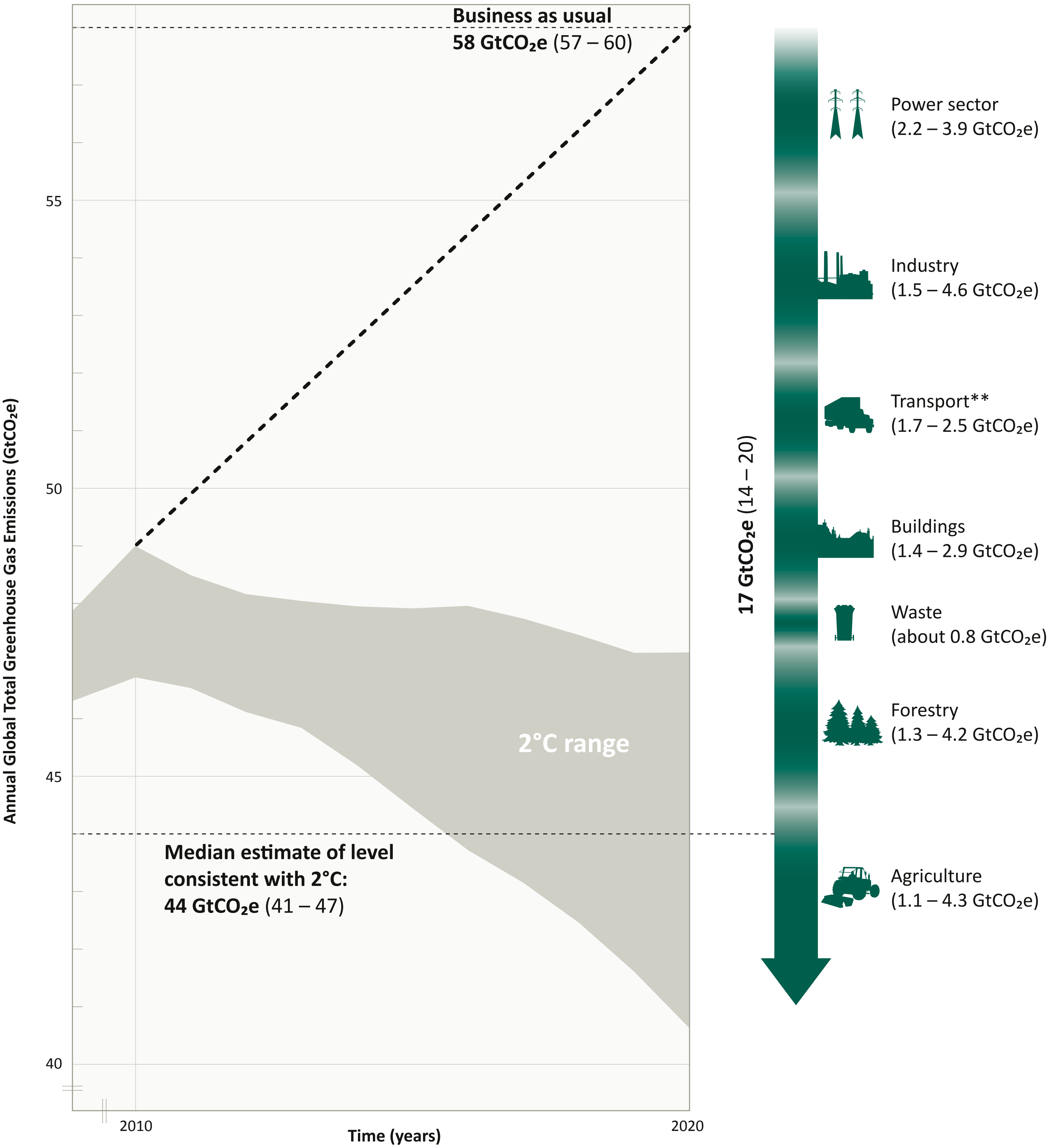
The report highlights concrete, internationally-coordinated ways to do so: by increasing current national reduction pledges to the higher end of their range, by bringing more ambitious pledges to the table, and by adopting strict rules of accounting.

The gap can also be closed by swift and comprehensive action to scale up a wide range of tried-and-true policy actions. These are actions that have worked around the world and in many different sectors, and which are not only beneficial to climate protection, but also satisfy a great variety of other local and national priorities.

The emissions gap



How to bridge the gap: results from sectoral policy analysis*



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