

**RESEARCH REPORT**

VTT-R-00140-15

# **Emission gap to 2 degree pathways**

## **– Framework to assess the ambition of Intended Nationally Determined Contributions, INDCs**

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Confidentiality: Public



<b>Report's title</b>		
Emission gap to 2 degree pathways – Framework to assess the ambition of Intended Nationally Determined Contributions, INDCs		
<b>Customer, contact person, address</b>		<b>Order reference</b>
Ministry of the Environment of Finland, Magnus Cederlöf		
<b>Project name</b>		<b>Project number/Short name</b>
EUilmasto		78222
<b>Author(s)</b>		<b>Pages</b>
Tomi J. Lindroos and Tommi Ekholm		40
<b>Keywords</b>		<b>Report identification code</b>
2 degree target, pledges, emission gap, ghg projections		VTT-R-00140-15
<b>Summary</b>		
<p>New international climate change agreement is the main target of Paris climate negotiations in Paris in December 2015. For the agreement, countries will give promises of emission reductions. Previously these promises have been referred as 'pledges' but, for Paris negotiations, countries will submit Intended Nationally Determined Contributions (INDCs). Three largest greenhouse gas (GHG) emitting countries (China, USA and EU) have given some indications of their INDCs. This report summarizes existing pledges and preliminary INDCs for Paris.</p> <p>Current pledges have varying scopes and coverages. Countries are urged to attach qualitative information to their INDCs, but the level of submitted details is unknown at the time of the writing. This report provides a framework to assess and compare the existing pledges and INDCs after country submissions. Report profiles and analyses 8 biggest GHG emitting countries: China, USA, EU, India, Russia, Indonesia, Brazil and Japan. The rest of the world is assessed more briefly.</p> <p>Each country profile includes emission statistics; summary of country's pledge and preliminary INDC when available; comparison of the GHG projection under current legislation and the country's pledge; GHG emission scenarios up to 2050 with different ambition levels; and calculated emission reduction indicators from these scenarios such as GHG per GDP, GHG per capita and renewable energy share.</p> <p>Based on these national scenarios, we compile three global emission reduction scenarios and compare these three scenarios to the 2 degree target pathways. The GHG development under the current legislation is at too high level compared to the 2 degree target, but ambitious GHG reductions may still be sufficient to reach 2 degree target. We need quick action to reach these emission low carbon pathways.</p>		
<b>Confidentiality</b>	Public	
Espoo 6.2.2015		
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<b>Distribution:</b> customer and VTT		
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## Preface

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This report analyses the emission reduction pathways to reach 2 degree target, countries' GHG emission projections under different scenarios and gives a framework to assess future pledges. The research has been done and the report written by Tomi J. Lindroos and Tommi Ekholm.

The work is a part of a larger research project commissioned by Finnish Ministry of the Environment. The steering group for the project comprised Environment Counsellor Magnus Cederlöf, Counsellor Harri Laurikka and Senior Adviser Paula Perälä. The authors wish to thank the steering group for their helpful comments regarding the report.

The views expressed in this report are those of the authors, and do not necessarily represent the view of Finnish Ministry of the Environment.

Espoo, 6.2.2015  
Authors

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## 1. Introduction

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Many developed and developing countries have given pledges where they set emission reduction targets for themselves for 2020 In Copenhagen Accord in 2009<sup>1</sup>. The content and conditions of given pledges varies much from country to another<sup>2, 3</sup>.

The main objective of Cancun agreement from 2010 is to “*establish clear objectives for reducing human-generated greenhouse gas emissions over time to keep the global average temperature rise below two degrees*”<sup>4</sup>. This includes compliance with two degree target and clear objectives, which was not always the case with Copenhagen pledges.

The next main climate conference will be held in Paris in 2015. For Paris, countries are invited to submit their Intended Nationally Determined Contributions (INDCs). Previous Climate Conferences (COP19, Warsaw and COP20, Lima) invited all countries to communicate their INDCs well in advance of Paris Negotiations (COP21). Countries' INDCs will be submitted to a public web portal<sup>5</sup>.

Some countries have already given preliminary indications of their INDCs, but at the time of writing this, none have submitted the official version. First INDCs are expected by the end of March 2015 and others during the 2015. UNFCCC will provide a summary report of INDCs by the beginning of November 2015.

The COP20 decision further urges countries to include quantified information, as appropriate, on time frames, scopes, coverages, assumptions and methodological approaches. In practice, countries may give more coherent pledges this time or not. There is still a clear need for a framework to be able to easily assess the level of ambition of different pledges.

Additionally, it is essential to quantify what level of global emissions would be reached with these pledges and is that sufficient for 2 degree targets. If the total emission reductions of preliminary Paris pledges are not enough to reach two degree target, there should be international negotiations to increase the ambition level. For this process, there is a need to compare preliminary pledges analytically.

The objective of this study is 1) to create a framework to assess and compare the ambition of national pledges and 2) to estimate the gap between 2 degree pathways and global GHG mitigation scenarios resulting from pledges.

An analytical approach to achieve these objectives require three basic blocks to build on

- a summary of the current scientific understanding of global emission pathways to two degree target (Chapter 2),
- a review of countries' emissions and pledges (Chapter 3) and
- projections of the development of countries' GHG emissions and energy systems under different mitigation scenarios (Chapter 4)

Chapter 5 compiles three global GHG mitigation scenarios based on the country level analysis and compares the total emissions of these scenarios to 2 degree pathways. Results are compared also to emission scenarios from Emission gap 2014 report<sup>6</sup>. Chapter 6 provides a summary and conclusions.

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<sup>1</sup> [http://unfccc.int/meetings/copenhagen\\_dec\\_2009/items/5262.php](http://unfccc.int/meetings/copenhagen_dec_2009/items/5262.php)

<sup>2</sup> [http://unfccc.int/meetings/copenhagen\\_dec\\_2009/items/5264.php](http://unfccc.int/meetings/copenhagen_dec_2009/items/5264.php)

<sup>3</sup> [http://unfccc.int/meetings/cop\\_15/copenhagen\\_accord/items/5265.php](http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5265.php)

<sup>4</sup> <http://cancun.unfccc.int/cancun-agreements/main-objectives-of-the-agreements/#c33>

<sup>5</sup> <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>

<sup>6</sup> <http://www.unep.org/publications/ebooks/emissionsgapreport2014/>





## 2. Emission reduction pathways for 2 degree target

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The two degree target has its roots in scientific studies from 1970s and 1980s<sup>7,8</sup>. The European Union proposed two degree target as a policy target at 1996 and further stressed the importance of this target at 2007<sup>9</sup>. United Nations Global Climate Change Conference agreed on a two degree target in Copenhagen in 2009:

*“To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, ....”<sup>10</sup>*

There is a vast amount of scientific literature trying to define the amount of emissions required to overstep or keep within the 2 degree target. The best understanding is compiled to the recent IPCC's fifth assessment report<sup>11</sup>. IPCC's summary for policy makers provide an easy-to-read summary of this rather complicated topic<sup>12</sup>.

The amount of allowed emissions depends crucially on assumed climate sensitivity, which defines how much and how fast a certain amount of emissions will warm the planet. The climate sensitivity is uncertain and gives us probabilities to achieve two degree target. In this report we use two probability categories:

- over 50% chance (medium chance) to keep the global temperature rise below 2 degrees and
- over 66% chance (likely chance) to keep the global temperature rise below 2 degrees.

Due to practical reasons, the cumulative emissions of two degree target are often interpreted as global emission reduction pathways. In these pathways, one of the most critical assumptions is the start year of mitigation actions. In this report we study

- two emission reduction pathways where mitigation actions start at 2010 and
- one late action scenario, which has only limited mitigation actions before 2020.

Additionally, we included one pathway for 1.5 degree target, because the Cancun agreement has a “consideration of a 1.5C goal, on the basis of the best scientific knowledge available”<sup>13</sup>. In this emission reduction pathway, the emission reduction measures start at 2010 and the pathway has likely chance to achieve 1.5 degree target.

UNEP's emission gap 2014 report provides updated global emission reduction pathways. Figure 1 presents a summary of emission reduction pathways where mitigation measures start from 2010. In 2 degree scenarios, drawn with orange and green color, the global GHG emissions stabilize at 2015 and start decreasing towards 2020. In these scenarios, the global emissions reach 1990 levels by 2030 and decrease from 20% to 30% below 1990 emissions by 2050. In 1.5 degree scenario, the amount of emissions decreases rapidly and reaches -25% from 1990 emissions by 2030.

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<sup>7</sup> <http://discovery.ucl.ac.uk/111750/>

<sup>8</sup> <http://www.jstor.org/discover/10.2307/1885679?sid=21105632263553&uid=2&uid=3737976&uid=4>

<sup>9</sup> [http://europa.eu/rapid/press-release\\_MEMO-07-17\\_en.htm?locale=en](http://europa.eu/rapid/press-release_MEMO-07-17_en.htm?locale=en)

<sup>10</sup> <http://unfccc.int/resource/docs/2009/cop15/eng/l07.pdf>

<sup>11</sup> <http://www.ipcc.ch/report/ar5/>

<sup>12</sup> [http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc\\_wg3\\_ar5\\_summary-for-policymakers.pdf](http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf)

<sup>13</sup> [http://unfccc.int/key\\_steps/cancun\\_agreements/items/6132.php](http://unfccc.int/key_steps/cancun_agreements/items/6132.php)

Figure 1 presents also global emissions statistics<sup>14</sup> from 1990 to 2013. Emissions statistics from 2013 are preliminary, but the global GHG emissions are rising quite steeply contrary to the pathways in the picture. Pathways and statistics include LULUCF<sup>15</sup> emissions.

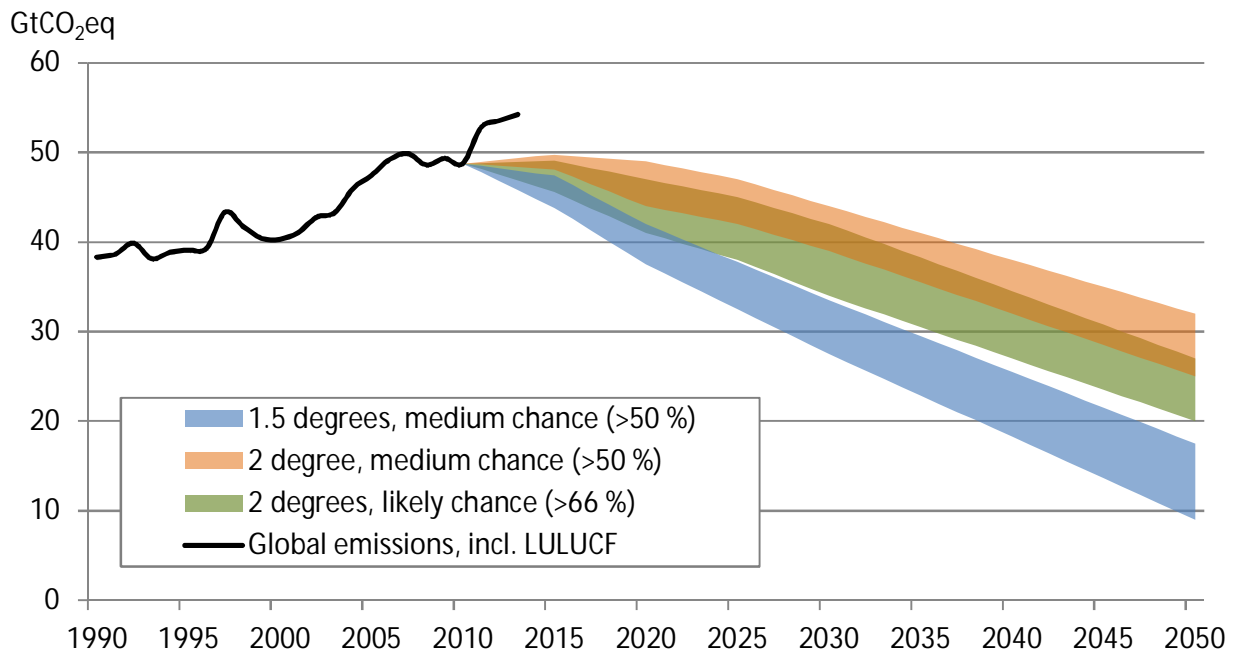


Figure 1. Global emissions from 1990 to 2013 and three emission reduction pathways from the Emission Gap 214 report. The orange pathway represents a medium chance (> 50%) to achieve two degree target and green pathway represents a likely chance (> 66%) to achieve two degree target. Blue pathway has a likely chance for 1.5 degree target.

Figure 2 presents a late action scenario where global emissions grow until 2020 and major mitigation measures start from 2020. Globally, we are closer to this late action pathway than any other of the pathways presented here. We may be on an even higher emission pathway, because the emissions at 2011, 2012 and 2013 were already at the level of the 2020 emissions from the late action scenario.

If the emissions grow higher at the beginning of the reduction pathways, we need deeper emission reductions at the later end of the pathway. This at least increases the costs as the first emission reduction measures are cheaper and the last ones are really expensive. If the emissions grow at the high enough level, the two degree target becomes more and more unlikely.

<sup>14</sup> Data from EDGAR, Emission Database for Global Atmospheric Research

<sup>15</sup> LULUCF - Land Use, Land Use Change and Forestry

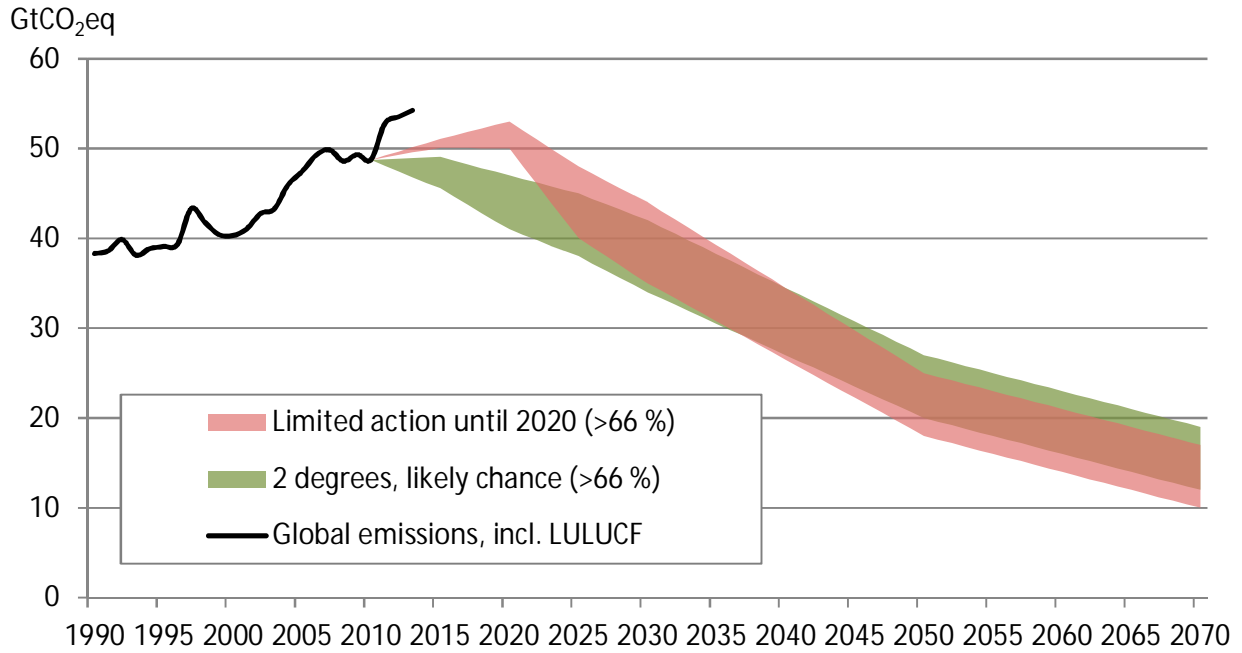


Figure 2. Global emissions from 1990 to 2013 and two emission reduction pathways from the Emission Gap 214 report. Green pathway is the same than in previous picture. Red one is otherwise similar to green path, but it has only limited mitigation actions before 2020. This creates a need for deeper emission reductions in the long term.

### 3. Global emissions and current pledges

#### 3.1 Global emissions 1990-2010

Table 1 summarizes the GHG emissions of 20 largest countries<sup>16</sup> measured by 2010 emissions. Table includes also the annual growth rates of emissions and shares of LULUCF emissions. The information is primarily from UNFCCC emission database<sup>17</sup>, secondarily from EDGAR database<sup>18</sup> and tertiary from FAO land use emission database<sup>19</sup>.

*Table 1. The GHG emissions of 20 largest countries measured by 2010 emissions and GHG emissions of international aviation and maritime.*

	GHG emissions (GtCO <sub>2</sub> eq)			Annual change		LULUCF share of GHGs (%)
	1990	2000	2010	'90 - '00	'00 - '10	average '08 - '10
China	3.5	4.7	10.9	+2.9%	+8.7%	-3%
USA	5.4	6.4	5.9	+1.7%	-0.8%	-16%
EU	5.4	4.8	4.4	-1.1%	-0.8%	-7%
India	1.3	1.8	2.6	+3.1%	+3.8%	-5%
Indonesia	1.1	1.4	2.0	+2.0%	+3.6%	+62%
Brazil	1.8	1.9	1.9	+0.9%	+0.1%	+32%
Russia	3.5	1.6	1.7	-7.3%	+0.04%	-34%
Japan	1.2	1.3	1.2	+0.7%	-0.6%	-6%
Congo, Dem. Rep.	1.4	1.0	1.1	-2.8%	+0.7%	+15%
Canada	0.52	0.67	0.78	+2.6%	+1.5%	+1%
Mexico	0.49	0.57	0.66	+1.5%	+1.5%	+4%
South Korea	0.30	0.51	0.65	+5.5%	+2.4%	-5%
Int. Shipping	0.37	0.48	0.61	+2.7%	+2.5%	-
Australia	0.55	0.51	0.57	-0.6%	+1.0%	+2%
Iran	0.28	0.45	0.53	+4.7%	+1.7%	-1%
Central African Rep.	0.25	0.19	0.51	-2.7%	+10.4%	+3%
Saudi Arabia	0.20	0.31	0.50	+4.3%	+4.8%	0%
<i>Int. Aviation</i>	0.30	0.36	0.47	+1.9%	+2.6%	-
South Africa	0.35	0.39	0.42	+1.3%	+0.7%	0%
Thailand	0.21	0.28	0.41	+3.1%	+3.8%	0%
Ukraine	0.87	0.36	0.35	-8.4%	-0.4%	-6%
Turkey	0.14	0.25	0.35	+5.6%	+3.4%	-18%
World total	38	40	50	+0.5%	+2.2%	+5%

Each country has its unique characteristics and they are hard to group by few simplifying parameters. For an example, China's emissions have grown very rapidly since 2000 and it has been the largest emitting country since 2004. At 2010 China's emissions were larger than the USA and EU combined and at 2013 preliminary emission statistics, China's emissions were larger than USA, EU and India combined.

USA has managed to decrease emissions since 2005 and it has large negative emissions from the LULUCF sector. The situation is quite opposite for Indonesia and Brazil which both

<sup>16</sup> a country or a group of countries such as the EU.

<sup>17</sup> <http://unfccc.int/di/FlexibleQueries.do>

<sup>18</sup> <http://edgar.jrc.ec.europa.eu/>

<sup>19</sup> [http://faostat3.fao.org/browse/G2/\\*/\\*E](http://faostat3.fao.org/browse/G2/*/*E)

have growing emissions and large emissions from the LULUCF sector. EU is the only major country which emissions have steadily decreased since 1990.

Twenty largest countries emitted 75% of global emissions at 2010 and 8 largest countries emitted over 60 % of global emissions in 2010. At 2013, the 8 largest countries were responsible already of about 70 % of global emissios.

Emission estimates have relatively large uncertainties in developing countries and especially in the LULUCF sector, but the trend seems clear. The emissions from the biggest countries grow relatively faster than from smaller countries.

### 3.2 Copenhagen pledges for 2020 (and 2050)

In the Kyoto protocol in 1992, developed countries agreed quantified national emission reduction targets for commitment period from 2008 to 2012. This group of countries has ever since been called 'Annex I' countries.

After this, the method of agreeing climate change mitigation targets moved towards an offering based mechanism where each country may give a promise to mitigate its emissions by a certain amount. In Copenhagen in 2009 developed countries gave quantified economy-wide emission targets<sup>20</sup> and developing countries promised to do Nationally Appropriate Mitigation Actions, NAMAs<sup>21</sup>. The full list is often referred as a 'Copenhagen pledges'. Referred documents contain a list of pledges from 62 countries. In total this would be 89 countries if EU member states should counted separately.

Table 2 presents Copenhagen pledges from 20 largest countries. The process is not mandatory, but all of the 8 biggest emitters have pledged to reduce their emissions and 14 of the 20 biggest emitters have pledged to reduce their emissions.

Smaller part of the pledges are 'unconditional' meaning the country will fulfil this promise nevertheless of the global climate policy. Most of the pledges are 'conditional' meaning that countries will fulfil those only if global climate negotiations advance well enough. Some countries expect climate funding and some deep enough commitments from other countries.

The content of pledges varies much from a country to another. Pledges were given with following criteria:

- Emission reduction % from year x
- Emission reduction % from baseline or business as usual emissions
- Reducing the emission intensity of economy (GHG/GDP)
- Non-GHG pledges such as reducing deforestation or increasing the forest stock
- Other NAMAs

In addition, different pledges cover different emissions. Most pledges are for total GHGs, but some cover only CO<sub>2</sub> from Fossil Fuels and Industry (FF&I) and other exclude LULUCF emissions. The last column of the Table 2 notes if country's pledge does not covers emissions only partially.

After these, there are difference also in many other aspects. Some pledges allow use of international credits while others don't. Countries' pledges may be for a single year or a time period. And finally, to make thing more complicated, pledges are monitored differently. Many developing countries don't have annual GHG inventories and their emissions are estimated by international institutes.

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<sup>20</sup> [http://unfccc.int/meetings/copenhagen\\_dec\\_2009/items/5264.php](http://unfccc.int/meetings/copenhagen_dec_2009/items/5264.php)

<sup>21</sup> [http://unfccc.int/meetings/cop\\_15/copenhagen\\_accord/items/5265.php](http://unfccc.int/meetings/cop_15/copenhagen_accord/items/5265.php)

Table 2. Summary of the Copenhagen pledges for the 20 largest countries (by 2010 GHG emissions). The last row of the table gives additional details on pledges and notes if a pledge excludes some emission sectors.

	2010 GHG emissions GtCO <sub>2</sub> eq	Unconditional pledge 2020	Conditional pledges 2020 2050		Details on pledge
China	10.9	-	4 targets	-	1) reduce CO <sub>2</sub> intensity (CO <sub>2</sub> /GDP) -40 % ... -45 % compared to 2005. <u>Includes CO<sub>2</sub> only from fossil fuels and industry.</u> 2) Non-fossil share of primary energy to 15 %, 3) increase forest coverage by 40 Mha and 4) increase forest stock by 1.3 billion m <sup>3</sup> from 2005.
USA	5.9	-	-17 %	-83 %	below 2005 emissions. 42% emission reduction by 2030.
EU	4.4	-20 %	-30 %	-80 ... -95 %	below 1990 emissions
India	2.6	-	-20 % ... - 25%	-	GHG intensity (GHG/GDP) below 2005 level, <u>excluding emissions from agriculture and LULUCF</u>
Indonesia	2.0	-26 %	-41 %	-	from BAU. List of NAMAs resulting -26% from BAU.
Brazil	1.9	-	-37 %	-	from BAU. List of NAMAs resulting -37% from BAU.
Russia	1.7	-15 %	-25 %	-50 %	below 1990 emissions
Japan	1.2	-3.8 %	-	-60 ... -80 %	below 2005 emissions
Congo, Dem. Rep.	1.1	-	-	-	-
Canada	0.73	-	-17 %	-60%/-70%	below 2005 emissions
Mexico	0.66	-	-30 %	-50 %	2020: -30 % from BAU. 2050: -50 % from 2000.
South Korea	0.65	-	-30 %	-	from BAU
Australia	0.63	-5 %	-15 % / -25 %	-80 %	below 2005 emissions
Int. Shipping	0.61	-	-	-	-
Iran	0.53	-	-	-	-
Central African Rep.	0.51	-	-	-	-
Saudi Arabia	0.50	-	-	-	-
Int. Aviation	0.47	-	-	-	-
South Africa	0.42	-	-34 %	-	from BAU <u>excluding LULUCF</u> . 42% emission reduction by 2025.
Turkey	0.42	-	-	-	-
Thailand	0.41	-	-	-	-
Ukraine	0.40	-	-20 %	-50 %	below 1990 emissions
World total	50				

### 3.3 INDCs for Paris 2015

Paris will be the venue for the next big climate change conference<sup>22</sup>. The aim is to agree on a new international agreement on climate change mitigation. More detailed topics include new national pledges; adaptation; climate finance; technology development and transfer; and many other issues.

OECD has written several reports with different aspects to Paris negotiations. Topics range for an example from “Establishing and Understanding Post-2020 Climate Change Mitigation Commitments”<sup>23</sup> to the different options to account emissions under the UNFCCC<sup>24</sup>; and from scaling up the climate fund<sup>25</sup> to tracking and trading of global emission units<sup>26</sup>. These reports serve as a qualitative base for these analyses.

For Paris, countries are invited to submit their Intended Nationally Determined Contributions (INDCs). Previous Climate Conferences (COP19, Warsaw and COP20, Lima) invited all countries to communicate their INDCs well in advance of Paris Negotiations (COP21). Countries’ INDCs will be submitted to a public web portal<sup>27</sup>. The COP20 decision further urges countries to include quantified information, as appropriate, on time frames, scopes, coverages, assumptions and methodological approaches.

First INDCs are expected by the end of March 2015 and others during the 2015. At the time of writing, only few countries had given indications of their INDCs, but on the other hand, those few countries are the biggest three emitting countries: China, USA and EU. Table 3 presents a summary of the preliminary pledges for the Paris.

*Table 3. Summary of the indications of the Independent Nationally Determined Contributions for the Paris. Official INDCs will be submitted ‘well in advance’ before Paris.*

	2010 GHG emissions GtCO <sub>2</sub> eq	Preliminary pledge for Paris	Details on pledge
China	10.9	2 targets	1) Peak CO <sub>2</sub> emissions from FF&I before 2030 and 2) increase non-fossil share of TPES to around 20 % by 2030.
USA	5.9	-26% to -28%	below 2005 emissions by 2025
EU	4.4	-40 %	At least 40% below 1990 emissions by 2030
...			
World total	50		

<sup>22</sup> The United Nations Climate Change Conference, COP21 and CMP11, will be held in Paris, France in December in 2015.

<sup>23</sup> [http://www.oecd.org/env/cc/CCXG%20EstablishingandUnderstanding\\_%20final%20full%20docOct2013.pdf](http://www.oecd.org/env/cc/CCXG%20EstablishingandUnderstanding_%20final%20full%20docOct2013.pdf)

<sup>24</sup> [http://www.oecd-ilibrary.org/environment-and-sustainable-development/made-to-measure-options-for-emissions-accounting-under-the-unfccc\\_5jzbb2tp8ptg-en](http://www.oecd-ilibrary.org/environment-and-sustainable-development/made-to-measure-options-for-emissions-accounting-under-the-unfccc_5jzbb2tp8ptg-en)

<sup>25</sup> [http://www.oecd.org/env/cc/Scaling\\_up\\_CCXGsentout\\_May2014\\_REV.pdf](http://www.oecd.org/env/cc/Scaling_up_CCXGsentout_May2014_REV.pdf)

<sup>26</sup> <http://www.oecd.org/env/cc/49101167.pdf>

<sup>27</sup> <http://www4.unfccc.int/submissions/indc/Submission%20Pages/submissions.aspx>





## 4. Country level analysis

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### 4.1 Structure of the country level analysis

In this chapter we study more closely the eight largest countries and more briefly the rest of the world. Each subchapter for each country is made in the same format to maintain the coherence and to make it easy to compare the country-level results.

On the first page of each sub-chapter, we present country's GHG statistics, give a summary of its pledges, report the sources of detailed emission reduction scenarios and compare the current development of the emissions to the country's pledge at 2020. The second picture on the first page is calculated the way each country defines its own pledge. For some countries this is total GHG emissions and for some this excludes certain emissions sectors, for an example the LULUCF emissions.

The second page of each country has six pictures. First two present the development of country's GHG emissions under different GHG mitigation scenarios. The picture on the left is with the coverage of country's pledge and the right one is with all GHGs. If the country's pledge is with all GHGs, the picture on right is calculated excluding LULUCF emissions.

The last 4 pictures of each country's assessment cover various ways which are used to formulate pledges. Top left picture calculates emission intensity (CO<sub>2</sub> from Fossil fuels and industry / GDP), top right picture calculates the GHG emissions per capita, bottom left picture presents the share of renewable energy sources when information is available and the bottom right picture presents the share of non-fossil fuels when the information is available. There are some country specific exceptions which are listed within the sub-chapter of each country.

## 4.2 China

Figure 3 shows the China's greenhouse gas emissions from 1990 to 2013. The emissions are mainly have grown rapidly from 2002 to 2013. The growth is mainly a result of increased coal consumption.

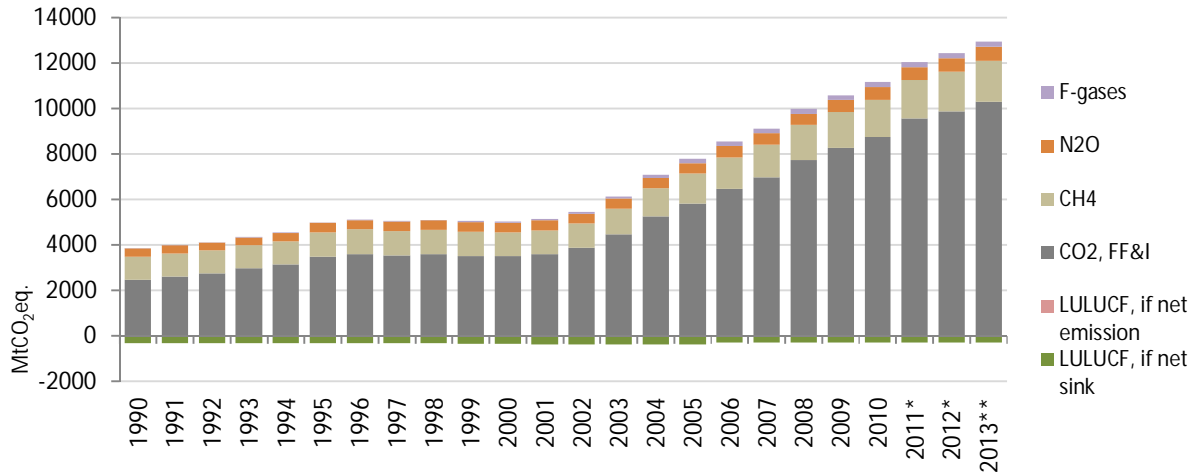


Figure 3. China's greenhouse gas emissions from 1990 to 2013. F-gas emissions from 2011 to 2013 are preliminary. All emissions at 2013 are preliminary.

China's pledge for 2020 includes four components. The first is to decrease CO<sub>2</sub> intensity (CO<sub>2</sub>/GDP) 40 % to 45 % from 2005. It is important to notice that this includes only CO<sub>2</sub> from fossil fuels and industry. Other 2020 pledge components are to 2) increase non-fossil share to 15 % of primary energy, 3) increase forest coverage by 40 Mha and 4) forest stock by 1.3 billion m<sup>3</sup> from 2005. China and USA published an agreement for Paris climate negotiations in which China pledged to peak CO<sub>2</sub> emissions before 2030 and increase the non-fossil share of TPES to around 20 % by 2030.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) Official projection (CO<sub>2</sub> from FF&I), 2) independent estimates of development under current legislation (CO<sub>2</sub> from FF&I), 3) 3.7 W scenario and from the Asian Modelling Exercise and 4) 2.6 W scenario from the Asian Modelling Exercise.

Figure 4 shows the estimated development of CO<sub>2</sub> emissions from fossil fuels and industry and compares the estimates to the recent statistics from 2011-2013 and official estimate of the pledge threshold. The recent increase of the CO<sub>2</sub> emissions has been more rapid than in the scenarios.

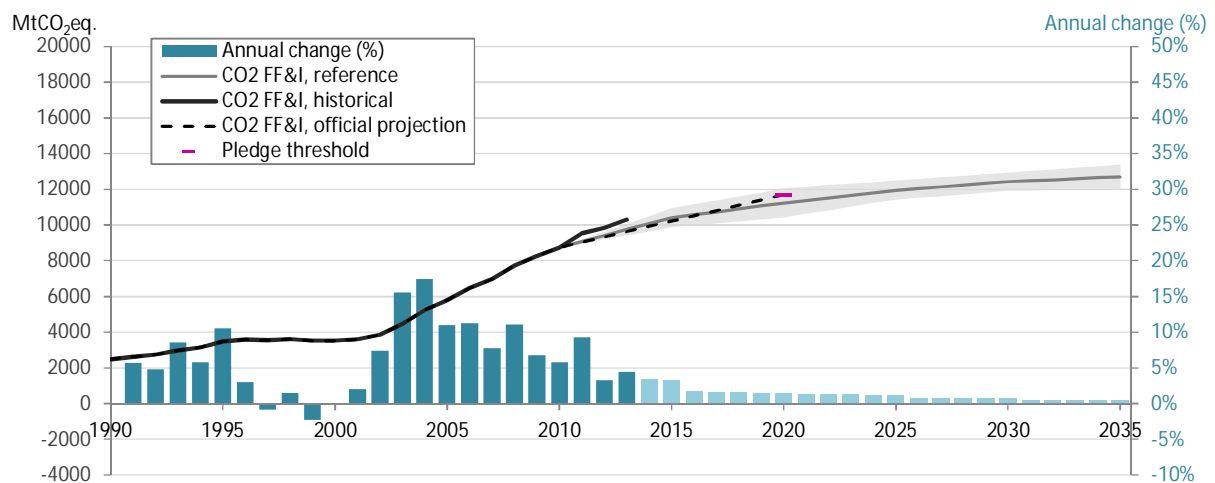


Figure 4. China's CO<sub>2</sub> emissions from fossil fuels and industry (FF&I) from 1990 to 2013, estimated development up to 2035 and official pledge threshold at 2020.

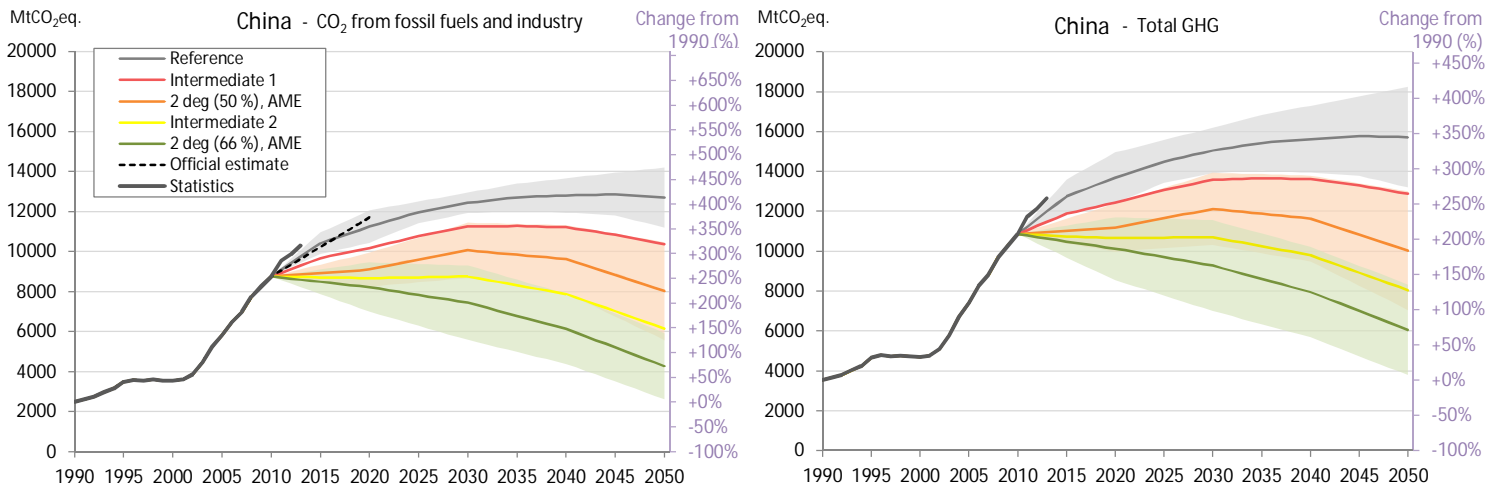


Figure 5. Estimate of China's a) CO<sub>2</sub> emissions from fossil fuels and industry (FF&I) and b) total GHG emissions. Official projection of CO<sub>2</sub> emissions from FF&I is presented with a dashed line. Peaking CO<sub>2</sub> emissions from FF&I before 2030 is not much more than development under current legislation.

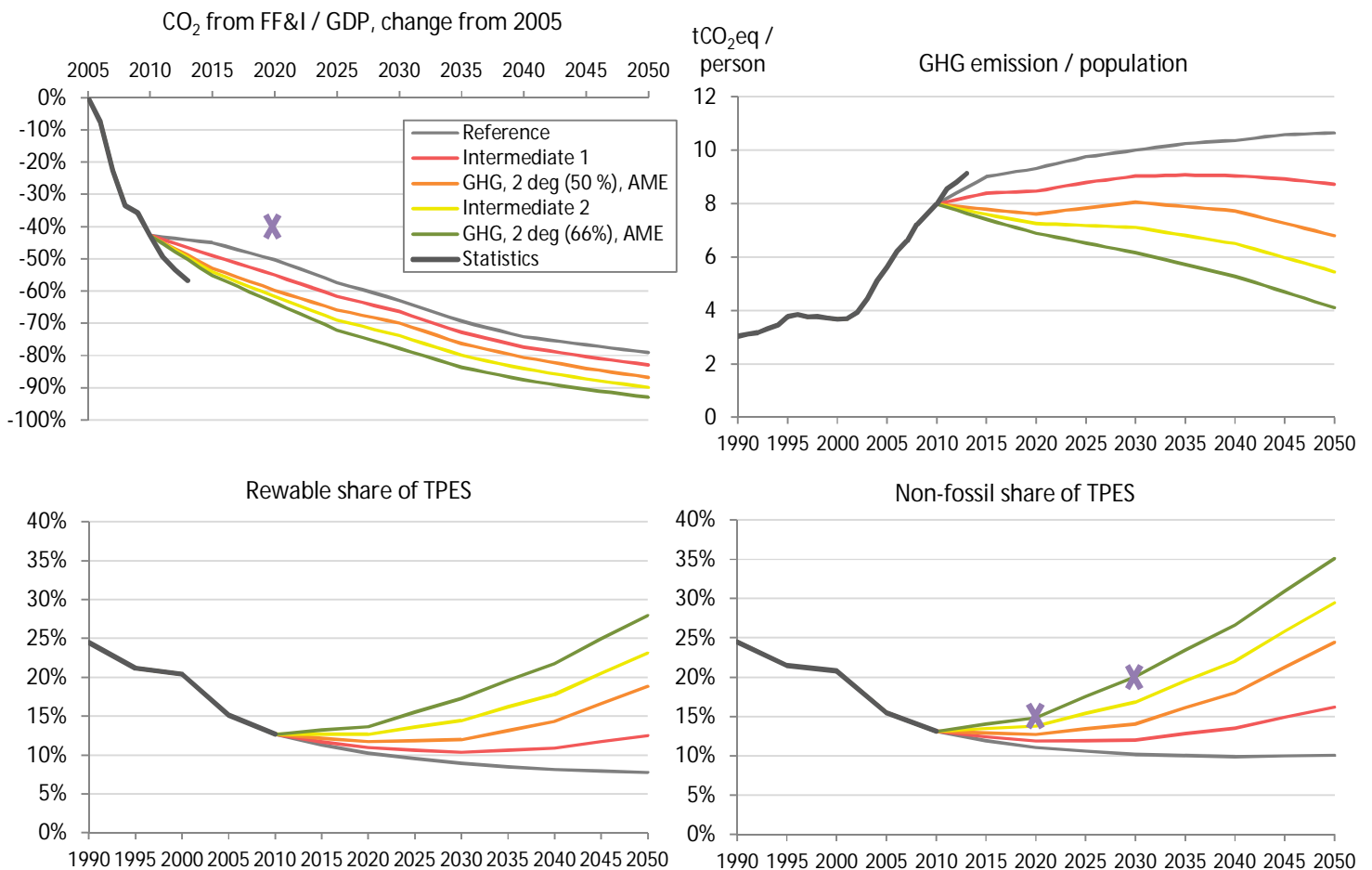


Figure 6. China's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES. Purple marks are at the levels of China's 2020 and 2030 pledges. According to AME modelling results, China's non-fossil energy target is quite ambitious.

### 4.3 United States

Figure 7 shows the USA's greenhouse gas emissions from 1990 to 2013. The LULUCF sector is a relatively large sink of the emissions at the USA. Emission removals from LULUCF have been from 13% to 15% of the total emissions without LULUCF.

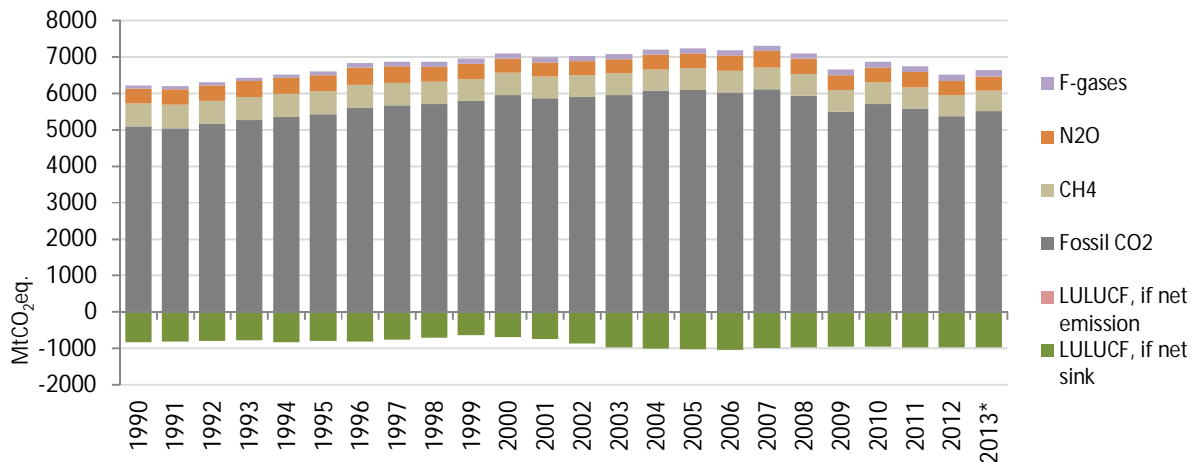


Figure 7. USA's greenhouse gas emissions from 1990 to 2013. Emissions at 2013 are preliminary.

USA's pledge for 2020 is to reduce total GHG emissions 17% below 2005 emissions. Additionally, the USA pledged to reduce the total GHG emissions 42% by 2030 and 83% by 2050. At the end of the 2014, USA and China published an agreement for Paris climate negotiations in which USA pledged to reduce total GHG emissions from 26% to 28% below 2005 emissions by 2025.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) estimate of development under current legislation, 2) 3.7 W scenario from the Asian Modelling Exercise, 3) 2.6 W scenario from the Asian Modelling Exercise and 4) linear trajectory from 2010 emission to -83 % at 2050.

Figure 8 compares the estimated development of emissions in the WRI current legislation scenario and USA pledges for 2020 and 2025. Figure includes LULUCF emissions.

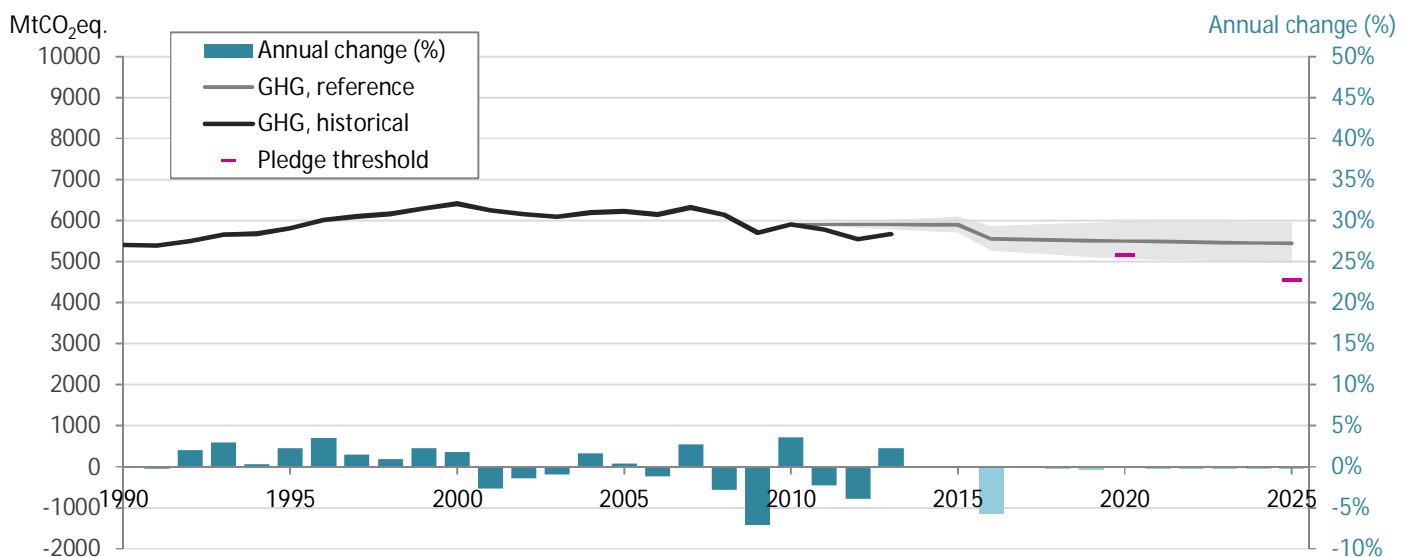


Figure 8. USA's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and pledge thresholds at 2020 and 2025. Estimates include LULUCF emissions.

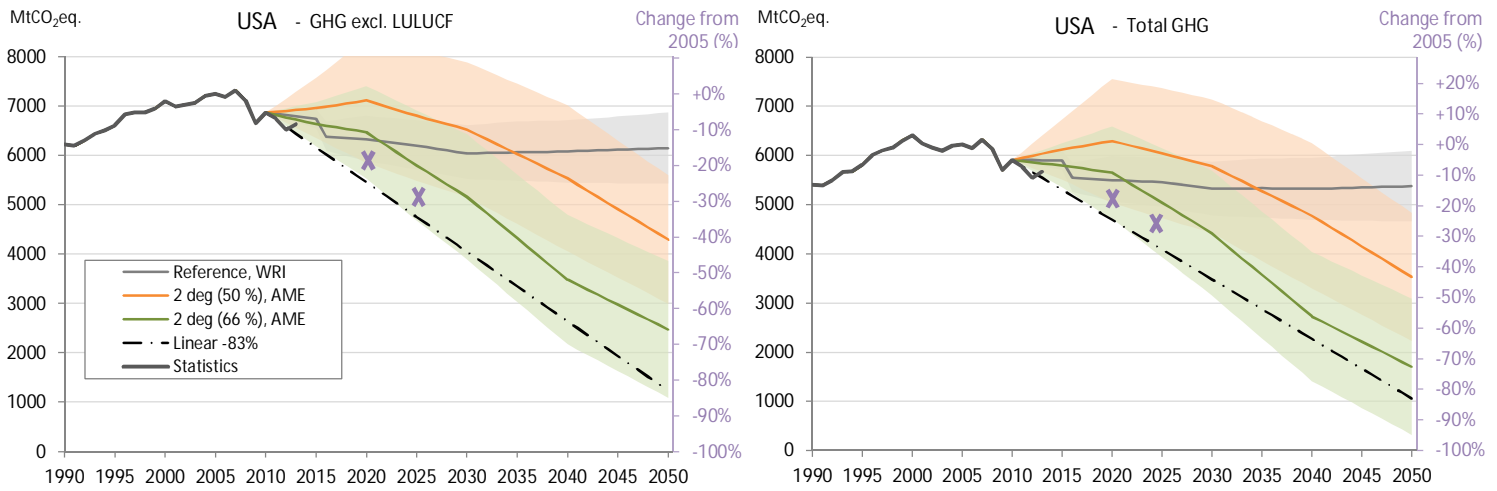


Figure 9. Estimate of USA's a) GHG emissions excluding LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios. Purple 'X's mark USA's pledges.

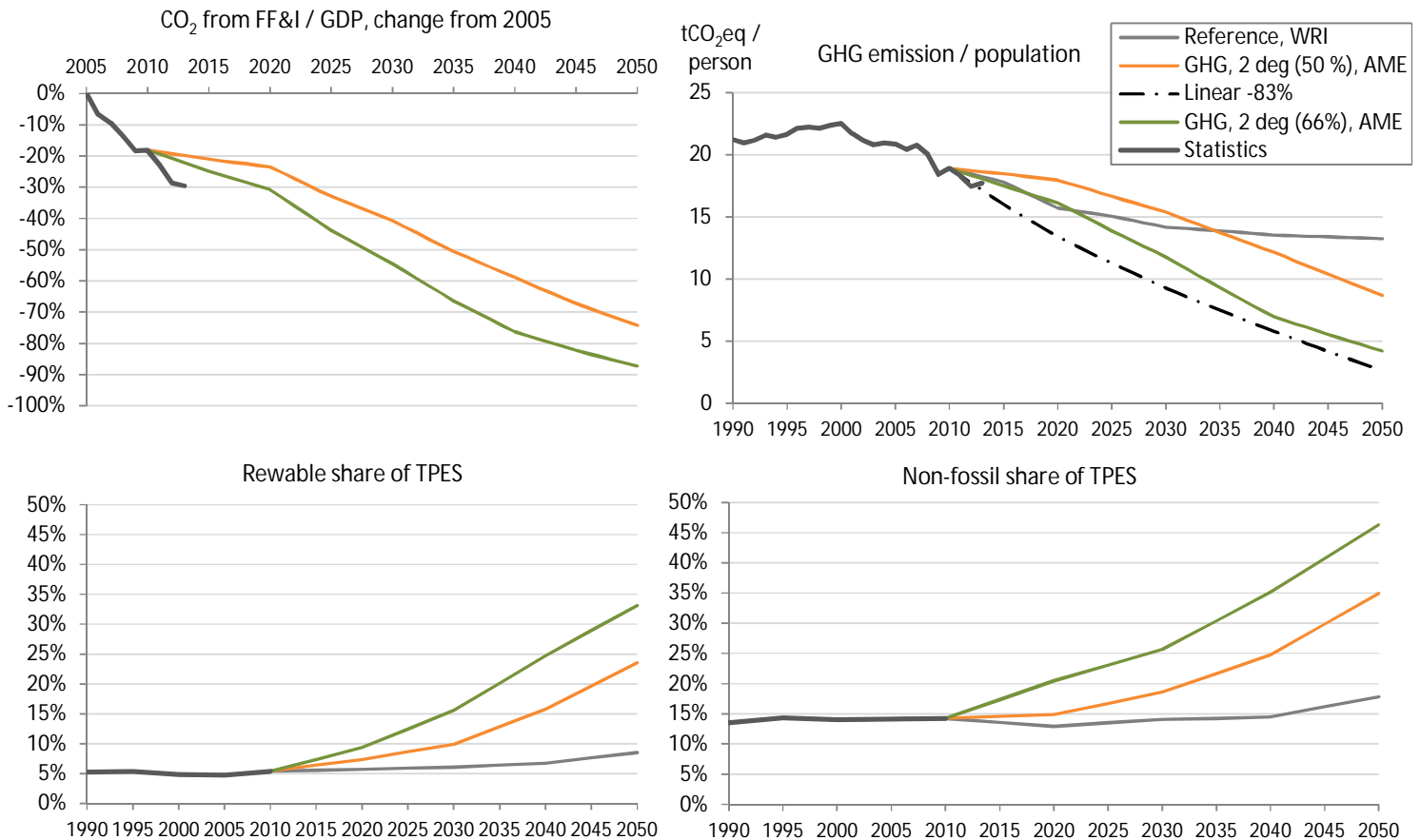


Figure 10. USA's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES.

## 4.4 European Union

Figure 11 shows the EU's greenhouse gas emissions from 1990 to 2013. The emissions have decreased steadily since 1990 and more rapidly after 2008. At the 2013, the emissions were already 23% below 1990.

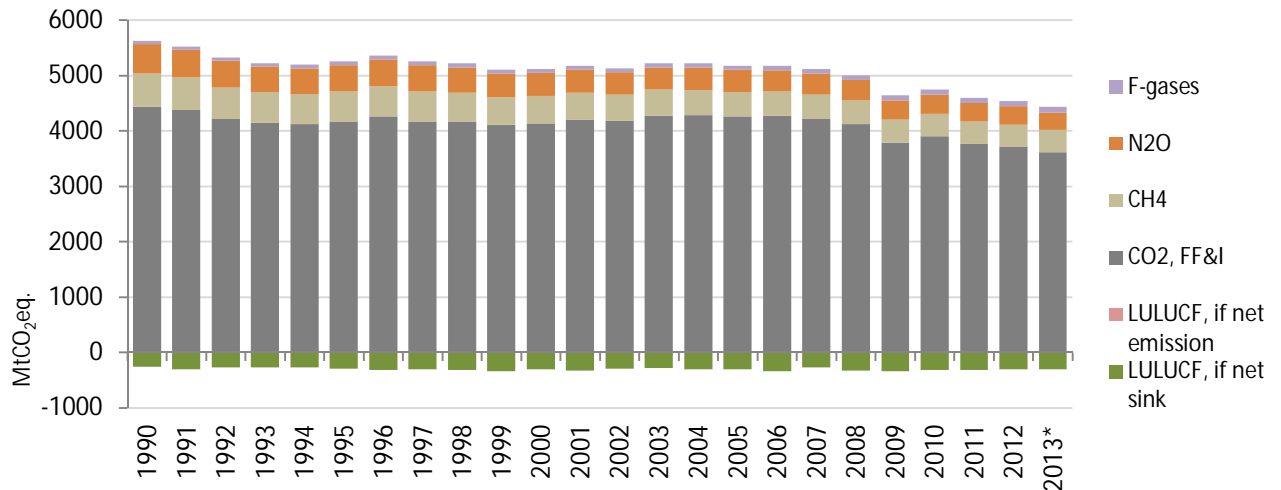


Figure 11. EU's greenhouse gas emissions from 1990 to 2013. Emissions at 2013 are preliminary.

EU's pledge for 2020 is to reduce emissions 20% from 1990. EU achieved this target already at 2009. EU has decided to reduce emissions 40% below 1990 emissions by 2030 in the 2030 energy and climate framework.

In this assessment, we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) EU reference 2013 scenario, 2) EU low carbon scenario, 3) 3.7 W scenario from the Asian Modelling Exercise and 4) 2.6 W scenario from the Asian Modelling Exercise.

Figure 12 shows the estimated development of EU's GHG emissions under current legislation. The estimates start from 2010, but from 2011 to 2013, emissions have decreased faster than in the reference scenario.

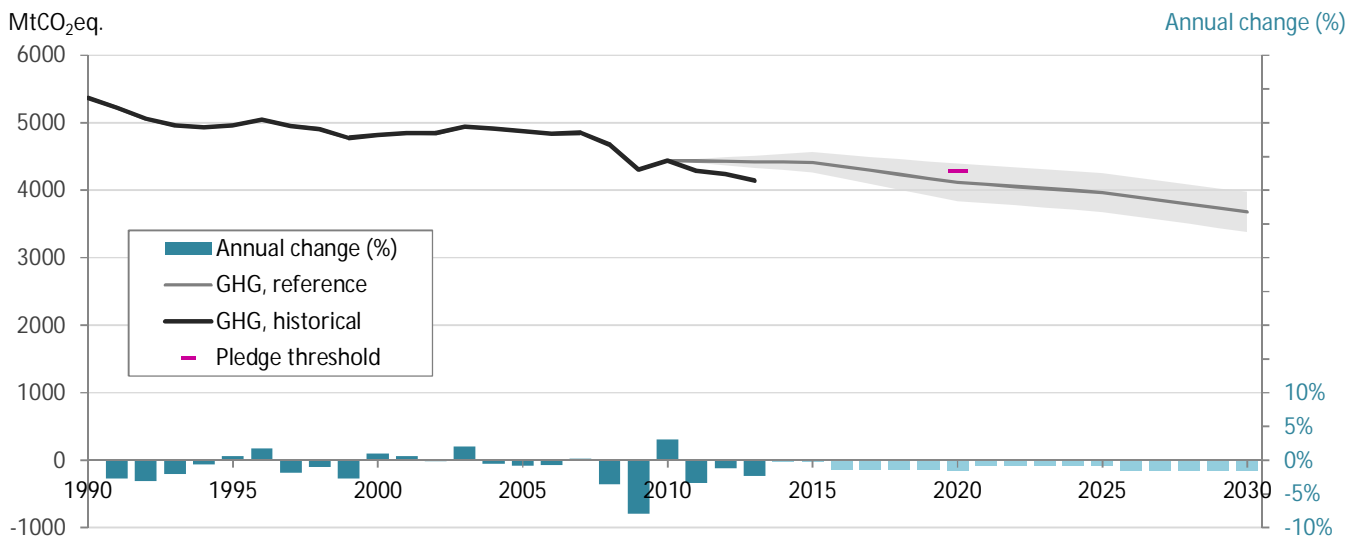


Figure 12. EU's GHG emissions from 1990 to 2013, estimated development up to 2030 with current legislation and pledge threshold at 2020.

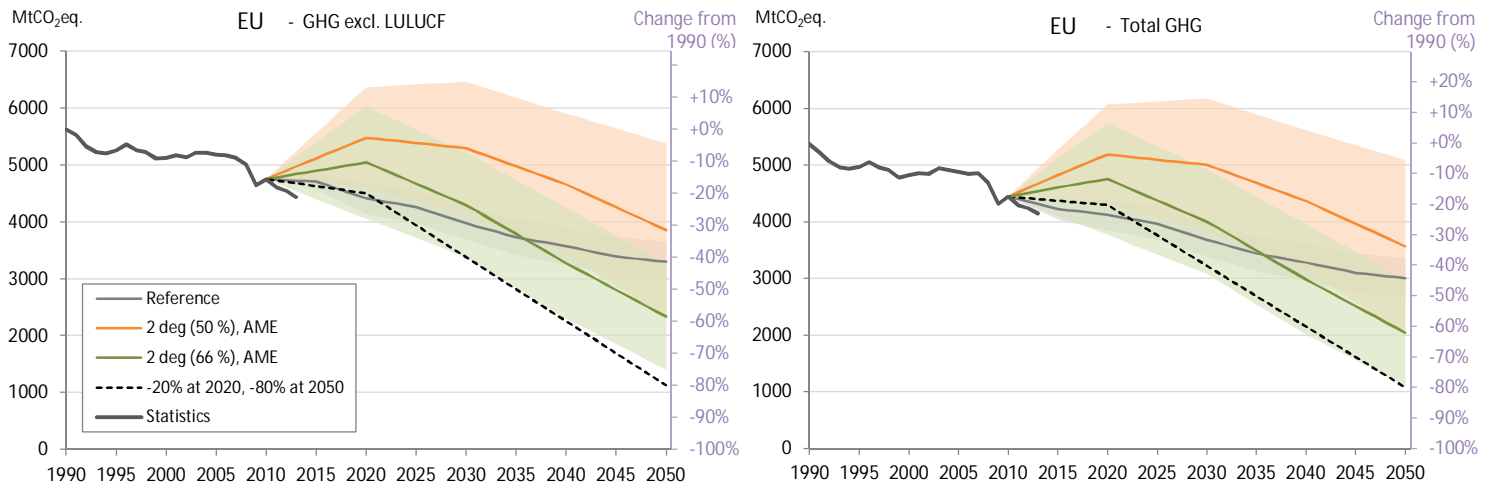


Figure 13. Estimate of EU's a) GHG emission excluding LULUCF and b) total GHG emissions from 1990 to 2050 in four different scenarios.

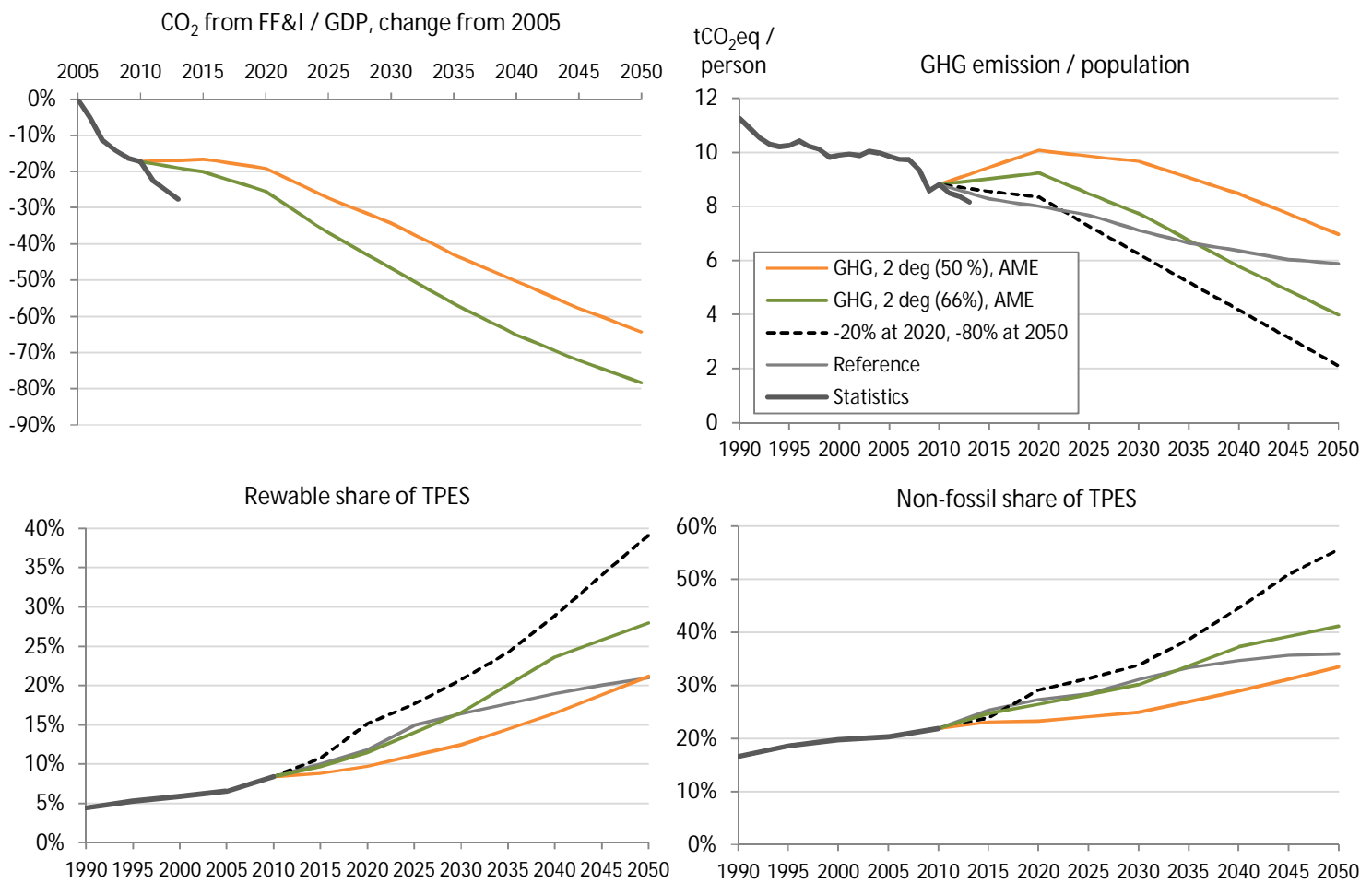


Figure 14. EU's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES.

## 4.5 India

Figure 15 shows the India's greenhouse gas emissions from 1990 to 2013. The total emissions are growing rapidly, about 4.5 % annually from 2000 to 2013.

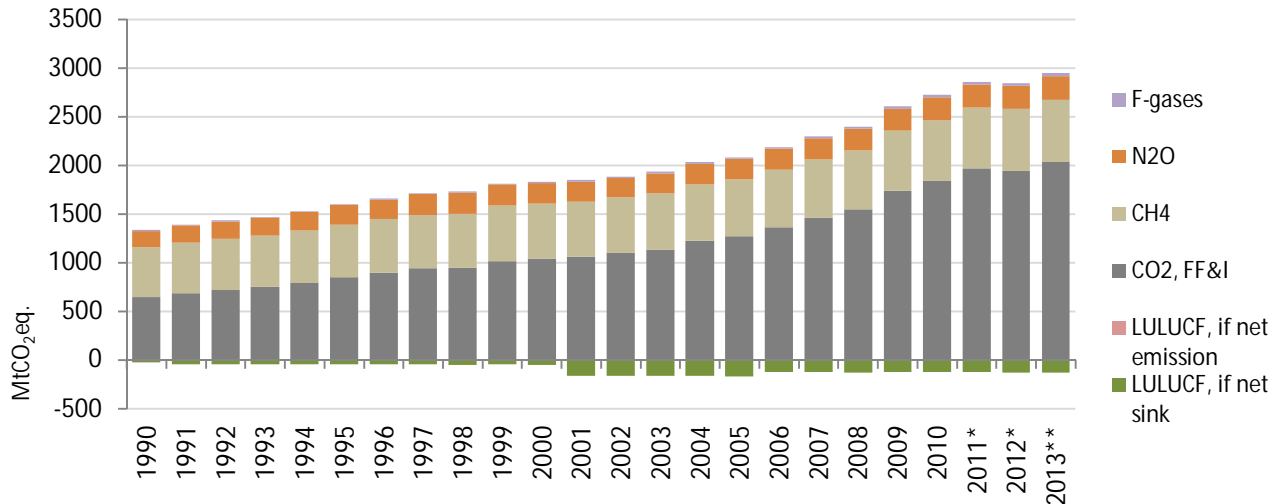


Figure 15. India's greenhouse gas emissions from 1990 to 2013. F-gas emissions from 2011 to 2013 are preliminary. All emissions from 2013 are preliminary.

India's pledge for 2020 is to reduce its greenhouse gas intensity 20% to 25% compared to 2005 value. India defines greenhouse gas intensity as greenhouse gas emissions excluding agriculture and LULUCF and compares the remaining emissions to GDP.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) Official projection of GHG emission development up to 2020 extrapolated with data from Asian Modelling Exercise (AME), 2) 3.7 W scenario from the AME and 4) 2.6 W scenario from the AME.

Figure 16 compares the estimated development of emissions and the estimated pledge at 2020. India's emissions are projected to increase steadily and remain below the emission level resulting from the pledge. The recent increase of emissions has been slower than estimated.

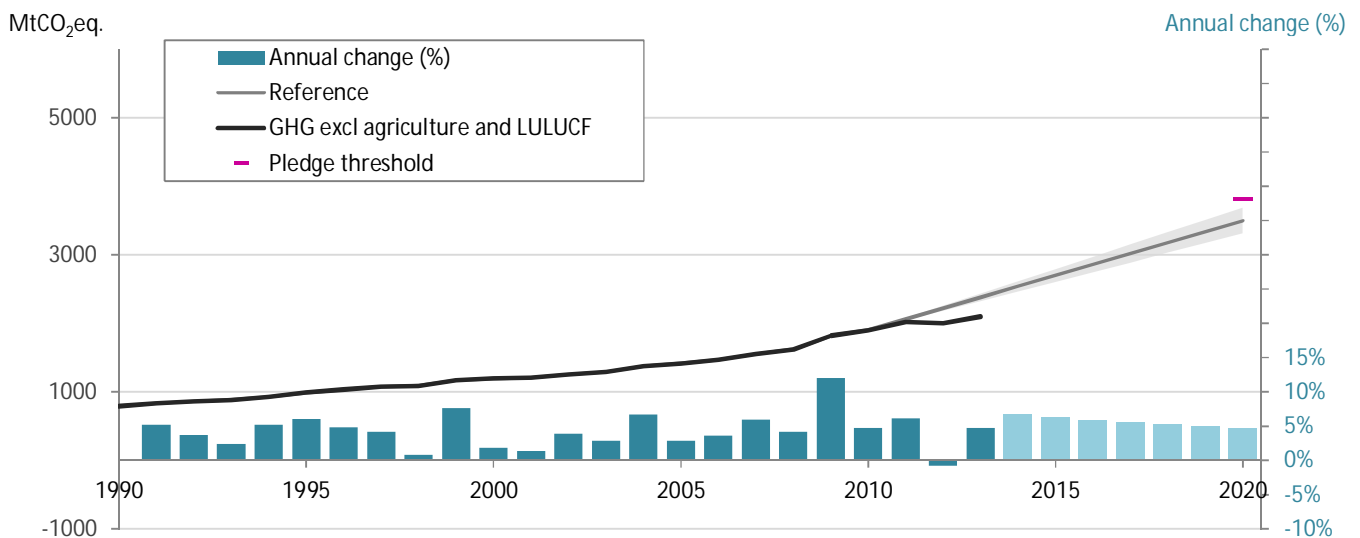


Figure 16. India's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and pledge threshold at 2020. Estimates exclude emissions from agriculture and LULUCF.



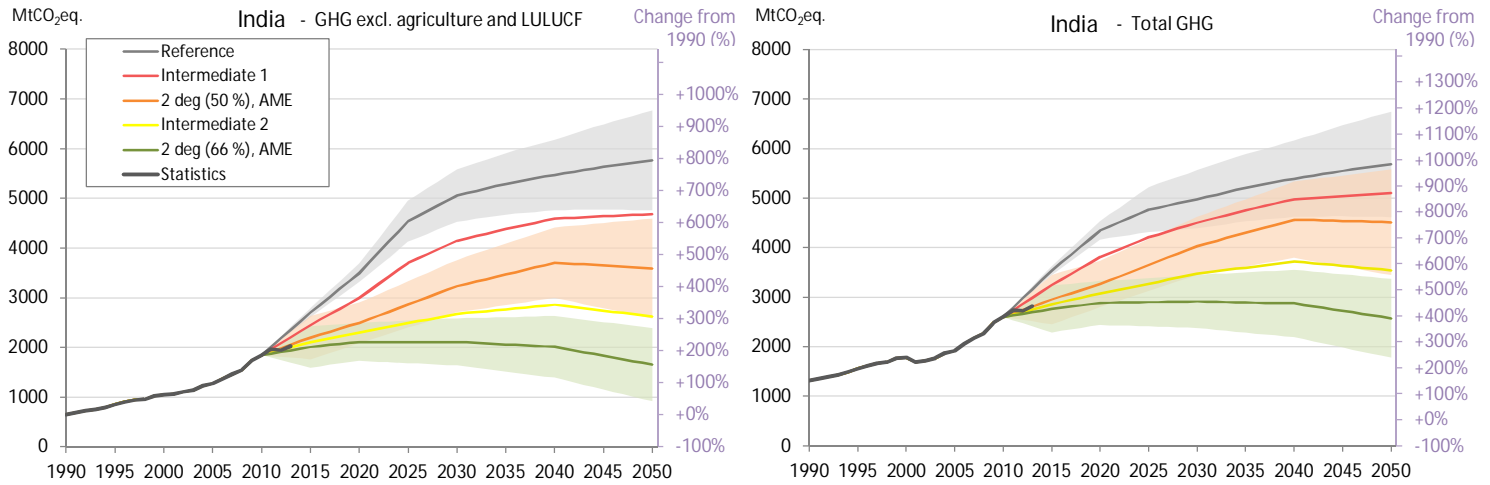


Figure 17. Estimate of India's a) GHG emissions excluding agriculture and LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios. The reference is an official estimate up to 2020 and after that the trend is extrapolated with AME data. Compared to 1990 emissions, India's emissions may increase significantly.

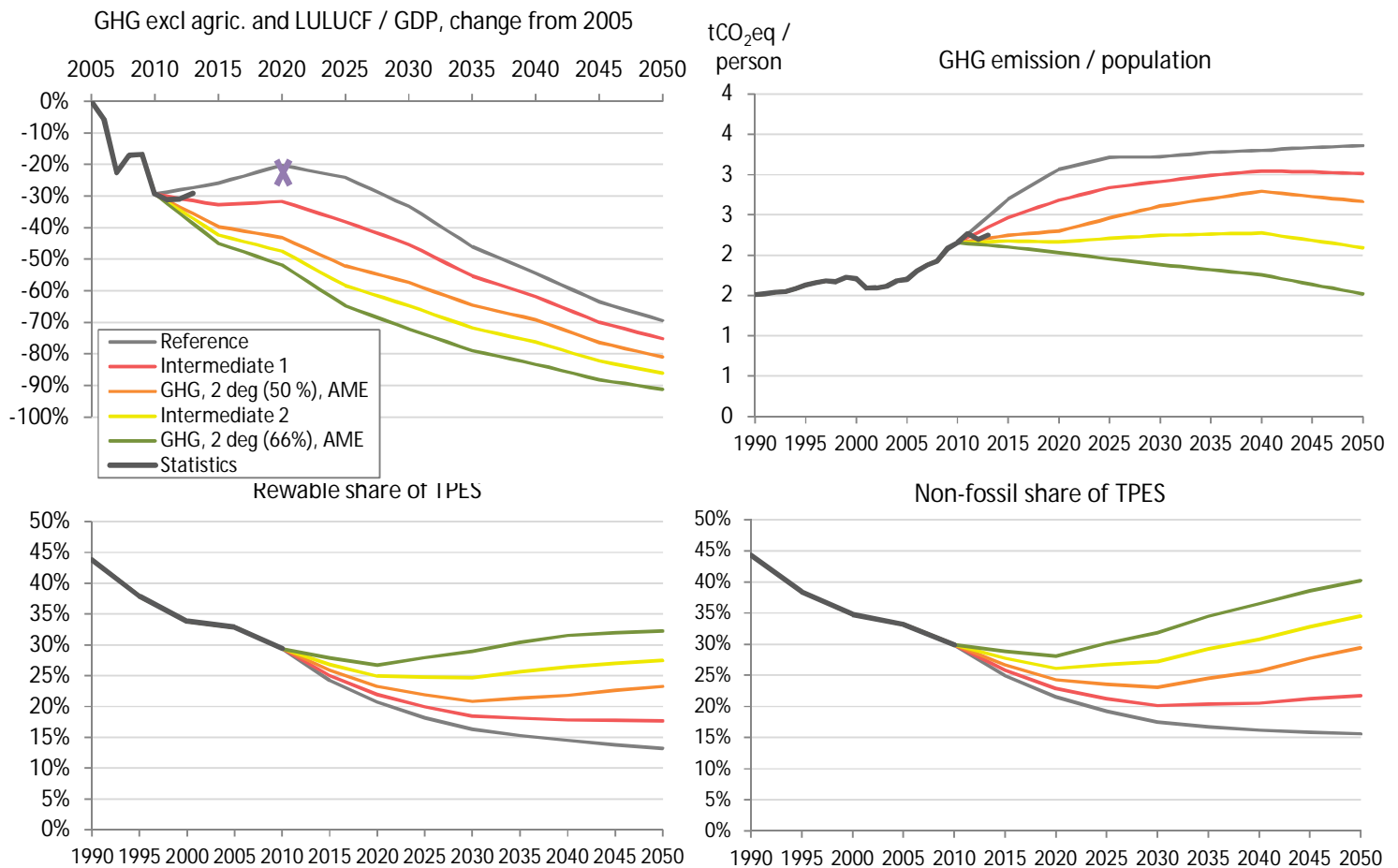


Figure 18. India's a) GHG emissions excluding agriculture and LULUCF per GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES. Purple X marks the India's pledge for 2020. India seems to be on track to meet its current pledge.

## 4.6 Indonesia

Figure 19 shows the Indonesia's greenhouse gas emissions from 1990 to 2013. Majority of emissions arise from LULUCF sector. The amount of LULUCF emissions have been increasing since 1990, but the annual amount vary much from year to year.

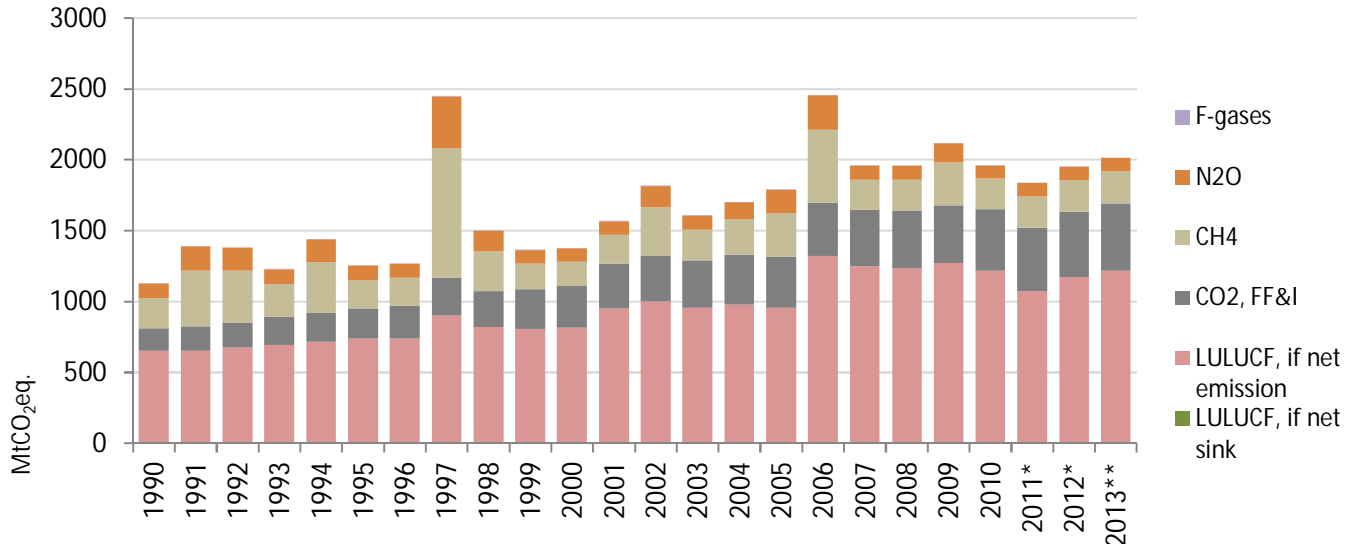


Figure 19. Indonesia's greenhouse gas emissions from 1990 to 2013. F-gas emissions from 2011 to 2013 are preliminary. All emissions at 2013 are preliminary.

Indonesia pledged to reduce GHG emissions unconditionally 26% below business as usual (BAU) development by 2020 and conditionally 41% by 2020. The official estimate is that this would equal total emissions of 2185 MtCO<sub>2</sub>eq at 2020. Estimates include LULUCF.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) Development under current legislation (reference scenario) based on estimates from UNEP emission gap 2014 and Asian Modelling Exercise (AME), 2) 3.7 W scenario from the AME and 4) 2.6 W scenario from the AME. In each scenario, we assume that LULUCF emissions stay at the 2010 levels.

Figure 20 compares the estimated development of emissions to 2020 pledge threshold. Estimated development has large uncertainties due to annual fluctuations and policy assumptions.

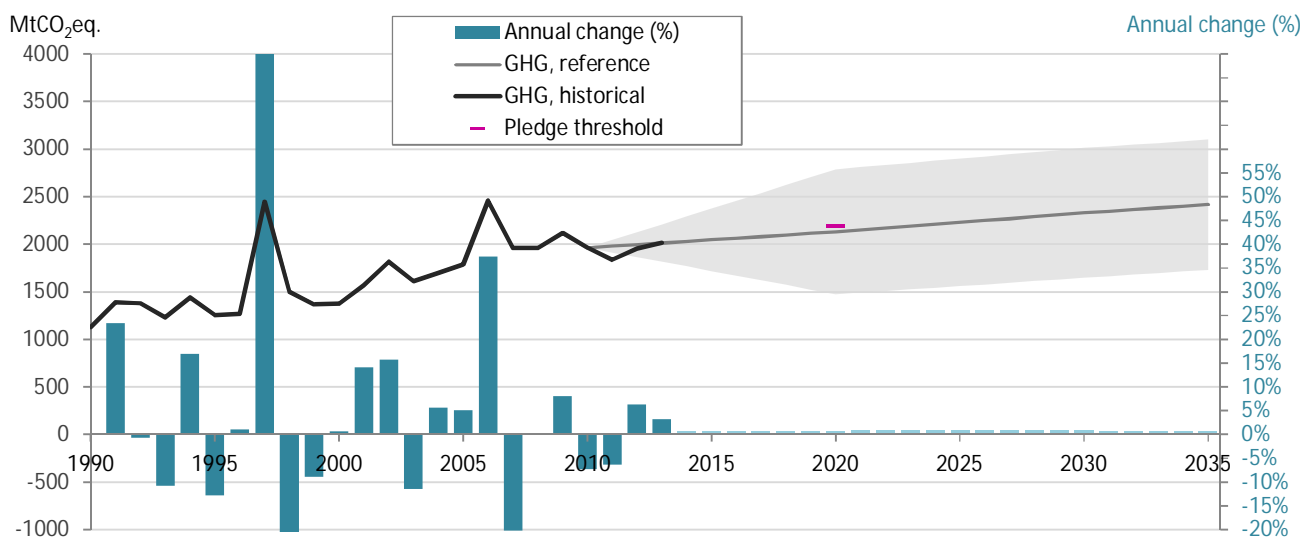


Figure 20. Indonesia's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and pledge threshold at 2020. Estimates include LULUCF emissions.

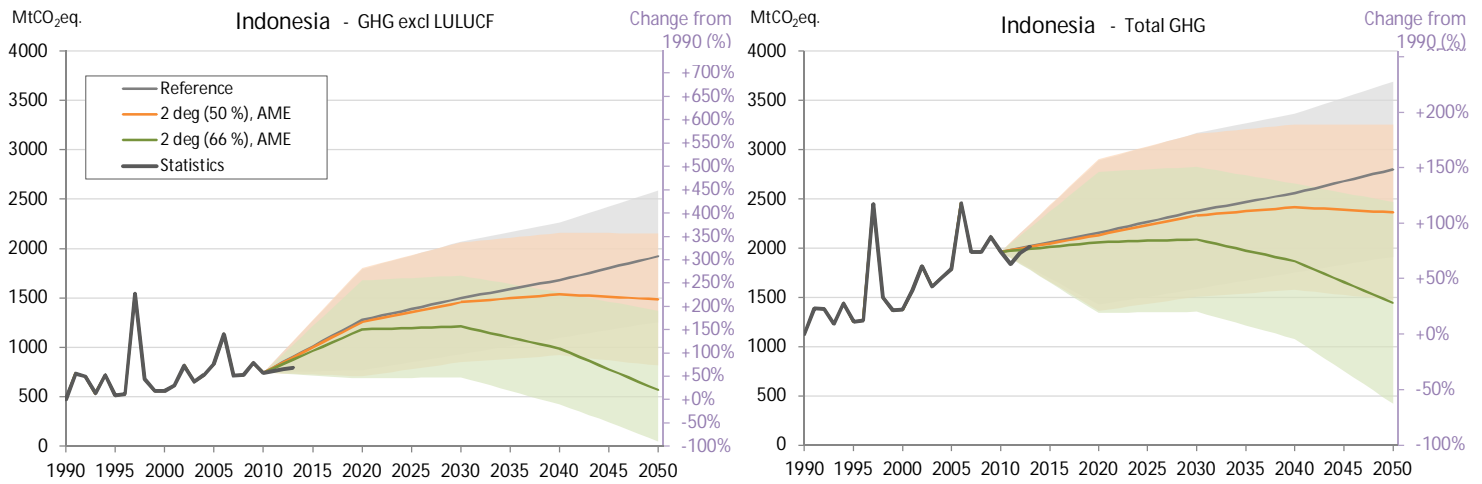


Figure 21. Estimate of Indonesia's a) GHG emissions excluding LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios. LULUCF emissions are estimated to remain at current levels.

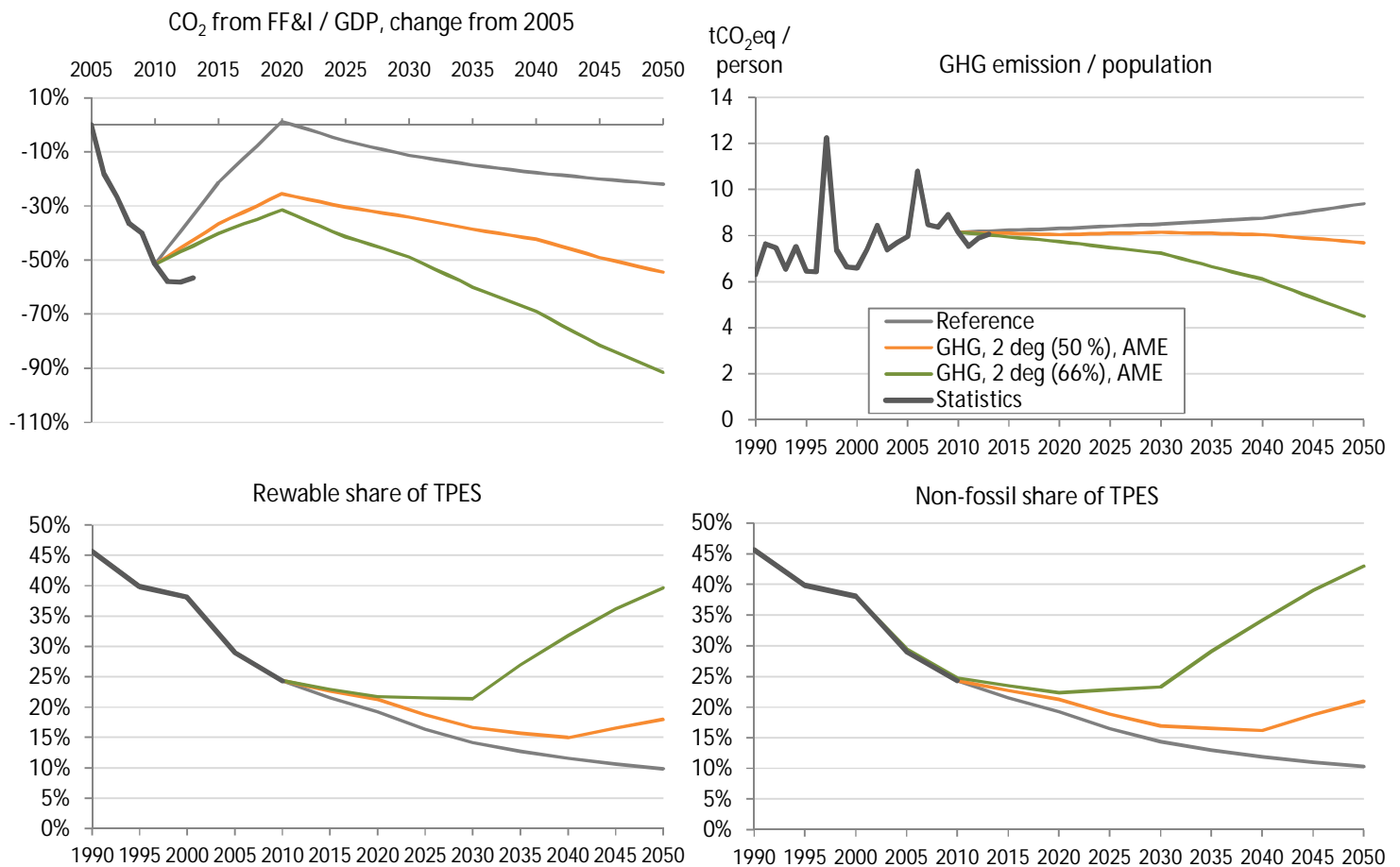


Figure 22. Indonesia's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES.

## 4.7 Brazil

Figure 23 shows the Brazil's greenhouse gas emissions from 1990 to 2013. Also in the Brazil, majority of emissions come from the LULUCF sector. Brazil has managed to reduce the LULUCF emissions, but the amount of other emissions has been increasing steadily.

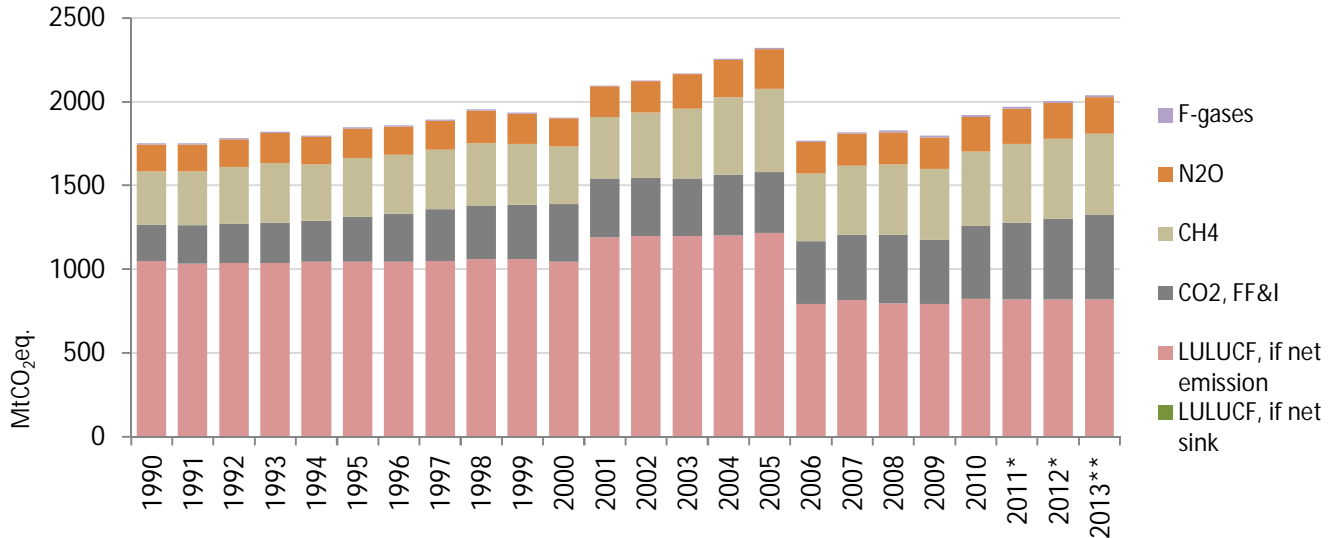


Figure 23. Brazil's greenhouse gas emissions from 1990 to 2013. F-gas emissions from 2011 to 2013 are preliminary. All emissions at 2013 are preliminary.

Brazil pledged to reduce GHG emissions 37% below business as usual (BAU) development by 2020. The official estimate is that this would equal total emissions of 2070 MtCO<sub>2</sub>eq at 2020. Estimates include LULUCF.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) Reference scenario based on estimates from UNEP emission gap 2014 and Asian Modelling Exercise (AME), 2) 3.7 W scenario from the AME and 4) 2.6 W scenario from the AME. In each scenario the LULUCF emissions were assumed to stay at 2010 levels.

Figure 24 compares the estimated development of emissions in the reference scenario to the estimated pledge threshold for 2020. The current estimate is that emissions would be about at the level of the pledge, but the estimate of the development of the LULUCF emissions required update.

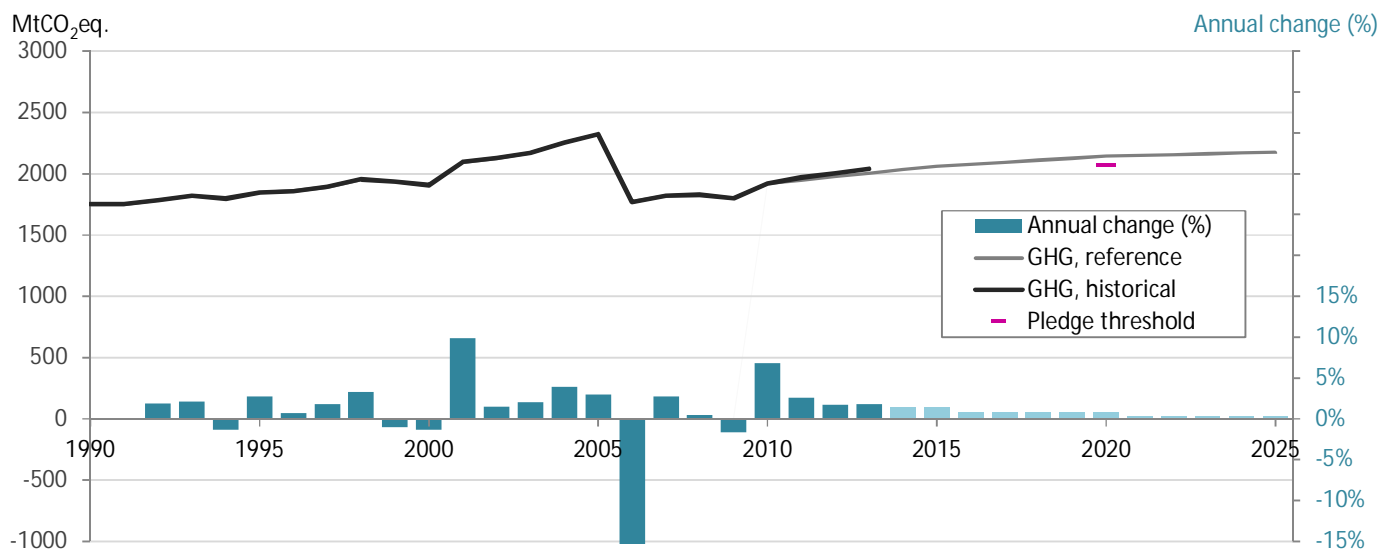


Figure 24. Brazil's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and pledge threshold at 2020. Estimates include LULUCF emissions.

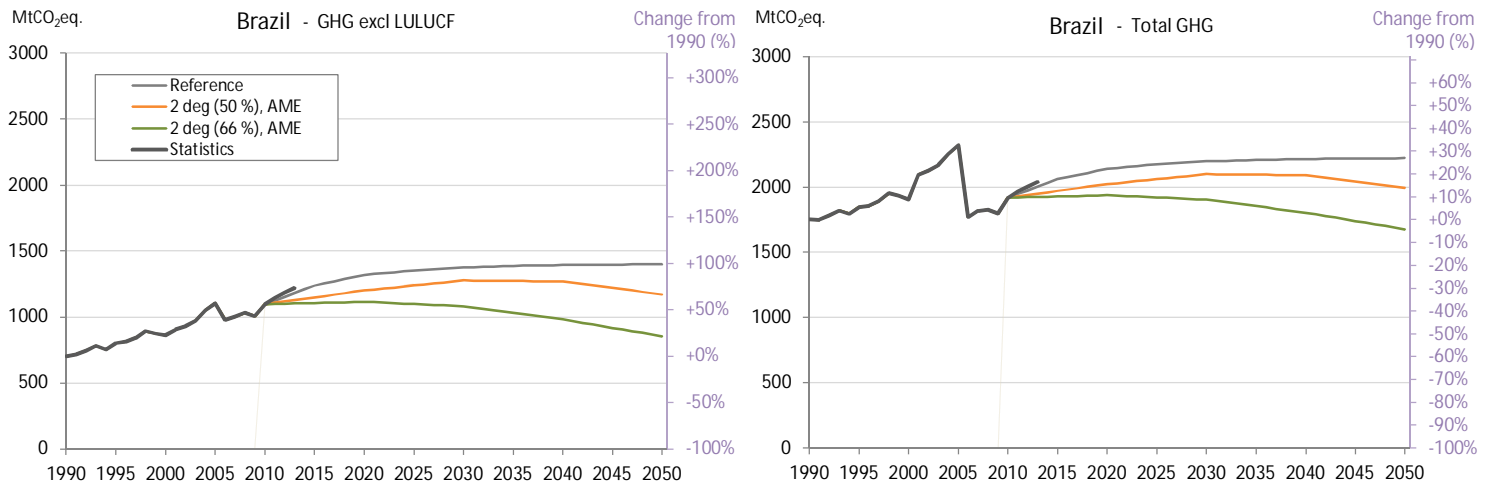


Figure 25. Estimate of Brazil's a) GHG emissions excluding LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios.

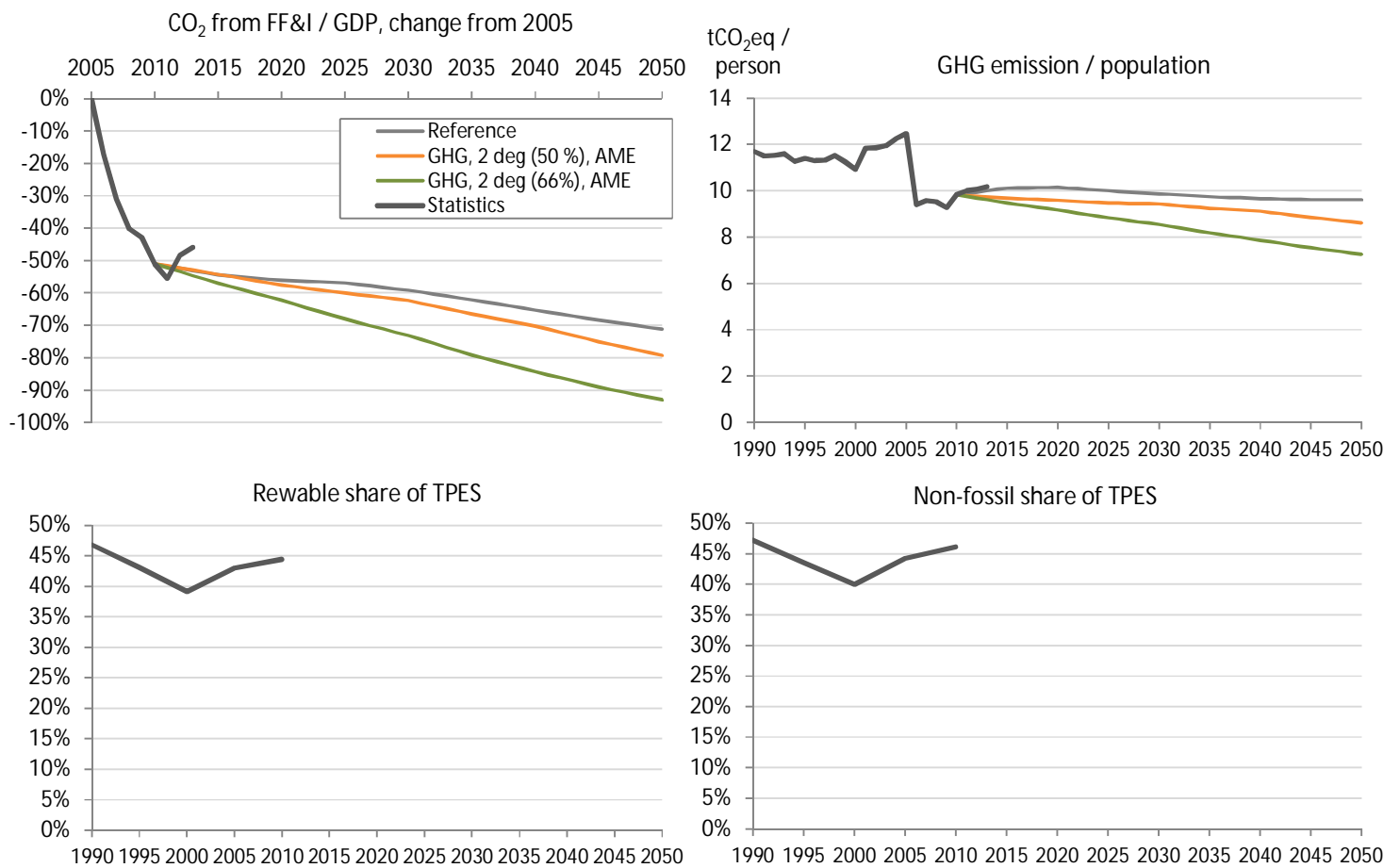


Figure 26. Brazil's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES.

## 4.8 Russia

Figure 27 shows the Russia's greenhouse gas emissions from 1990 to 2013. Russia's emissions decreased sharply at the beginning of 1990s after the collapse of the Soviet Union. This also reduced the amount of forest used in industry and currently, the Russia's forest stock is growing rapidly.

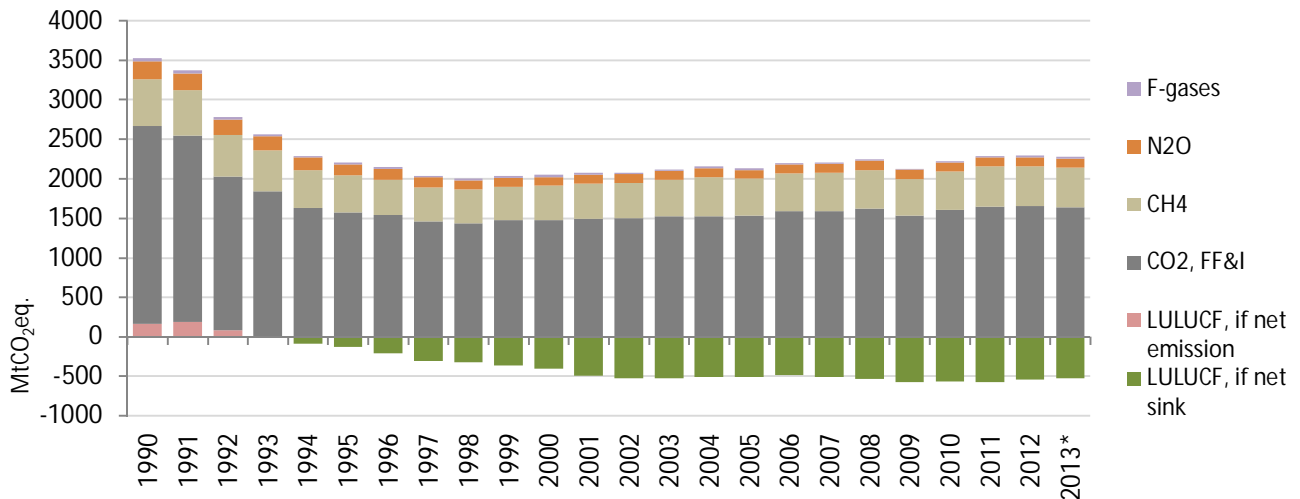


Figure 27. Russia's greenhouse gas emissions from 1990 to 2013. Emissions at 2013 are preliminary.

Russia's pledge for 2020 is to unconditionally reduce GHG emissions 15% below 1990 emissions and conditionally 25% below 1990 emissions. Russia's Copenhagen pledge includes conditional emission reduction of 50% below 1990 emissions by 2050. In February 2014, Russia started an action plan to establish measures to reduce emissions 75% below 1990 level by 2050.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) April 2014 study of GHG development under current legislation (reference)<sup>28</sup>, 2) Scenario for CO<sub>2</sub> from the same study and 3) linear trajectory to -75% compared to 1990 by 2050.

Figure 28 compares the pledge and estimated development of emissions under current legislation. Russia's emissions are likely to increase slightly, but not reach the pledge threshold for 2020.

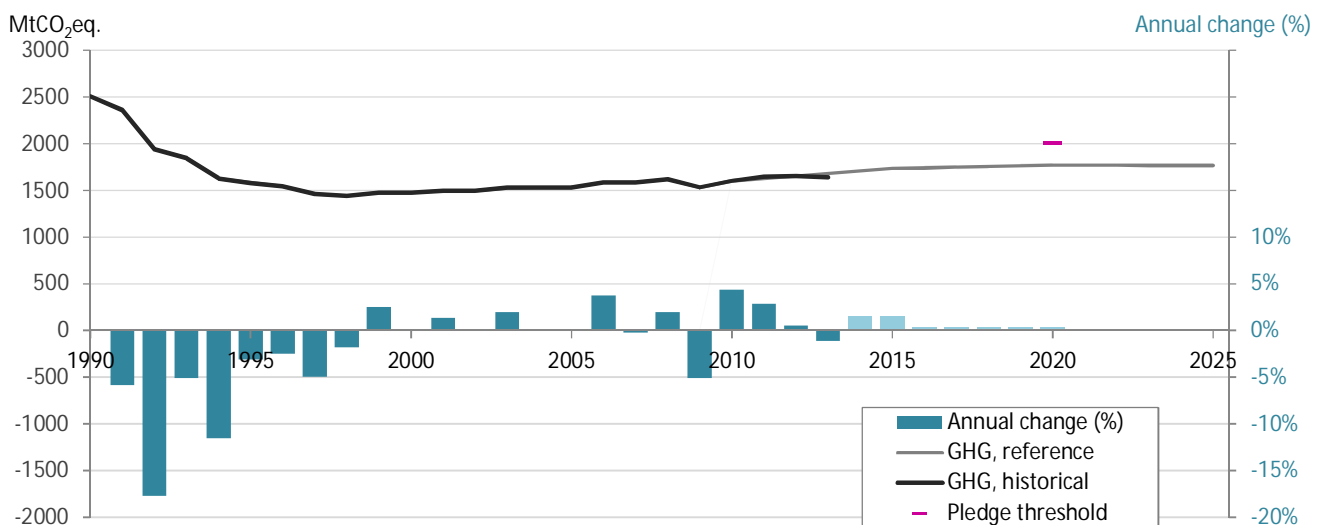


Figure 28. Russia's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and pledge threshold at 2020. Estimates include LULUCF emissions.

<sup>28</sup> Russia's Greenhouse Gas Target 2020 - Projections, Trends, and Risks; <http://library.fes.de/pdf-files/id-moe/10632.pdf>

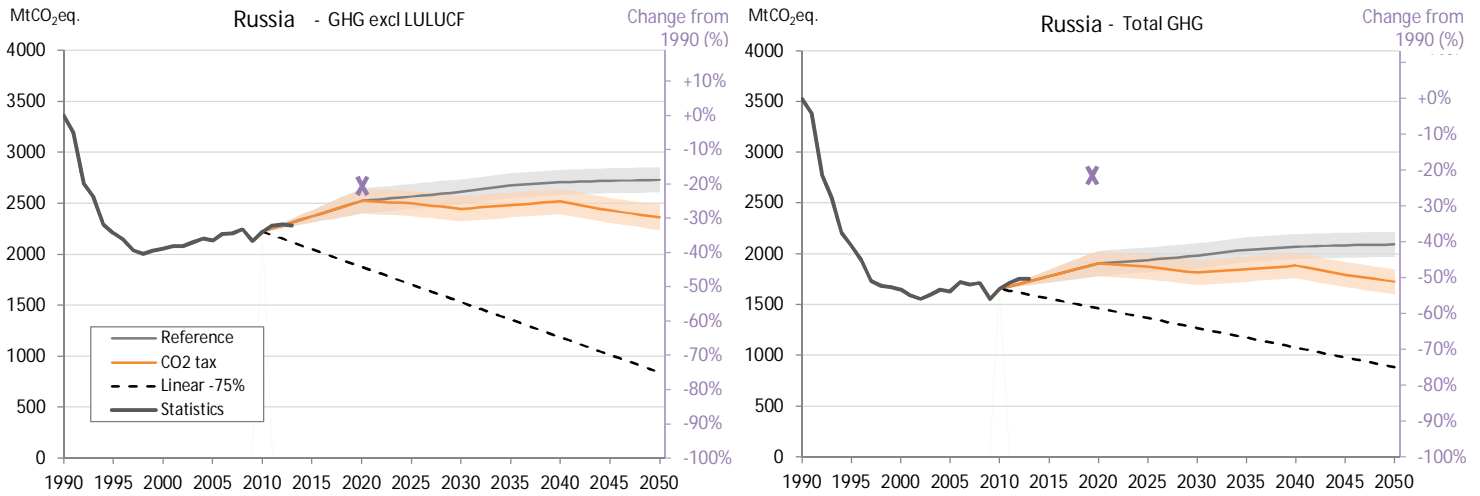


Figure 29. Estimate of Russia's a) GHG emissions excluding LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios. Purple 'X's mark the pledge threshold for Russia. The left picture is calculated without LULUCF and the right picture is calculated with LULUCF.

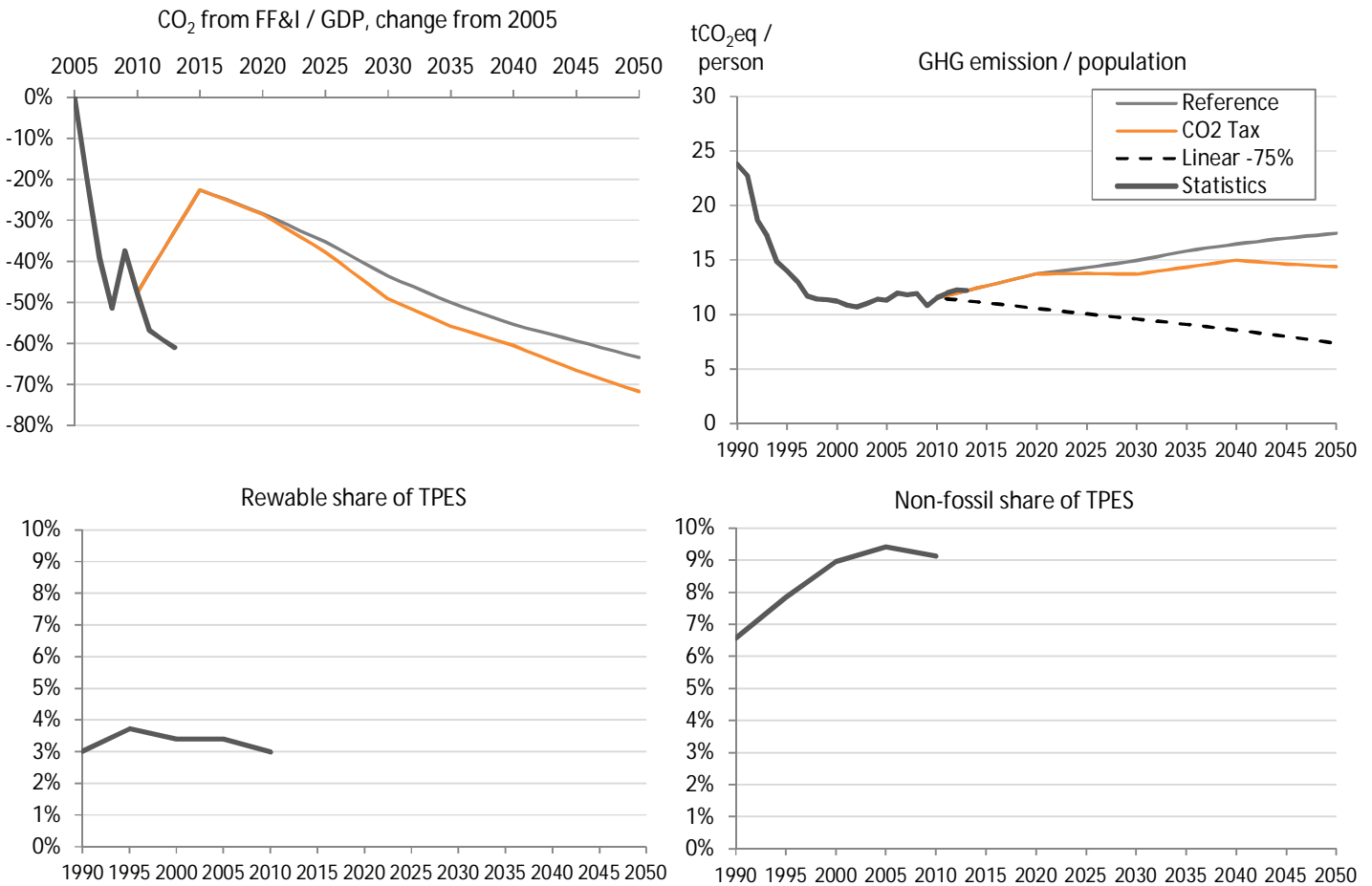


Figure 30. Russia's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita, c) renewable energy share of total primary energy supply (TPES) and d) share of renewable and nuclear (non-fossil) of TPES. There was no detailed energy data available with scenarios.

## 4.9 Japan

Figure 31 shows the Japan's greenhouse gas emissions from 1990 to 2013. The share of CO<sub>2</sub>-emissions is higher than in other countries studied here. Japan's emissions have grown from since 2009, which is two years prior Fukushima accident.

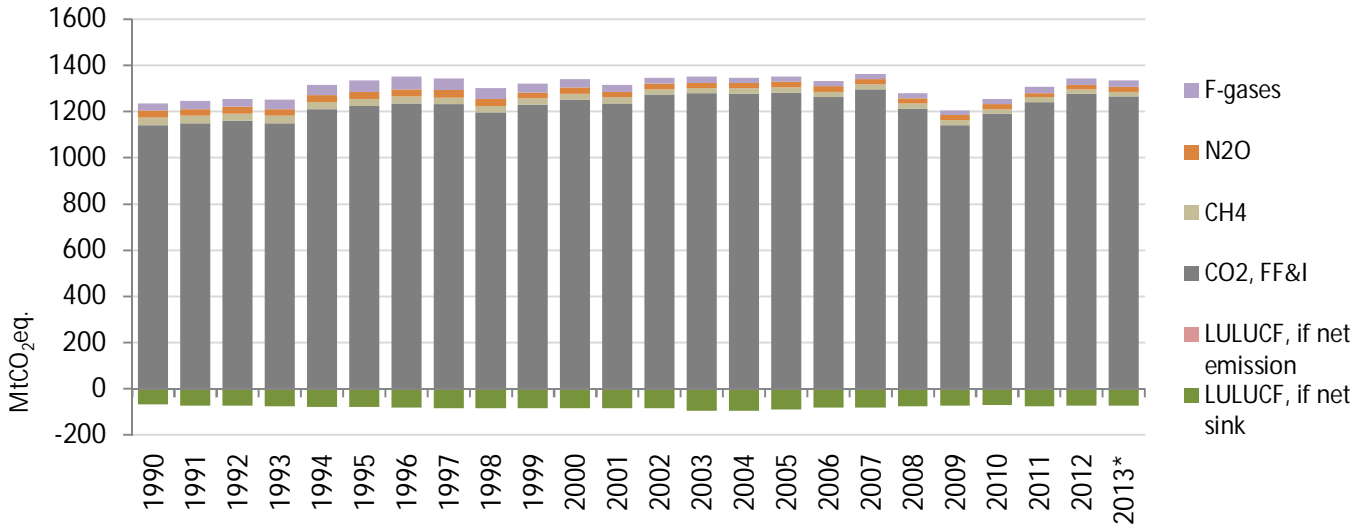


Figure 31. Japan's greenhouse gas emissions from 1990 to 2013. Emissions at 2013 are preliminary.

Japan updated its pledge after the Fukushima accident to reduce emissions 3.8% below 2005 emissions by 2020. Japan may review its pledge second time following further review of energy policy. In the original Copenhagen pledge, Japan pledged to reduce emissions 60% to 80% below 2005 emissions by 2050.

In this assessment we use the following GHG scenarios to estimate the development of GHG emissions up to 2050: 1) reference scenario from Emission Gap 2014 report and Asian Modelling Exercise (AME), 2) 3.7 W scenario from the AME and 4) 2.6 W scenario from the AME. Figure 32 compares the estimated development of emissions and Japan's revised pledge.

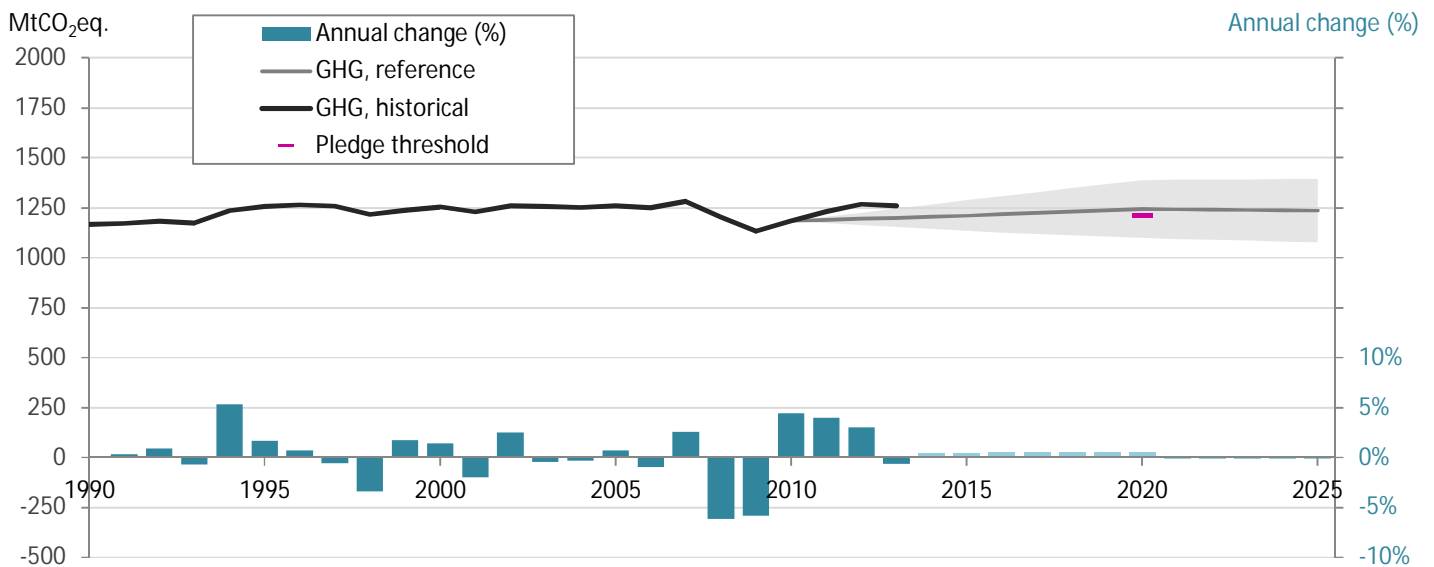


Figure 32. Japan's GHG emissions from 1990 to 2013, estimated development up to 2025 under current legislation and revised pledge threshold at 2020. Estimates include LULUCF emissions.



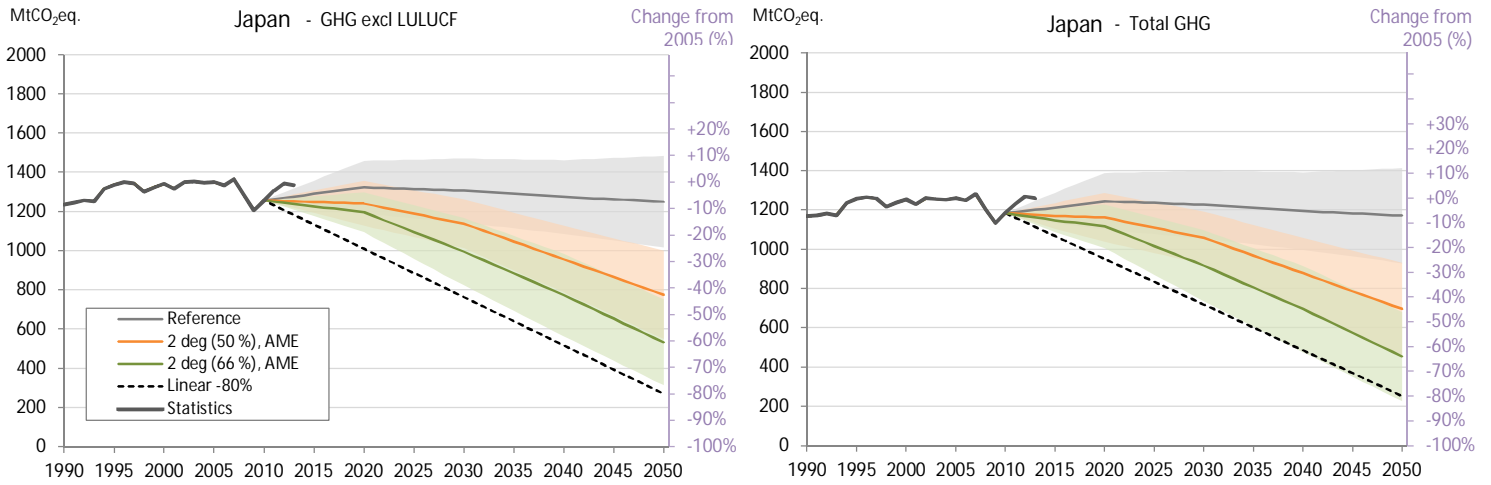


Figure 33. Estimate of Japan's a) GHG emissions excluding LULUCF and b) total GHG emissions from 1990 to 2050 in different scenarios.

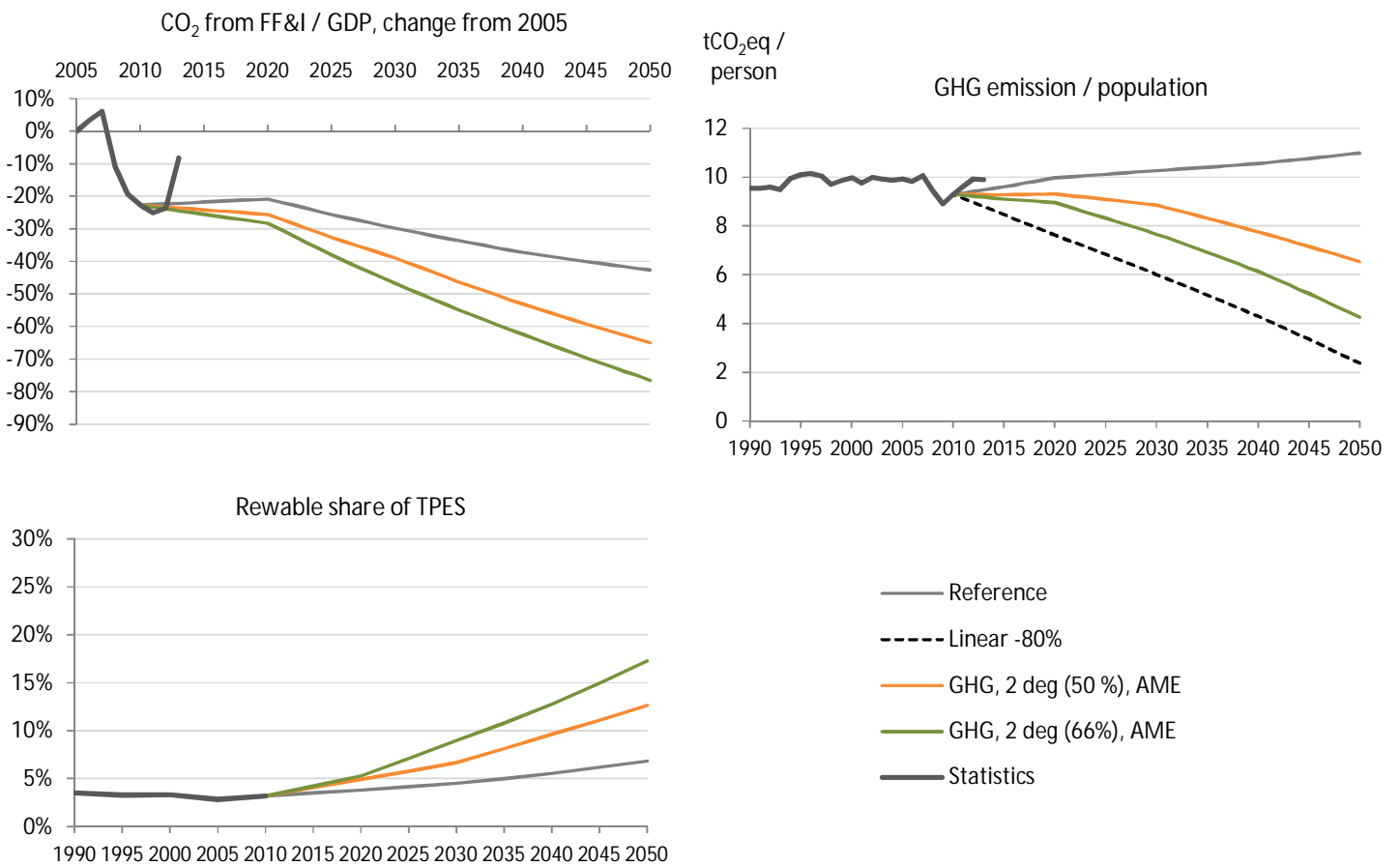


Figure 34. Japan's a) CO<sub>2</sub> emissions / GDP compared to 2005 value, b) greenhouse gas emissions per capita and c) renewable energy share of total primary energy supply (TPES).

## 4.10 Rest of the World

Figure 35 shows the emissions of all the rest of the world from 1990 to 2012. Largest 8 emitters correspond roughly two thirds of global emissions and all the remaining 200 countries emit roughly one third of global emissions.

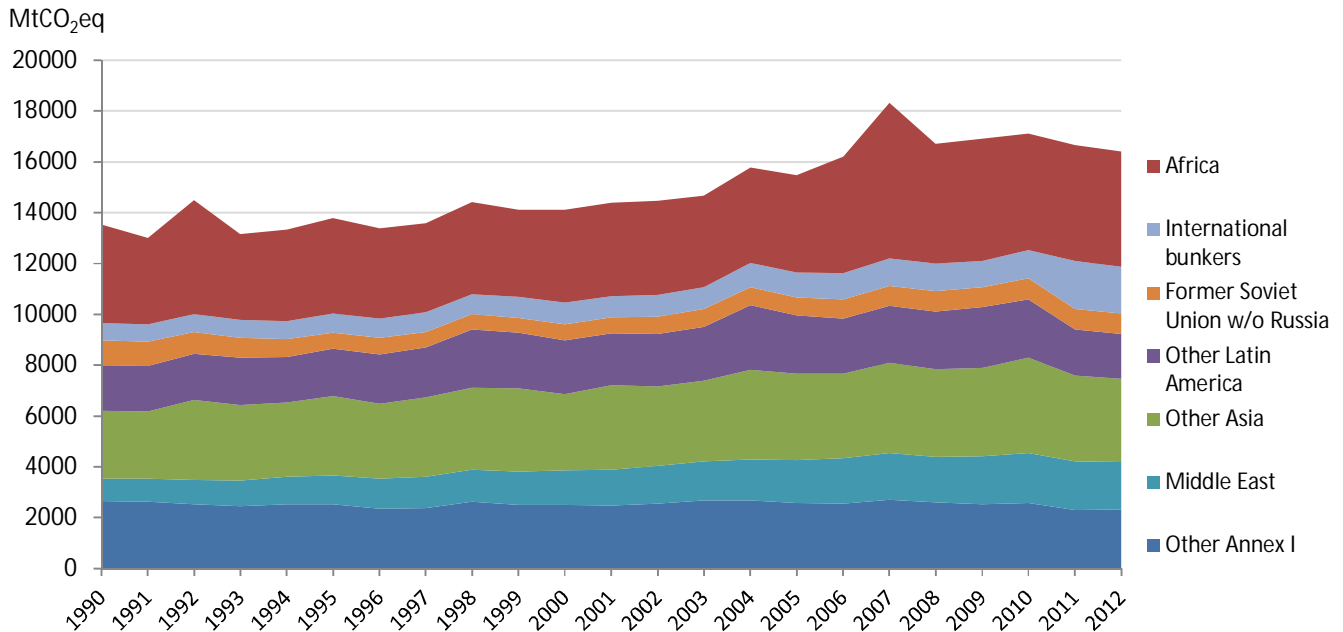


Figure 35. Total greenhouse gas emissions of the rest of the world from 1990 to 2012.

This chapter covers a large range of countries from developed countries such as Australia and Canada (in other Annex I group) to poor African countries and to tiny islands from Caribbean (in other Latin America). Additionally, emissions from international bunkers are included to cover the remaining GHG emissions. Pledges from these countries have been summarized in chapter 3.2.

To maintain a comparable approach with analysis of 8 biggest emitting countries, we used similar scenarios to estimate the development of the GHG emissions of this country group. Table 4 summarizes the assumptions which were used to form three mitigation scenarios. The ambitious scenario is slightly tighter than the current 2050 pledges for Other Annex I and former Soviet Union countries.

Table 4. A list of assumptions used to build three GHG mitigation scenarios for rest of world in this study. We assumed that the emissions of each country group would follow the development of the most similar big country studied in detail.

	Level of ambition		
	Reference	Moderate action	Ambitious
Other Annex I	as USA reference	As USA 2.6 W	Linear -80%
Africa	Current trend extrapolated	Saturation at 2020 levels	1990 emissions at 2050
Other Asia	As India reference	As India 3.7W	As India 2.6W
Other Latin America	As Brazil reference	as Brazil 3.7W	as Brazil 2.6W
Middle East	Current trend extrapolated	Saturation at 2020 levels	1990 emissions at 2050
Former Soviet Union w/o Russia	As Russia reference	As Russia CO <sub>2</sub> tax	Linear -75%
Bunker	Current trend extrapolated	Saturation at 2020 levels	2005 emissions at 2050

Figure 36 presents the total emissions of rest of the world from 1990 to 2050. Figures include LULUCF. Total emissions decrease only 20% from the 1990 levels in the ambitious scenario, because the share of non-Annex I emissions is high. Emissions remain at relatively high level especially in Africa and Other Asia.

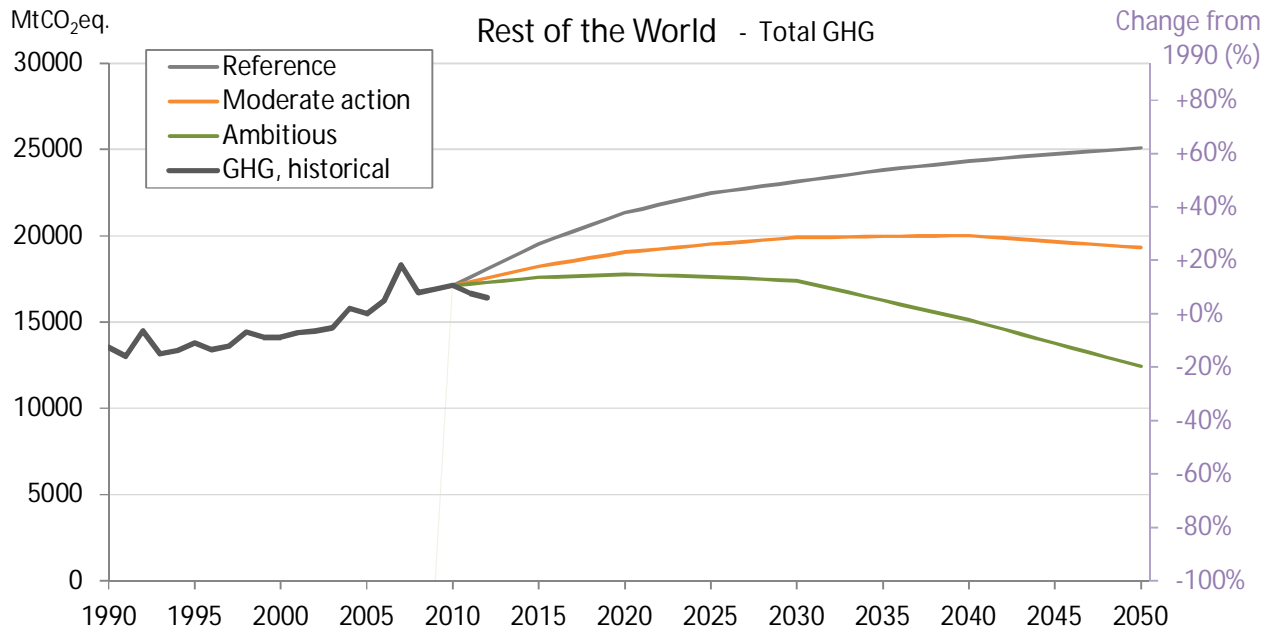


Figure 36. Total greenhouse gas emissions of the rest of the world from 1990 to 2050 in three different mitigation scenarios.

## 5. Comparing the mitigation scenarios and 2 degree pathways

Table 5 presents three global GHG mitigation scenarios based on the country-level assessments in previous chapter. The first scenario is a reference scenario which projects how emissions could develop with current legislation and level of ambition. The second scenario consists of moderate action at country level. The last scenario is ambitious scenario where most countries do more than their current pledges for 2020, 2030 and 2050 are.

Table 5. A list of chosen sub-scenarios chosen to build three global GHG mitigation scenarios.

	Level of ambition		
	Reference	Moderate action	Ambitious
China	Reference	3.7W	2.6W
USA	Reference	2.6W	Linear -80%
EU	Reference	Reference up to 2030, 2.6W from '30 to '50 <sup>1)</sup>	Linear -83%
India	Reference	3.7W	2.6W
Russia	Reference	CO <sub>2</sub> tax	Linear -75%
Indonesia	Reference	3.7W <sup>2)</sup>	2.6W <sup>2)</sup>
Brazil	Reference	3.7W <sup>2)</sup>	2.6W <sup>2)</sup>
Japan	Reference	2.6W	Linear -80%
Other Annex I	as USA reference	As USA 2.6 W	Linear -80%
Africa	Current trend extrapolated	Saturation at 2020 levels	1990 emissions at 2050
Other Asia	As India reference	As India 3.7W	As India 2.6W
Other Latin America	As Brazil reference	as Brazil 3.7W	as Brazil 2.6W
Middle East	Current trend extrapolated	Saturation at 2020 levels	1990 emissions at 2050
Former Soviet Union w/o Russia	As Russia reference	As Russia CO <sub>2</sub> tax	Linear -75%
Intl. bunkers	Current trend extrapolated	Saturation at 2020 levels	2005 emissions at 2050

1) EU reference scenario has lower emissions than any other EU mitigation scenario at 2020. EU reference has lower emissions than AME 2.6W scenario until 2030. Chosen combination is stricter than either of the scenarios.

2) LULUCF emissions are assumed to remain at 2010 level both in Brazil and Indonesia.

Figure 37 has one emission graph for each scenario. Emissions are presented from 1990 to 2050 for each country group. Up to 2010 emissions are statistics and from 2010 to 2050 presented emission levels are based on projections.

Figure 38 compares the 2 degree pathways from chapter 2 to total GHG emissions from these three scenarios and to 'Current Pledges' scenario from Emission Gap 2014 report. Emission Gap report's Current pledges scenario is in between of this report's reference and Moderate action. The ambitious scenario would have a medium chance to achieve two degree target, but the emission levels from 2011 to 2013 are much above the required level.

Figure 39 compares the same scenarios to late action pathway to two degree target. In this scenario, there's only limited action before 2020 and effective climate reduction targets from 2020 to 2050. This scenario is roughly at the level of 'Moderate action' and 'Current pledges' until 2020. Recent emission development and reference scenario are at much higher level.

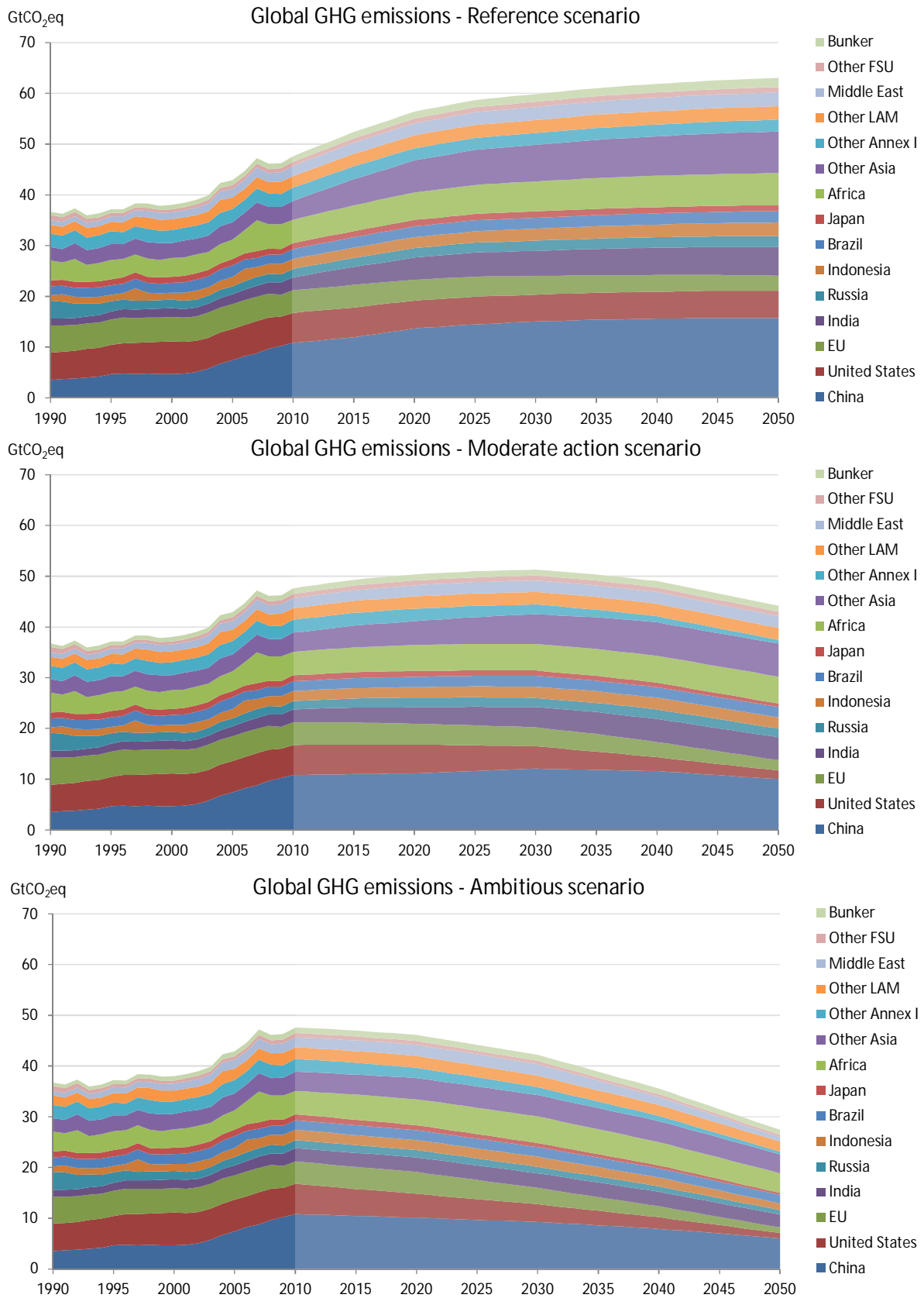


Figure 37. Total greenhouse gas emissions in a) reference scenario, b) moderate action scenario and c) ambitious scenario. Chosen sub-scenarios for each country and country group are presented in Table 5.

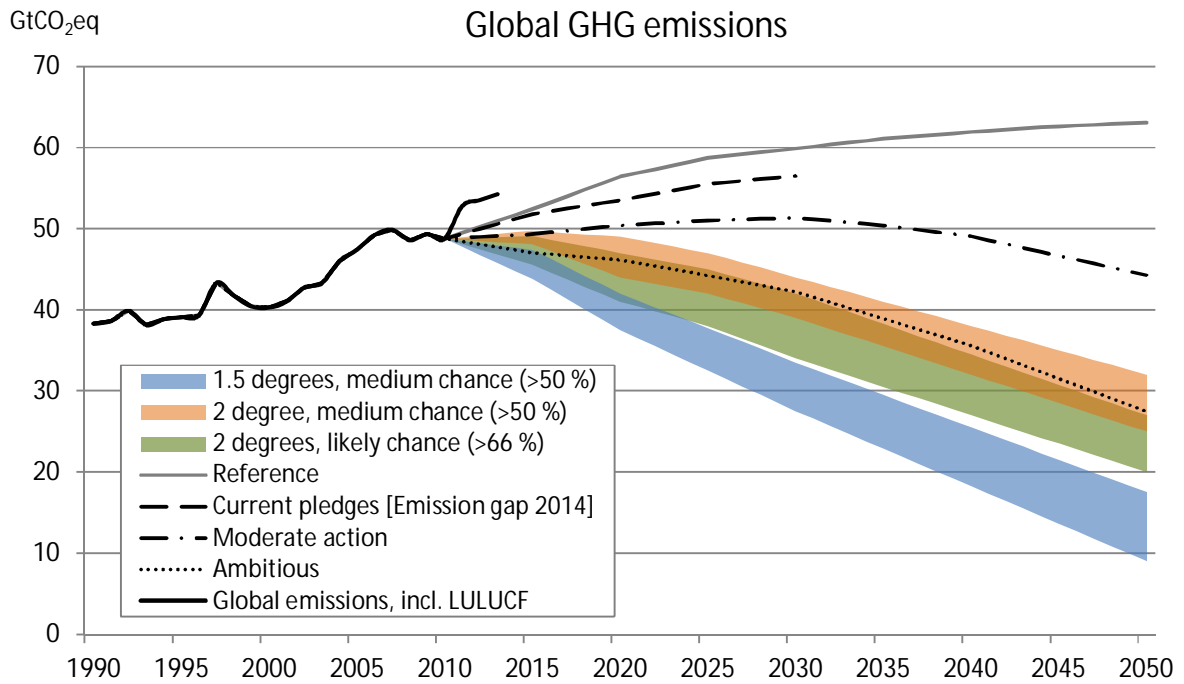


Figure 38. Four mitigation scenarios for global GHG emissions compared to emission reduction pathways for 2 degree target. GHG scenarios start from 2010 and statistics reach up to 2013. 2013 emissions are preliminary.

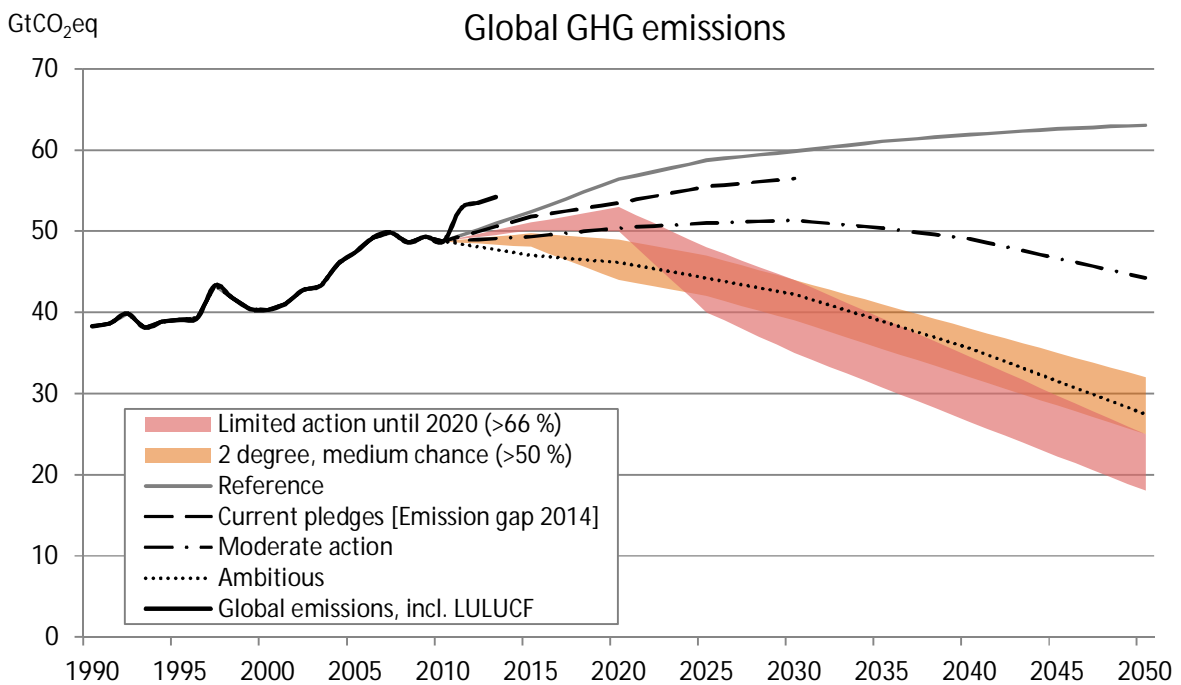


Figure 39. Four mitigation scenarios for global GHG emissions compared to late action emission reduction pathway and medium chance pathway for 2 degree target. GHG scenarios start from 2010 and statistics reach up to 2013. 2013 emissions are preliminary.

## 6. Summary and conclusions

### Paris 2015

The main international agreements to reduce global GHG emissions and mitigate the climate change have been the Kyoto Protocol from 1992, Copenhagen Accord from 2009 and the Cancun Agreement from 2010. The next major climate change agreement is the main target of the climate change negotiations in the Paris in December 2015.

### Intended Nationally Determined Contributions (INDCs)

In the Kyoto protocol, 38 countries agreed to adopt quantified economy-wide emission targets. Developing countries did not have quantified targets in the Kyoto protocol. In the Copenhagen Accord and Cancun Agreement, both developed and developing countries pledged to reduce emissions or do other corresponding mitigation actions such as reduce deforestation. In total 90 countries gave pledges.

Copenhagen pledges were hard to compare as they didn't have uniform structure, countries didn't originally submit all the necessary information to interpret the pledges and the pledges cover different emission sectors. During the following years, most of these details were sorted out and the estimate was that the Copenhagen pledges were not sufficient to achieve 2 degree target. UNEP publishes annually an update of emission gap between current development of emissions, pledges and 2 degree target emission reduction pathways.

On the road to the Paris climate negotiations, this process is slightly adjusted based on lessons learned. This time, countries should submit their INDCs 'well in advance'. Countries are also urged to submit quantified information on necessary details. China, USA and EU have already given preliminary indications on their INDCs. The first official INDCs are expected before the end of March 2015. UNFCCC will publish all submitted INDCs on an INDC portal and compile a summary report of submissions by the November 2015.

### Framework to compare pledges

This report gives a summary of Copenhagen pledges and already published preliminary pledges for Paris. It analyses GHG mitigation scenarios at country-level and gives a framework to compare preliminary pledges for Paris.

Table 6. Summary of pledges and quantification of pledges of 8 biggest GHG emitting countries

	2010 GHG emissions		Included GHGs	Pledge quantified (compared to 2005 GHG emissions) <sup>1)</sup>	
	GtCO <sub>2</sub> eq	Details of pledges and indicative INDCs		2020	2030
China	10.9	1) Reduce CO <sub>2</sub> intensity (CO <sub>2</sub> /GDP) -40 % ... -45 % compared to 2005. Includes CO <sub>2</sub> only from fossil fuels and industry. 2) Non-fossil share of primary energy to 15 %, 3) increase forest coverage by 40 Mha and 4) increase forest stock by 1.3 billion m <sup>3</sup> from 2005.	1st target: CO <sub>2</sub> from FF&I. Targets 2 to 4 are non GHG targets	+96%	2)
USA	5.9	Conditional: -17% from 2005 emissions by 2020, -26% to -28% by 2025, -42 % by 2030 and -80% by 2050.	all GHG	-17%	-26% ... -28%
EU	4.4	Unconditional: -20% from 1990 emissions by 2020, -40% by 2030. Conditional: -80% by 2050.	all GHG	-12%	-34%

	2010 GHG emissions GtCO <sub>2</sub> eq	Details of pledges and indicative INDCs	Included GHGs	Pledge quantified (compared to 2005 GHG emissions) <sup>1)</sup>	
				2020	2030
India	2.6	Conditional: decrease GHG intensity (GHG/GDP) from 20% to 25% below 2005 level	all GHG excluding agriculture and LULUCF	+99%	-
Indonesia	2.0	Unconditional: NAMAs resulting -26% from BAU. Conditional: -41% from BAU by 2020.	all GHG	+22%	-
Brazil	1.9	Conditional: NAMAs resulting -37% from BAU by 2020.	all GHG	-11%	-
Russia	1.7	Unconditional: -15% from 1990 emissions by 2020. Conditional: -25% by 2020 and -50% by 2050.	-15 %	+84%	-
Japan	1.2	Unconditional: pledge revised to 3.8% below 2005 emissions by 2020.	all GHG	-4%	-
World total	50				

- 1) This compares the total GHG emissions of 2005 to estimated pledge threshold of 2020 including all GHGs.
- 2) China's preliminary 2030 pledge has two targets. The first is to stop the growth of CO<sub>2</sub> emissions from FF&I. This is close to reference level and would result to high GHG emissions. The second target is to increase the share of non-fossil energy sources up to 20 % of TPES. According to model analysis, this is much more ambitious target. The combined effect of these two is not yet analyzed.

Country-level assessments are presented in detail in chapter 4 with as identical structure to each other as possible. Each analysis consists of emission statistics, at least three emission scenarios up to 2050 and pre-calculated pledge thresholds from presented scenarios. The current 2020 pledges and preliminary 2030 pledges are compared to the results from GHG mitigation scenarios. This framework should be clear and easy enough to assess also future pledges and compare their ambition levels.

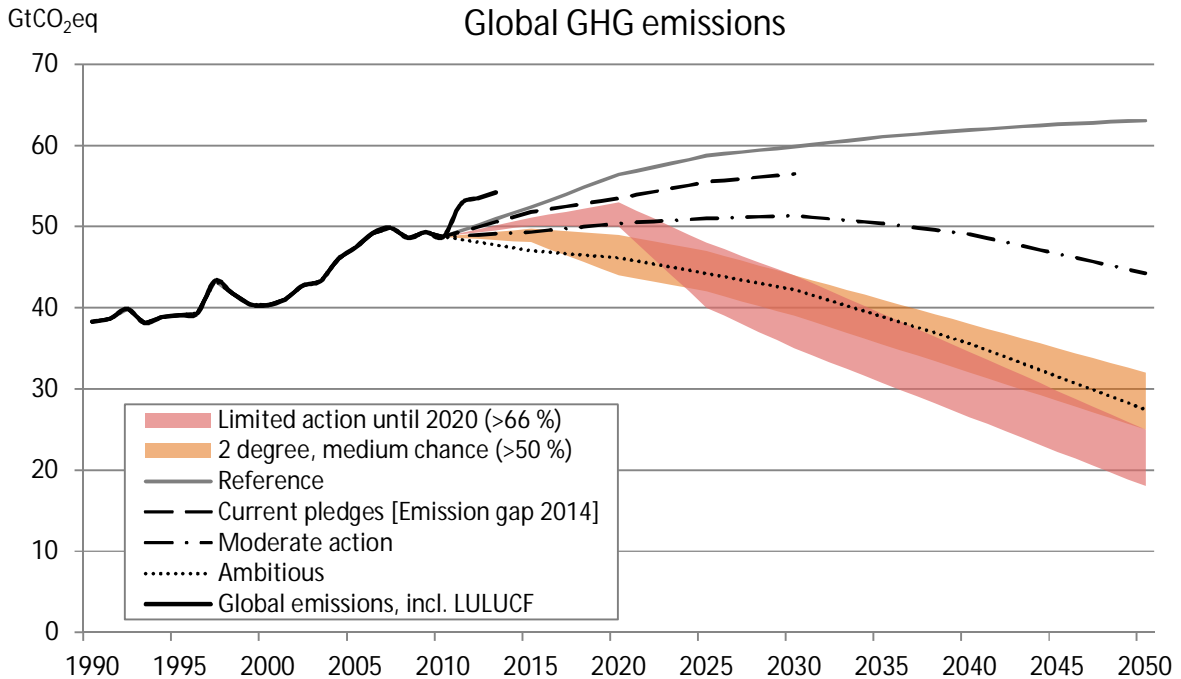
### Compatibility with 2 degree target

Figure 40 compares four global GHG mitigation scenarios from chapter 5 to the two degree emission reduction pathways from chapter 2. The reference scenario projects the development of the emissions under current legislation and ambition level. In the reference scenario, the emissions keep growing and veer far off from the two degree target pathways.

The second scenario is Moderate action scenario which roughly follows the late action mitigation pathway until 2020. Late action pathway has only limited action until 2020 and relatively fast emission reductions between 2020 and 2030. Ambitious scenario remains at the level of medium chance two degree pathway from 2010 to 2050. With these global emission reductions, we should have medium (> 50%) chance to achieve two degree target.

Emission Gap 2014 report has updated 'Current Pledges' scenario which estimates the situation if all conditional pledges would be adopted. This falls in the between of Reference and Moderate action Scenarios.





*Figure 40. Four global GHG mitigation scenarios compared to late action emission reduction pathway and medium chance pathway for 2 degree target. GHG scenarios start from 2010 and statistics reach up to 2013. 2013 emissions are preliminary.*

Unfortunately, the preliminary emissions statistics from 2011 to 2013 have increased to higher level than in any of these scenarios. The statistics reach up to 2013, but scenarios start from the 2010 statistics. This approach makes pictures slightly more confusing, but gives very valuable additional information about the recent progress.

If we don't manage to curb the rising emissions, we have to do deeper and more expensive emission reductions closer to 2050.