



# Executive summary

## 1. The strengthened long-term objectives of the Paris Agreement require even stronger actions than previously identified, calling for accelerated efforts pre-2020, as well as increasing the ambition of the Nationally Determined Contributions

The Paris Agreement has very specific language about the long-term goals and how to get there, including:

- A long-term goal of keeping the increase in global average temperature to well below 2 degrees Celsius (°C) above pre-industrial levels.
- An aim to limit the temperature increase to 1.5°C, as this would significantly reduce the risks and impacts of climate change.
- The need for global emissions to peak as soon as possible, followed by a rapid decline – recognising that this will take longer for developing countries.

Compared to the 2°C goal that was the reference point of earlier Emissions Gap Reports, these new objectives require stronger short-term action and deeper cuts in the medium and longer term, as the remaining carbon dioxide budget is now considerably lower. Against the background of the large emissions gap that was identified in previous reports, this further amplifies the need for ambitious early action that accelerates and strengthens the Nationally Determined Contributions of countries.

Enhanced pre-2020 and pre-2030 action will reduce the so-called transitional challenges associated with the necessary shift in emissions pathways, and:

- Reduce the lock-in of carbon and energy intensive infrastructure in society and the energy system, encourage the rapid deployment of state of the art technologies, and spur near-term learning and development of technologies that will be essential in the long term.

- Reduce the overall costs and economic challenges during the transitional period, for example, in terms of upscaling energy investments.
- Reduce future dependence on unproven technologies, including negative emissions technologies, and increase the options to achieve stringent emission reductions
- Reduce climate risks, for example, by reducing the pace of the global temperature increase.
- Realise immediate co-benefits through enhanced early action on climate change mitigation, such as improved public health as a result of lower air pollution, improved energy security, and reduced crop yield losses.

Additional early action will be essential to keeping the door open to limit warming to below 1.5°C by 2100.

## 2. Record speed of entry into force of the Paris Agreement signals strong commitment to action

The adoption of the Paris Agreement on climate change by 195 countries and the global agreement on the Sustainable Development Goals, made 2015 a landmark year. The Paris Agreement is the first climate deal with universal contributions to mitigation action. With ratification having surpassed the agreed minimum of 55 countries, representing at least 55 per cent of global emissions, the Agreement will enter into force before the Conference of Parties to the United Nations Framework Convention on Climate Change in Marrakesh (COP 22). This sends a strong signal that countries are committed to action

The need for urgent action has been reinforced by the fact that 2015 was the hottest year since modern record keeping began. Although high temperatures were exacerbated by the effect of El Niño, it is notable that ten of the warmest years on record have occurred since 2000, and the trend continues, with the first six months of 2016 all being the warmest ever recorded.

### 3. Focus of the 2016 Emissions Gap Report

The United Nations Environment (UNEP) Emissions Gap Report 2016 provides an authoritative assessment of the extent to which the current and planned national emissions reductions as specified in the submitted Intended Nationally Determined Contributions will contribute towards the Paris Agreement goals. It does so by providing an estimate of the additional reductions – the gap – required by 2030 to be on a least-cost path that is likely to ensure the global temperature goals.

The assessment focuses on the 2°C goal, as well as on the implications for limiting the temperature increase to 1.5°C.

The key new features and results of the 2016 Report are:

- The assessment is based on Intended Nationally Determined Contributions submitted by almost all countries in the world, and a large number of studies supporting robustness of the estimates.
- The key quantitative results stay within the ranges presented in the 2015 assessment.
- The results underpin the urgency of immediate and strong action, and the need to build on the momentum of the entry into force of the Paris Agreement. Since the results are not likely to change in the next two years, enhanced action need not wait for the facilitative dialogue in 2018.
- The report identifies where solutions are available to deliver low-cost emission reductions at scale, including three major areas of action: contribution by non-state actors, energy efficiency acceleration and synergies with achievement of the sustainable development goals.

The report has been prepared by an international team of leading scientists who assessed all available information, including those reviewed by the Intergovernmental Panel on Climate Change in its fifth assessment report, as well as more recent scientific literature. The assessment production process has been transparent and participatory, and governments of the countries with specific mention in the report have been invited to comment on the assessment findings before finalisation.

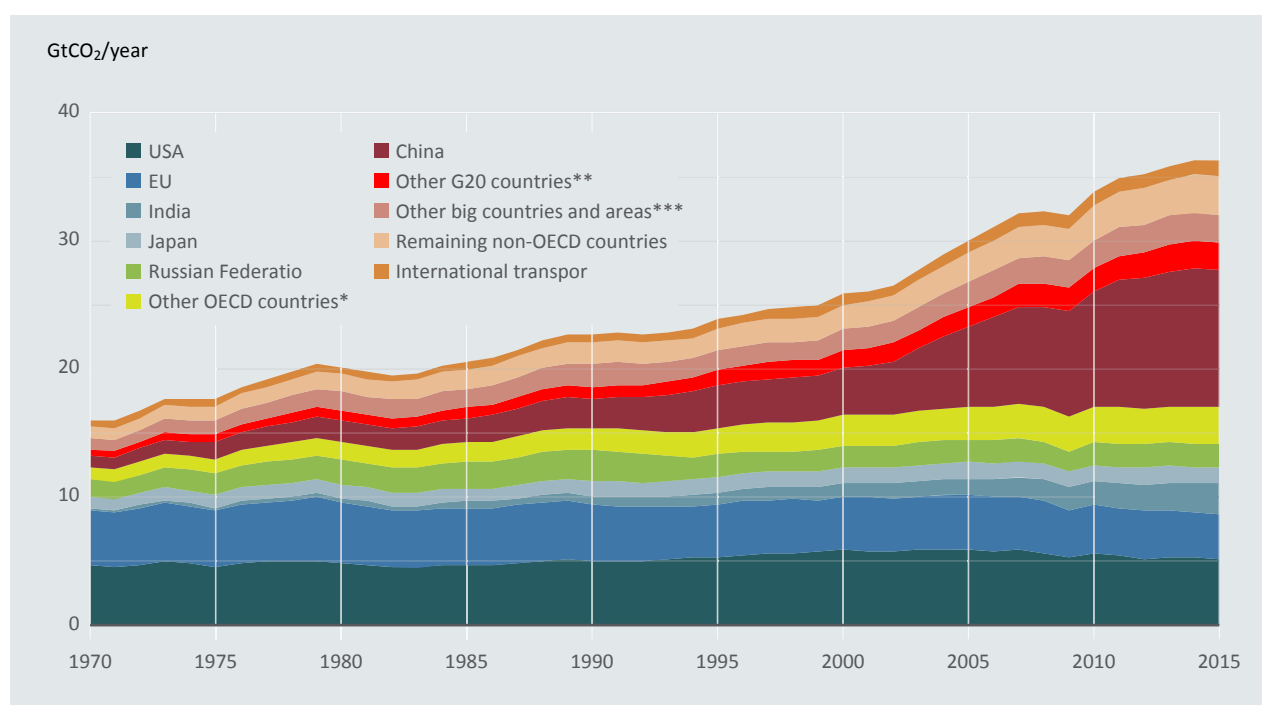
### 4. Global greenhouse gas emissions continue to increase

Total global greenhouse gas (GHG) emissions continue to show a steady increase, reaching approximately 52.7 gigatonnes carbon dioxide equivalent (GtCO<sub>2</sub>e) in 2014. There have been small variations around this longer trend. Notably, the rate of global greenhouse gas emissions increase during the period 2000 to 2010 was faster (2.2 per cent per year) than during the period 1970 to 2000 (1.3 per cent per year), increasing in 2010 and 2011 (3.5 per cent per year) and then slowing in 2012 to 2013 (1.8 per cent per year).

#### Global carbon dioxide emissions from fossil fuel use and industry seem to stabilize

Global carbon dioxide emissions from fossil fuel combustion, cement production and other industrial processes are the major source of total global greenhouse gas emissions. Currently, they account for about 68 per cent of total global greenhouse gas emissions, and were estimated to be 36.2 GtCO<sub>2</sub> in 2015. Figure ES1 presents a detailed overview of the development in global carbon dioxide emissions from fossil fuel use and industry for the period 1970 to 2015.

Figure ES1: Carbon dioxide emissions from fossil-fuel use and industry.



\* Other OECD countries include Australia; Canada; Mexico; Republic of Korea and Turkey.

\*\* Other G20 countries include Argentina; Brazil; Indonesia; Saudi Arabia; South Africa and Turkey.

\*\*\* Other big countries and areas include Egypt; Iran; Kazakhstan; Malaysia; Nigeria; Taiwan, Province of China; Thailand and Ukraine.

In 2015, global carbon dioxide emissions from these sources stagnated for the first time and showed signs of a weak decline. Prior to 2015, global carbon dioxide emissions increased by roughly 1.3 per cent per year for the period 2012 to 2014, which was significantly slower than that of the 12 preceding years, where the average increase was 2.9 per cent per year (2000-2011), but higher than the average growth rate of around 1 per cent per year during the 1990s. These findings are in line with other studies on trends in global energy-related carbon dioxide emissions.

In summary, **global greenhouse gas emissions continue to grow, and while the indications are encouraging that the growth rate of global carbon dioxide emissions from fossil fuel use and industry is slowing, it is still too early to say whether this is likely to be permanent.**

The continued growth of global emissions and the underlying trends show that the world is not yet on a trajectory that allows for a transition to stringent low emissions development pathways consistent with the stated temperature goals.

## 5. Collectively, members of the G20 are on a likely track to meet their Cancun Pledges for 2020, but these pledges do not deliver the necessary early emission reductions

From a global perspective, early action is especially important for the major economies of the world; crucially these countries, as members of the G20, account for approximately three quarters of global emissions. Most of the G20 members at COP 16 in Cancun formalised the emission reduction pledges they had put forward as a follow up to the Copenhagen Accord. Since then, the annual Emissions Gap Reports have consistently assessed the progress countries are making towards delivering on these pledges, as they represent the main formalised early action commitment, and their timely achievement will send very positive signals to other countries.

It should be noted that not all pledges demand the same level of effort. A country currently on track to achieve its pledge has not necessarily made a greater effort to mitigate emissions than a country not yet on track. The projections assessed are subject to the uncertainty associated with macroeconomic trends, such as changes in gross domestic product, and population trends, as well as the impact of each country's climate policy action. The emission trajectories analysed here do not quantify the potential impact of using offsets to achieve pledges, which is considered to be quite limited.

The assessment shows that according to all available estimates three of the G20 members – China, the European Union, and India – are on track to meet their pledges without purchasing offsets. Three more – Brazil, Japan, and Russia – are on track according to most estimates.

According to both government and independent estimates, Canada, Mexico, and the United States of America are likely to

require further action, possibly supplemented by purchased offsets, in order to meet their pledges. Mexico's Cancun Pledge is conditional on the provision of adequate financial and technological support from developed countries as part of a global agreement, and the fulfilment of this condition has not been assessed.

Government and independent sources have found a gap between Australia's projected 2020 emissions and its target level for that year. However, Australia's latest official projections find that for the budget period, and including carry-over from its first commitment period under the Kyoto Protocol, the country is now on track to meet its Kyoto target.

According to independent analysis, the Republic of Korea will also require further action to meet its pledge. This cannot be verified using available official projections. The Republic of Korea has domestically abandoned its 2020 target, replacing it with the Intended Nationally Determined Contributions target in the amended Green Growth Act. However, its earlier pledge has not been officially withdrawn.

Sufficient information is currently unavailable to determine whether Indonesia and South Africa are on track to meet their pledges. In the case of Indonesia, independent projections span a wide range, and official projections reflecting current policies are unavailable.

Finally, Argentina, Saudi Arabia and Turkey have not made greenhouse gas reduction pledges for 2020. All three countries submitted post-2020 pledges to the United Nations Framework Convention on Climate Change as part of their Intended Nationally Determined Contributions.

Overall, there is general progress on pledge achievement, but **several countries will need to accelerate action to meet their Cancun Pledge by 2020. It must be underlined that, collectively, these pledges are not ambitious enough to have a better starting point in 2020 to meet the 2030 levels of global greenhouse gas emissions consistent with the longer-term goals of below 2 or 1.5°C.**

The urgency of enhancing pre-2020 mitigation action is, therefore, indisputable:

- It strengthens the likelihood that countries will meet and exceed their Cancun Pledges.
- It provides a more solid foundation for implementing the Nationally Determined Contributions from 2020, and for continuously strengthening their ambition
- It supports the transition towards a least-cost emissions reduction trajectory after 2020 that is consistent with the 2°C goal.
- It is likely the last chance to keep the option of limiting global warming to 1.5°C in 2100 open, as all available scenarios consistent with the 1.5°C goal imply that global greenhouse gas emissions peak before 2020.

## 6. Pathways for staying well below 2 and 1.5°C require deep emission reductions after, and preferably also before, 2020 and lower levels of emissions in 2030 than earlier assessed 2°C pathways

The central aim of the Paris Agreement is to keep the global temperature increase by the end of the century to well below 2°C compared to pre-industrial levels, with an ambition to limit the temperature increase even further to 1.5°C. While these global goals are quite clear, there is a need to interpret what they mean. For example, what if the global average temperature exceeds these goals during the century, but is below the goals by end of it? Similarly, it is necessary to define an acceptable probability for achieving the goals, which in the end is a political rather than scientific question, as it requires value judgments about what is acceptable and desirable to society. In line with the Intergovernmental Panel on Climate Change's definition of "likely", this report generally uses a 66 per cent or higher probability.

A large body of literature is available on least-cost pathways that limit warming to below 2°C with a 66 per cent or higher probability. This issue has been covered extensively by the Intergovernmental Panel on Climate Change and earlier Emissions Gap Reports. For a 1.5°C goal, the body of literature is much more sparse and there are no published scenarios that meet the 1.5°C limit permanently with more than 66 per

cent probability. Therefore, the studies assessed operate with a 50 per cent probability, which in Intergovernmental Panel on Climate Change terminology is considered "about as likely as not". The 2018 Special report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways by the Intergovernmental Panel on Climate Change will provide a more comprehensive picture as it will cover new studies. Table ES1 presents the pathway characteristics for achieving the two different temperature goals, showing the median acceptable emission levels for key years between 2020 and 2100.

As in the earlier Emissions Gap Reports, it is important to highlight that most scenarios that are available in the literature, and that limit warming to below 2 or 1.5°C, assume the use of so-called negative emissions technologies in the second half of the century -- that is the active and permanent removal of carbon dioxide from the atmosphere. This can be achieved, for example, through sustainable afforestation and reforestation, enhanced soil carbon absorption, biochar, and the combination of bio-energy with carbon capture and storage. Important challenges have been identified for large-scale application of negative emissions technologies. For example, with biomass there is a challenge to produce enough biomass without harming biodiversity and a potential for competition between energy and food production over land and water resources.

**Table ES1:** Overview of pathway characteristics for two global temperature targets.

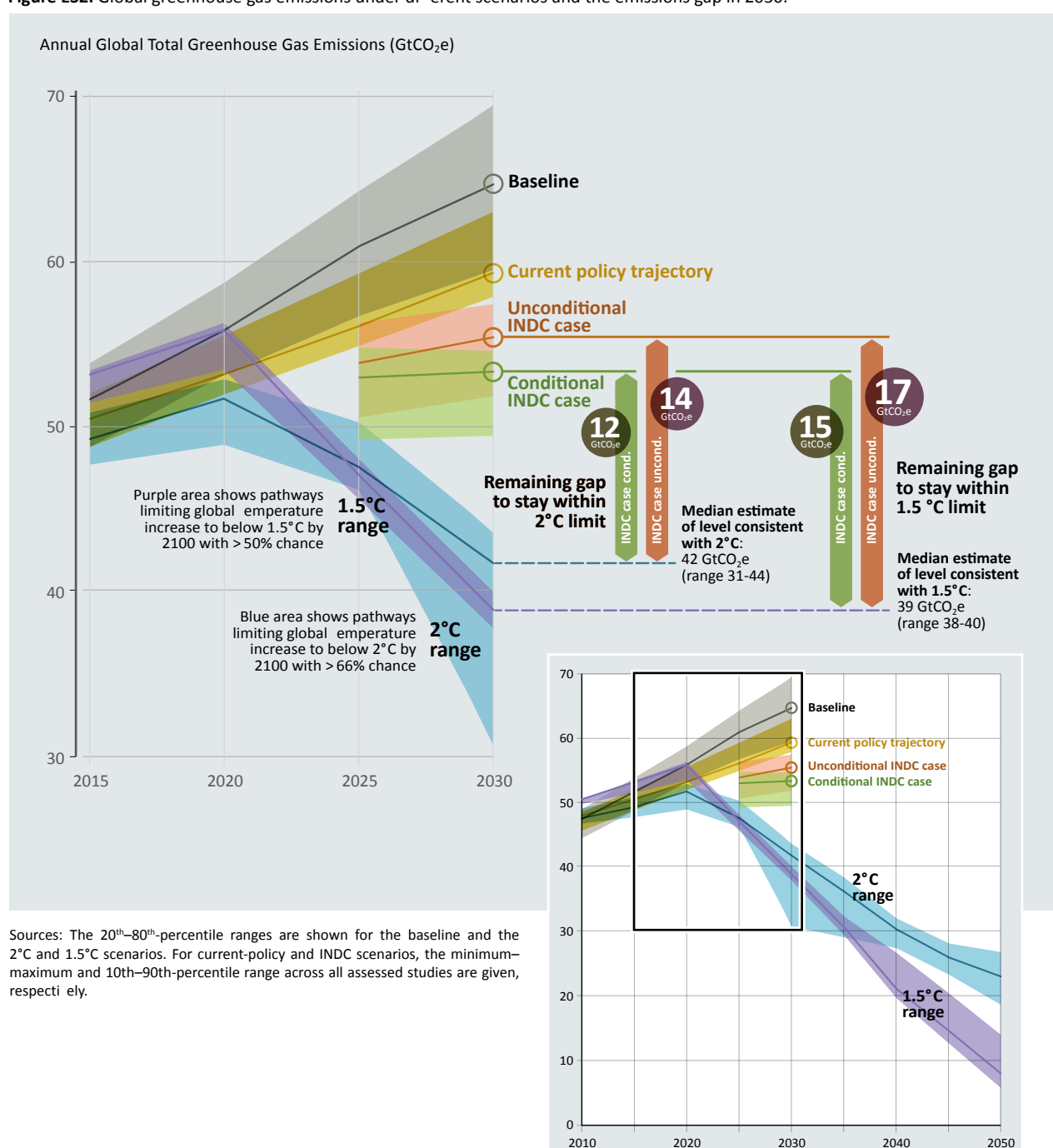
<b>1.5°C (&gt;50% in 2100)</b> Pathways limiting warming to below 1.5°C by 2100 with >50% probability Limited action until 2020 and cost-optimal mitigation afterwards					
Number of available scenarios: <b>6</b> ; Number of contributing modelling frameworks: <b>2</b> Year of global annual emissions becoming net zero <sup>†</sup> for: Kyoto-GHG: <b>(2060-2080)</b> ; total CO <sub>2</sub> (including LULUCF): <b>(2045-2050)</b> ; CO <sub>2</sub> from energy and industry: <b>(2045-2055)</b>					
Annual emissions of global total greenhouse gases [GtCO <sub>2</sub> e/year]					
Year	2020	2025	2030	2050	2100
median*	<b>56</b>	<b>47</b>	<b>39</b>	<b>8</b>	<b>-5</b>
range and spread**	53(-/-)56	46(-/-)48	37(-/-)40	4(-/-)14	-5(-/-)-3
CO <sub>2</sub> carbon budgets [global total cumulative CO <sub>2</sub> emissions in GtCO <sub>2</sub> ]					
Time period	2015-2030	2030-2050	2050-2075	2075-2100	2015-2100
median*	<b>552</b>	<b>236</b>	<b>-199</b>	<b>-353</b>	<b>217</b>
range and spread**	503(-/-)567	178(-/-)259	-146(-/-)277	-288(-/-)372	71(-/-)383
<b>2°C (&gt;66% in 2100)</b> Pathways limiting warming to below 2°C by 2100 with >66% probability Limited action until 2020 and cost-optimal mitigation afterwards					
Number of available scenarios: <b>10</b> ; Number of contributing modelling frameworks: <b>4</b> Year of global annual emissions becoming net zero <sup>†</sup> for: Kyoto-GHG: <b>2085 (2080-2090)</b> ; total CO <sub>2</sub> (including LULUCF): <b>2070 (2060-2075)</b> ; CO <sub>2</sub> from energy and industry: <b>2070 (2060-2075)</b>					
Annual emissions of global total greenhouse gases [GtCO <sub>2</sub> e/year]					
Year	2020	2025	2030	2050	2100
median*	<b>52</b>	<b>48</b>	<b>42</b>	<b>23</b>	<b>-3</b>
range and spread**	49(49/53)55	44(46/50)53	29(31/44)44	17(18/27)29	-11 (-9/-)0
CO <sub>2</sub> carbon budgets [global total cumulative CO <sub>2</sub> emissions in GtCO <sub>2</sub> ]					
Time period	2015-2030	2030-2050	2050-2075	2075-2100	2015-2100
median*	<b>533</b>	<b>362</b>	<b>70</b>	<b>-288</b>	<b>553</b>
range and spread**	481(499/582)572	242(258/431)447	-97(-52/175)187	-120(-146/-327)-342	483(490/934)988
* Rounded to the nearest 1 GtCO <sub>2</sub> e/year					
** Rounded to the nearest 1 GtCO <sub>2</sub> e/year. Format: minimum value (20 <sup>th</sup> percentile/8 <sup>th</sup> percentile) maximum value – no percentiles are provided if less than 10 scenarios are available.					
† Rounded to nearest 5 years. Format: median (20 <sup>th</sup> percentile – 8 <sup>th</sup> percentile); (minimum – maximum) if less than 10 scenarios are available.					

Some studies have examined options for hedging against a strong reliance on negative emissions in the long-term. These studies find that this is only possible by reducing emissions more steeply in the very near-term that is over the coming 5 to 15 years.

**Table ES2:** Global total greenhouse gas emissions in 2025 and 2030 under different scenarios.

Emissions estimates (GtCO <sub>2</sub> e/year)			
Scenario	Global total emissions in 2025	Global total emissions in 2030	Number of scenarios in set
Baseline	61.0 (56.7-64.3)	64.7 (59.5-69.5)	179
Current policy trajectory	56.2 (54.8-59.4)	59.4 (57.9-63.1)	3
Unconditional INDCs	53.9 (50.6-56.3)	55.5 (51.9-57.5)	10
Conditional INDCs	53.0 (49.3-54.9)	53.4 (49.5-54.7)	10 (6+4)
2°C pathways (least-cost from 2020)	47.7 (46.2-50.2)	41.8 (30.6-43.5)	10
1.5°C pathways (least-cost from 2020)	47.2 (45.8-48.2)	38.8 (37.7-40.0)	6

**Figure ES2:** Global greenhouse gas emissions under different scenarios and the emissions gap in 2030.





**7. The emissions gap for 2030 is 12 to 14 GtCO<sub>2</sub>e compared with 2°C scenarios, for 1.5°C the gap is 3 GtCO<sub>2</sub>e larger. Even if fully implemented, the unconditional Intended Nationally Determined Contributions are only consistent with staying below an increase in temperature of 3.2°C by 2100 and 3.0°C, if conditional Intended Nationally Determined Contributions are included**

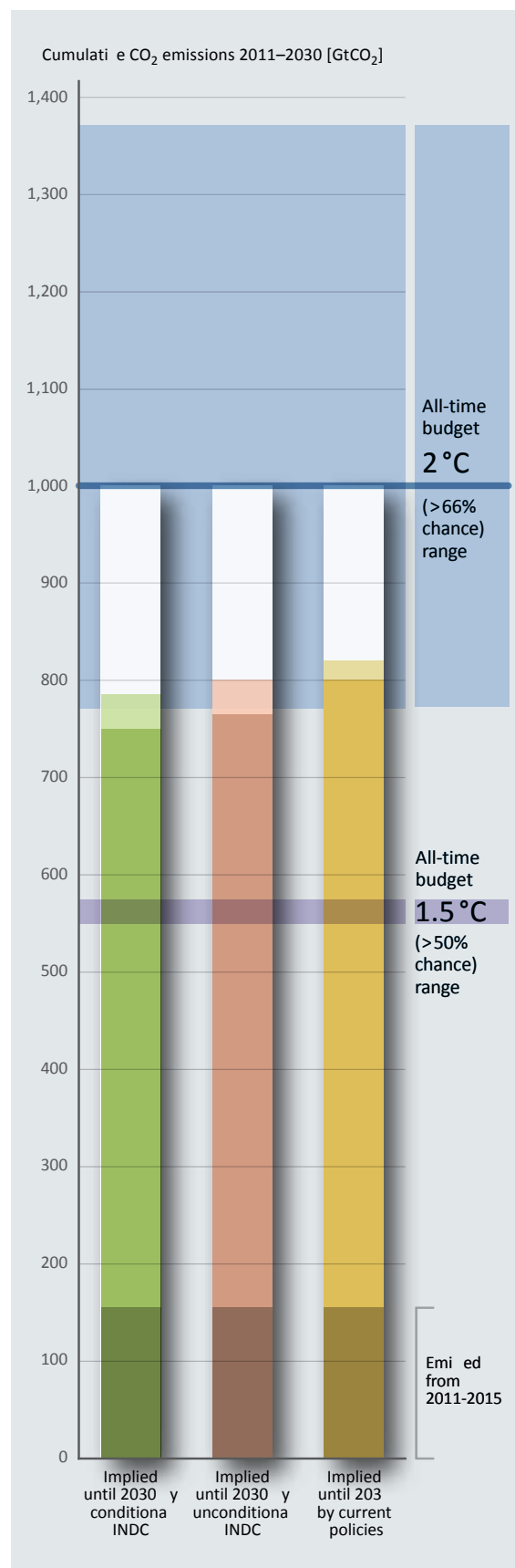
In the period up to COP 21 in Paris, United Nations Environment had, as part of the preparation of the Emissions Gap Report 2015, engaged a team of independent experts to assess the mitigation impacts of the Intended Nationally Determined Contributions. The results were presented as a key part of the Emissions Gap Report and covered the 118 countries having submitted an Intended Nationally Determined Contribution by 1 October 2015. This year, new international studies are available that include the 160 Intended Nationally Determined Contributions submitted, representing 187 out of 195 Parties to the United Nations Framework Convention on Climate Change. The assessment is based on 10 different global level Intended Nationally Determined Contribution studies that all provide analysis of the unconditional contributions and six that cover both conditional and unconditional pledges. The scenarios presented describe the following cases:

- **The baseline scenario** reflects emission projection that assume no additional climate policies have been put in place from 2005 onwards.
- **The current policy trajectory scenario** reflects the best estimates of global emissions taking into account currently adopted and implemented policies.
- **The Intended Nationally Determined Contribution** describe how global greenhouse gas emissions might evolve under full implementation of two Intended Nationally Determined Contribution cases:
  - **Unconditional Intended Nationally Determined Contribution case:** assuming full implementation of unconditional Intended Nationally Determined Contributions
  - **Conditional Intended Nationally Determined Contribution case:** assuming full implementation of both unconditional and conditional Intended Nationally Determined Contributions

**The 1.5°C and 2°C scenarios** represent least-costs global scenarios consistent with a likely chance of limiting warming to below 2°C and 1.5°C above pre-industrial levels consistent with the estimates presented in table ES2.

Figure ES2 shows that full implementation of the **unconditional Intended Nationally Determined Contributions** – using rounded numbers – will reduce global greenhouse gas emissions in 2030 by 9 GtCO<sub>2</sub>e (range: 7-13) relative to the median in the no-policy baseline scenario, and by 4 GtCO<sub>2</sub>e (range: 2-7) relative to the median in the current policy trajectory. Comparing the cost-optimal 2°C and 1.5°C scenarios to the unconditional Intended Nationally Determined Contribution projections shows a gap in 2030

**Figure ES3:** Comparison of projected emissions by 2030 and all-time 1.5°C and 2°C carbon budgets. Cumulative global total carbon dioxide emissions for the conditional INDC case, the unconditional INDC case and the current policies scenario, and carbon budgets from the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC AR5) (IPCC, 2014a). The carbon budget ranges show the values based on the range of scenarios assessed by Working Group III (IPCC, 2014b). The solid horizontal line at 1,000 GtCO<sub>2</sub> shows the estimate based on complex Earth-System Models, assessed by Working Group I (IPCC, 2014a).



of 14 GtCO<sub>2</sub>e (range: 10-16) between the unconditional Intended Nation ally Determined Contribution scenario and the 2°C scenario. Comparing the unconditional Intended Nation ally Determined Contribution scenario with the 1.5°C scenario would further increase the gap by 3 GtCO<sub>2</sub>e, as shown in figure ES2.

If countries were to fully implement the **conditional Intended Nation ally Determined Contributions**, the estimated global greenhouse gas emissions in 2030 would be about 2.4 GtCO<sub>2</sub>e (range: 1.2–4.8) lower in 2030 compared to the unconditional Intended Nation ally Determined Contribution scenario case. This leaves a gap in 2030 of 12 (range: 8–13) GtCO<sub>2</sub>e between the conditional Intended Nation ally Determined Contribution scenario and the cost-optimal 2°C scenario. When comparing with the 1.5°C scenario, the gap would increase by an additional 3 GtCO<sub>2</sub>e.

Interestingly, a number of countries have Intended Nation ally Determined Contribution targets suggesting emission levels in 2030 above their estimated no-policy baseline or current policy scenario. These countries are, thus, assumed to overachieve on their Intended Nation ally Determined Contribution targets, and the different model teams treat this issue in different ways, which adds an uncertainty of 1 GtCO<sub>2</sub>e (range: 0-1) by 2030, to the

estimated Intended Nation ally Determined Contribution and gap projections

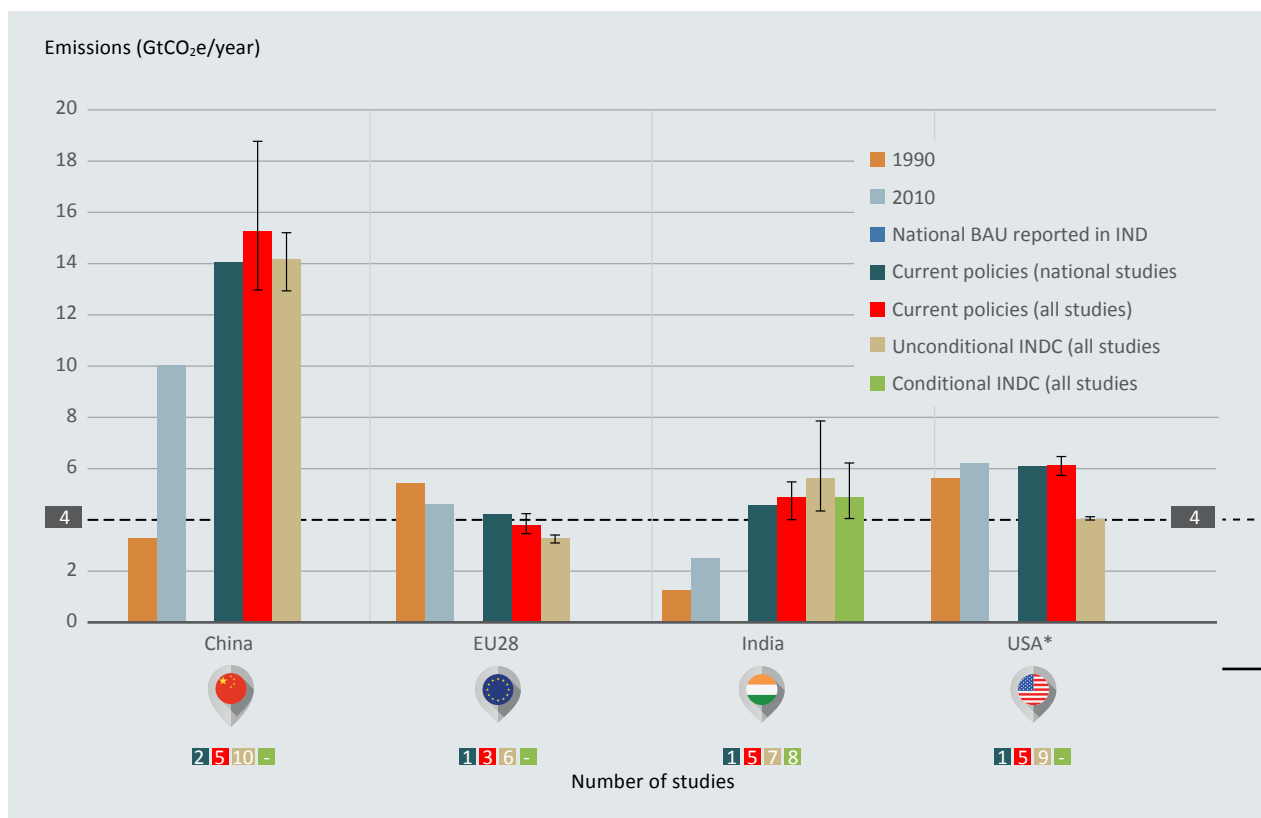
Compared to last year's report, the estimates of the emission levels that would be realised under full implementation of the Intended Nation ally Determined Contributions have not changed significantly. In summary, **the Intended Nation ally Determined Contributions represent a first start to initiate the required transition, but are far from being consistent with the agreed upon long-term temperature goals.**

The **full implementation of the unconditional Intended Nation ally Determined Contributions is consistent with staying below an increase in temperature of 3.2°C** (median, range: 2.9–3.4°C) by 2100 relative to pre-industrial levels with greater than 66 per cent probability. This is lower than current policies, which imply staying below warming of 3.6°C (median, range: 3.4–3.7°C) by 2100 with greater than 66 per cent probability. **Full implementation of the conditional Intended Nation ally Determined Contributions would lower the temperature projections relative to the unconditional Intended Nation ally Determined Contributions by about 0.2°C.**

Under the Intended Nation ally Determined Contribution scenarios, **the carbon dioxide budget estimated by the**

**Figure ES4:** Greenhouse gas emissions (all gases and sectors) of the G20 economies, and G20 as a whole, by 2030 for the business as usual (BAU) emissions projection from the INDC submission (third bar), for the current policies scenario from official and national studies (fourth bar), from global model studies used for our analysis (fifth bar), or the unconditional INDC scenario (sixth bar), and for the conditional INDC scenario (seventh bar). The uncertainty ranges are explained in the main text. For reporting reasons, the emissions projections for China, EU, India and USA are shown in panel (a), and the other countries in panel (b), with different vertical axes. The Figure also shows the number of studies underlying the estimate (if available) for the last four bars: current policies (national studies), current policies (all studies) and the unconditional INDC and conditional INDC (all studies).

**Figure ES4a**



\* For USA unconditional INDC is for 2025.

**Intergovernmental Panel on Climate Change for limiting warming to below 2°C with at least 66 per cent probability will be close to depleted by 2030, and the similar budget aligned with limiting warming to below 1.5°C with at least 50 per cent probability will already be well exceeded by 2030.** Figure ES3 shows the cumulative carbon dioxide emissions implied by the Intended Nationally Determined Contribution scenarios.

**8. Assessments of Intended Nationally Determined Contributions from individual G20 members show ambition, but also reveal that for some countries current policies are estimated to deliver greater reductions than the Intended Nationally Determined Contributions. This indicates that there might be room for strengthening the ambition of Intended Nationally Determined Contributions, noting that the analytical uncertainties are fairly large**

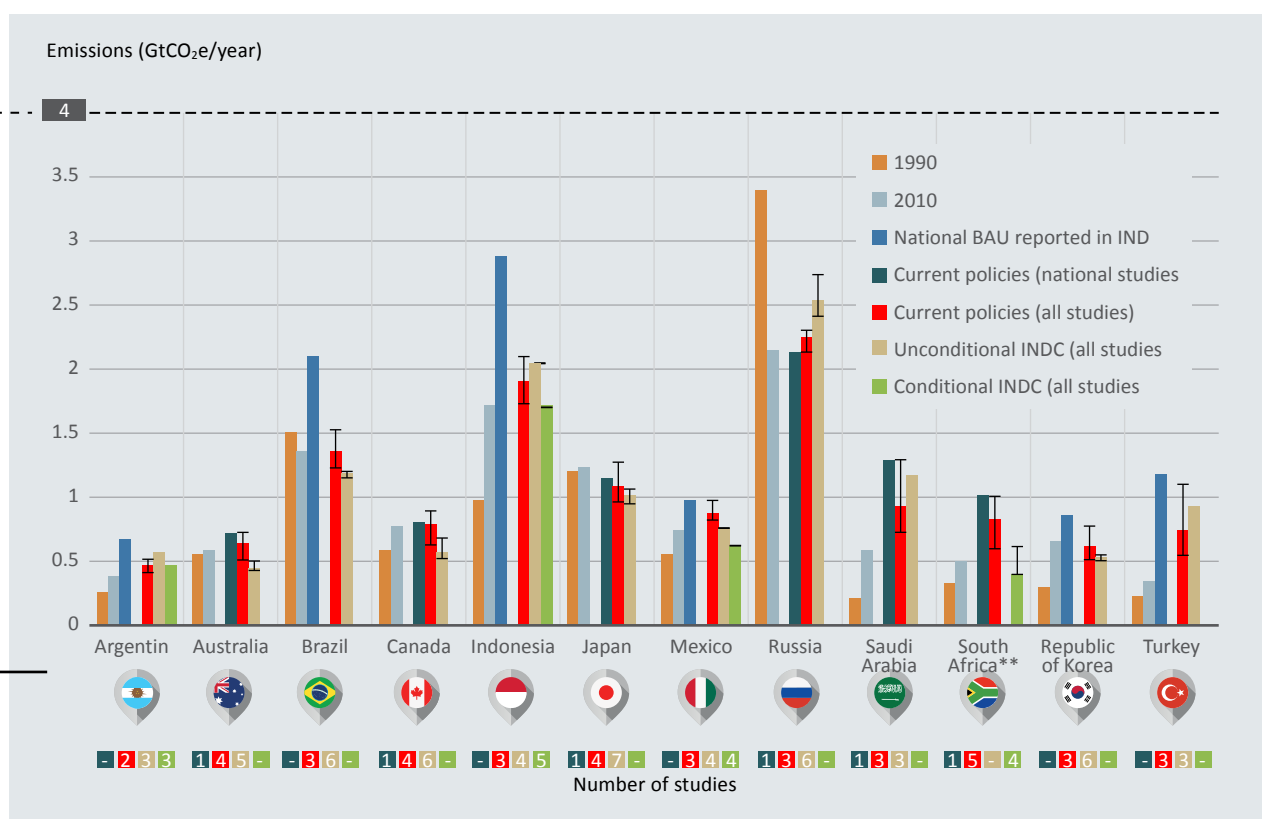
Reflecting on the dominant share of global emissions coming from the G20 members, this year's Emissions Gap Report presents a more detailed assessment of the Intended Nationally Determined Contributions from this group of countries.

The calculation of the G20 members' median emission projections resulting from full implementation of the Intended Nationally Determined Contribution is based on the same data as the 2015 Emissions Gap Report, complemented with: a) the data from two new studies, and b) the estimates for the three G20 economies, Argentina, Saudi Arabia and Turkey, that were not included in the previous report.

Results of this assessment are presented for all the individual countries and the European Union in figure ES4, noting that data is not available for all countries.

The figure shows that for many countries the implementation of the Intended Nationally Determined Contribution would lead to lower emissions than the current policies scenario that is additional policies would have to be implemented to meet the Intended Nationally Determined Contribution. It is interesting to note that for some countries the Intended Nationally Determined Contribution is above the current policies scenario, indicating that it should be possible to enhance ambition quite easily. However, additional research is necessary because for many countries the uncertainty ranges overlap, and the number of studies for the current policies and Intended Nationally Determined Contribution cases vary significantly.

Figure ES4b



\*\* South Africa's INDC is based on an emissions trajectory with an emissions range of 398–614 MtCO<sub>2</sub>e including LULUCF over the period 2025–2030.



## 9. Non-state actor initiatives could likely reduce emissions in 2020 and 2030 with a few additional gigatonnes. It is difficult to assess the overlap with Intended Nationally Determined Contributions as these are often not detailed enough. State and non-state actions can both overlap and mutually reinforce each other

Global climate governance has become substantially more diverse, with many actors other than national governments undertaking climate actions. Such actors include: the private sector, cities and regions and other subnational actors like cities and groups, referred to here as “non-state actors”. Their actions could be both individual (for example, a company or city taking on a particular target), as well as cooperative (for example, an international cooperative initiative for city action). In some instances, national governments also participate and sometimes even drive the action. Figure ES5 shows the broad sectoral engagement of major cooperative initiatives.

During COP 20 in 2014, the Non-state Actor Zone for Climate Action was launched – an online platform to showcase non-state climate actions, both by individual and cooperative entities. It currently contains more than 11,000 commitments, mostly from individual actors. The Lima-Paris Action Agenda was also launched in 2014, by Peru, France, the United Nations Framework Convention on Climate Change Secretariat and the office of the United Nations Secretary General, and was given a prominent position during COP 21 to showcase the commitment of both state and non-state actors. These initiatives have now been integrated, for COP 22, as part of a new Global Climate Action Agenda to boost commitments and cooperative action between governments, cities, businesses, investors and citizens to cut emissions and help vulnerable nations adapt to climate impacts and build their own clean energy

and sustainable future. More emphasis is put on increasing transparency, tracking results and demonstrating credibility of non-state action

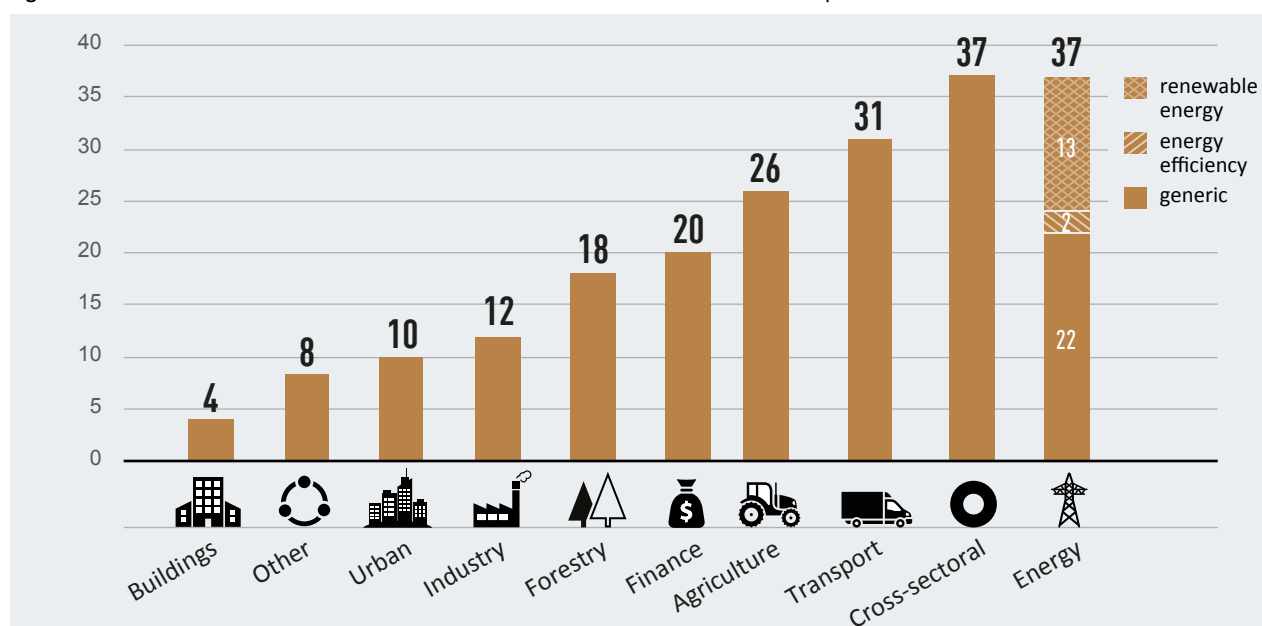
Some open questions remain, for example how can the international process best formally recognise, support, and catalyse non-state action? Equally important will be how non-state action relates to national governments’ efforts to implement their Nationally Determined Contributions, and to the development of future Nationally Determined Contributions.

**National action and Intended Nationally Determined Contributions, on the one hand, and non-state actions, on the other, can reinforce each other and together create a virtuous cycle of increasing ambition.** Many initiatives address issues like financing, technology deployment and capacity building that may have important indirect effects on emissions. They can go hand-in-hand with policies of national governments.

In relation to the emissions gap, the interest is focused on the potential and actual contribution of actions by non-state actors to enhance global efforts to reduce greenhouse gas emissions.

A growing number of studies are available, estimating the potential contribution from actions by non-state actors to global efforts of reducing greenhouse gas emissions. Figure ES6 illustrates the results from eight different studies. **The data still has significant gaps concerning actual impacts, overlaps and relation with Intended Nationally Determined Contributions;** the figure is, therefore, only indicative of information about the potential of non-state action. The arrows showing the emission reductions potential start at different levels, because the individual studies use different baselines, and the last three studies explicitly estimate the impact additional to Intended Nationally Determined Contributions

**Figure ES5:** Overview of sectoral distribution of 203 mitigation focused International Cooperative Initiatives.



Note: Some initiatives cover more than one sector.

The data indicates that **the aggregated impact of the initiatives are in the order of a few GtCO<sub>2</sub>e in 2030 beyond the current Intended Nationally Determined Contributions that is potentially a significant contribution to closing the gap**, if the initiatives reach their stated goals and if these reductions do not displace actions elsewhere. At the same time, many initiatives, in addition to their direct actions and contributions, provide political momentum and exercise pressure on governments to take further action

## 10. Ambitious action on energy efficiency becomes more urgent given that the long-term objective in the Paris Agreement is more stringent. Well-documented opportunities exist to strengthen national policies and deliver deeper reductions through more effective delivery of energy efficiency policies

When examining the Intended Nationally Determined Contributions, it is evident that **167 countries have included energy efficiency as one of their priority action areas**. It is also important to note that despite generally declining fossil energy prices, global investments in energy efficiency increased by 6 per cent to US\$221 billion in 2015, indicating that action is already happening.

Energy efficiency has been included in earlier Emissions Gap Reports reflecting the significant potential for emission reductions. This year's report presents policies that have proven to accelerate energy efficiency gains in three key sectors: buildings, industry and transport (see figure ES7). About 40 per cent of global greenhouse gas emissions are generated from direct energy use in these three sectors,

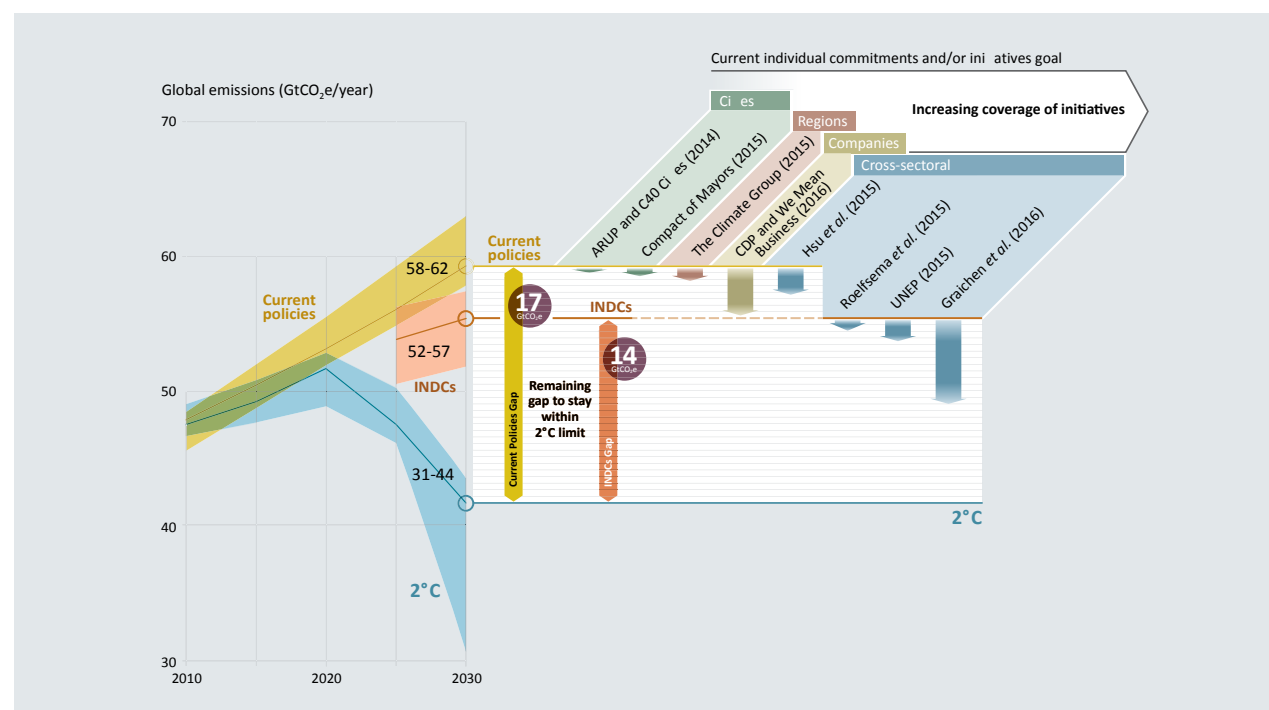
while an additional 25 per cent are related to the power generation providing electricity to these end users.

**If scaled-up, globally, the assessed energy efficiency policies can dramatically reduce energy use and greenhouse gas emissions** in these key sectors. Sector-specific estimates of emission reduction potentials are highly dependent on the underlying assumptions and approaches. Studies based on the Fourth Assessment Report of the Intergovernmental Panel on Climate Change show that for a cost range of between US\$20 and 100 per tonne of carbon dioxide, the estimates of both direct and indirect emissions reduction potentials in 2030 are (in GtCO<sub>2</sub>e): 5.9 for buildings, 4.1 for industry and 2.1 for transport. The study notes that these estimates are conservative and the real potential in each sector is likely bigger.

A more recent analysis by the International Energy Agency indicates that the cumulative direct and indirect emissions estimates to 2035 are (in GtCO<sub>2</sub>e): 30 for buildings, 22 for industry and 12 for transport. The two studies are not comparable due to basic differences in approaches, but, collectively, illustrate the significant potential in the three sectors.

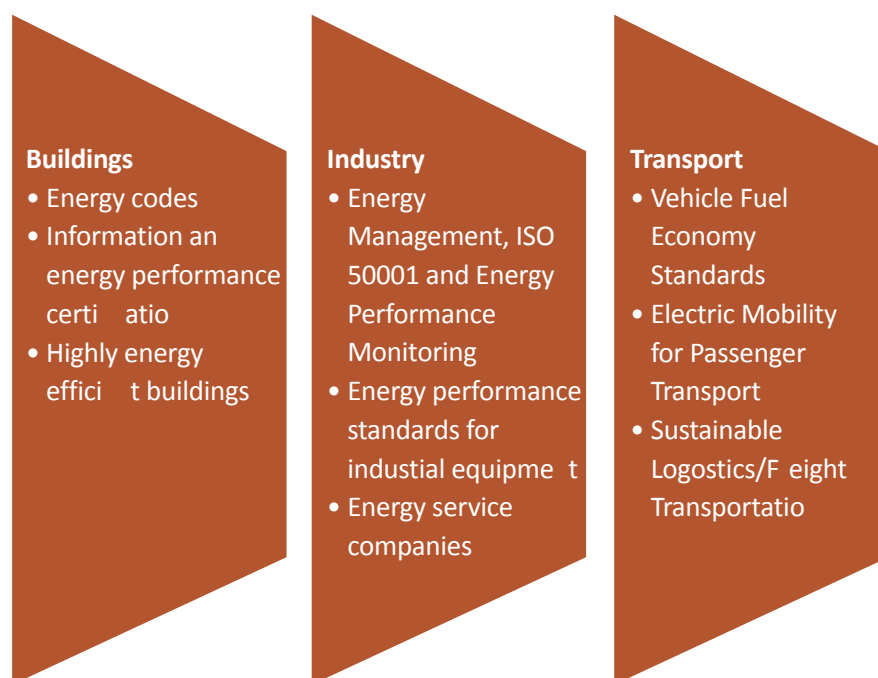
Beyond mitigation improved energy efficiency also offers many other benefits like reduced air pollution and improved local employment. Energy efficiency is an integral part of Sustainable Development Goal 7, which aims to 'ensure access to a affordable, reliable, sustainable and modern energy for all'. The energy efficiency target is to double the global rate of improvement in energy efficiency by 2030, from 1.3 per cent per year to 2.6 per cent. The achievement of this goal will be important for achieving many of the other goals.

**Figure ES6:** Illustration of impact of initiatives by study.



Note: The arrows showing the emission reductions potential start at different levels because the individual studies use different baselines (the last three studies explicitly estimate the impact additional to INDCs).

**Figure ES7: Sectoral energy efficiency policies assessed**



Many policy options exist in the three sectors; this assessment has focused on a small number of policies already implemented or under implementation in many countries where good results have been achieved.

Not all mitigation options can be associated with individual sectors, and it is important to consider the wider energy system as an integration between different elements. For example, design of housing efficiency needs to be closely integrated with the selection of heating and cooling technologies and lighting.

While most emissions in cities originate from the building, industry and transport sectors, a sizeable share of these emissions could be avoided through city-level mitigation options, such as spatial planning, improving transit options, increasing and co-locating employment and residential densities, and increasing green spaces.

More sustainable lifestyles, behaviours, cultures and consumption patterns are equally important to consider when designing policies – for example, for transport, building and appliance efficiency. While traditional policymaking has focused on technological and economic solutions, changes in energy behaviour are increasingly recognised as a key focus area when aiming for transformative action.

## 11. The Paris Agreement defines the Sustainable Development Goal (SDG) on climate change. Making the right choices in implementing all goals will be crucial to achieving the Paris Agreement objectives and the 2030 Agenda for Sustainable Development

The 2030 Agenda for Sustainable Development, adopted in 2015, defines the international development agenda of the next 15 years. The 2030 Agenda expressly recognizes the

United Nations Framework Convention on Climate Change as the authoritative body for defining the sustainable development goal thirteen on climate change, providing a direct link between the Paris Agreement and the goal on climate change.

**Climate action is not only a sustainable development goal in its own right; it also directly affects and is affected by efforts to achieve many of the other goals.** In some cases, interactions between the different goals may be mutually reinforcing, or path-aligned, while in other cases they may be conflictual, or path-dependent. This means that strategic choices matter. Successful implementation of both the United Nations Framework Convention on Climate Change and the Sustainable Development Goal agendas will, therefore, depend on the ability of national governments to develop and implement a set of national targets that serve both agendas, optimise benefits, exploit synergies, and reconcile trade-offs.

**Among the key findings of analyses to date is that the earliest impacts of climate change may undermine our ability to deliver the goals by 2030, and that failure to deliver on the climate action goals will have even larger implications for maintaining development progress post-2030.**

Exploring a complementary approach, the nature of the relationship between seven Sustainable Development Goals, selected based on their relevance for mitigation in key sectors, and the mitigation action required under the Paris Agreement is investigated. Table ES3 presents an overview of the findings. Of the four path-aligned goals, three directly relate to sustainability and ecosystems and would, therefore, be expected to align well with climate change mitigation goals. Encouragingly, the report additionally finds that achieving universal access to energy is compatible with emission reduction targets, as this is associated with

low energy demands and, in most cases, best achieved through expansion and reliance on low-carbon distributed technologies.

For the path-contingent goals, there is often general or even specific knowledge of how to overcome many of the challenges, as well as longstanding experience of particular policies and practices that can help to minimize trade-offs and maximize synergies between different interests.

While it is too early to provide an assessment of the quantitative emissions implications of pursuing the Sustainable Development Goals, and vice versa, emerging results from integrated assessment models provide insights into the available “solution space” that allows for simultaneous achievement of multiple goals and targets. An emphasis on measures that reduce energy and other consumption demands generally benefits overall development concerns by freeing up the solution space for other goals, for example, food security and infrastructure.

**Table ES3:** Overview of path-aligned and path-contingent Sustainable Development Goals (SDG) covered in the report.

Alignment	SDG	Topic
Path-aligned	SDG7	Sustainable energy access
	SDG11	Sustainable cities
	SDG12	Sustainable consumption and production
	SDG15	Terrestrial ecosystems
Path-contingent	SDG2	Hunger and food security
	SDG8	Growth and employment
	SDG9	Infrastructure, industrialization, and innovation