

2020 and beyond: 2050 in Light of the Copenhagen Accord

Christoph Meyer

At the end of the Copenhagen Conference of December 2009, the attending parties failed to agree on a legally binding commitment, but ultimately signed the Copenhagen Accord. The countries signing this accord took different engagements in respect to their economic and emissions status. The developed countries stated their targets in the Annex 1, where a specific emissions reduction is planned by 2020 based on a specific year. Non-annex 1 countries, developing nations, stated their emissions targets in different terms, usually in terms of a reduction versus business as usual or a reduction in carbon intensity. Through simple calculations, this paper seeks to illustrate what these targets represent concretely, in the same unit of CO₂ emissions. By looking at the entirety of the Annex 1 countries, in addition to the major emitters of non-Annex 1, China and India, this paper will project emissions to 2020 and 2050 and discuss their relevance to the goal of 450 ppm.

In the Copenhagen Accord, Annex 1 countries take on the most stringent reductions as they formulate these in terms of a percentage reduction from a base year¹. Unlike non-Annex 1 countries, this represents a quantifiable and known emissions limit that these countries need to attain by 2020. Many of the Annex 1 Countries have two different emissions reductions scenarios, based on how other countries will decide to reduce their emissions. As such, the ultimate reductions in the year 2020 represent a spread, seen in the graph below².

Adding up all these numbers for the Annex 1 countries, as well as their low and high end targets yields the above graph. The pink square on the graph represents the minimum targets whereas the green triangle shows the reductions that could be achieved if the countries follow their high end emissions reductions.

This paper will project CO₂ emissions to 2020 and 2050 and discuss their relevance to the goal of 450 ppm.

Based on the 2020 targets, it is possible to project out to 2050, using a linear progression of these reduction targets.

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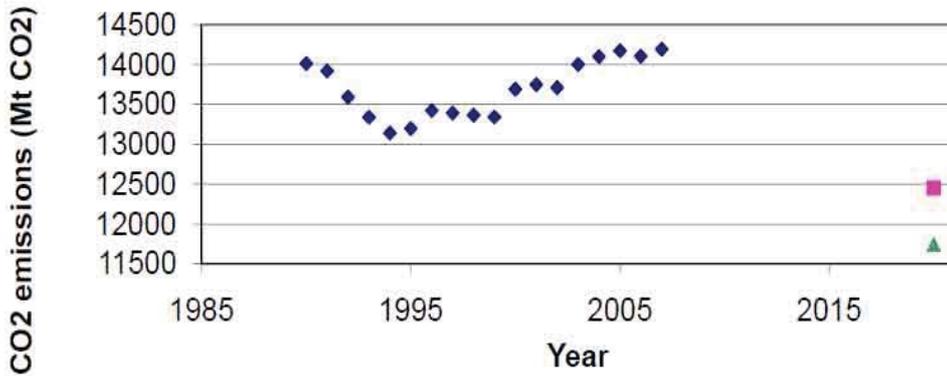
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Annex 1 Countries Proposal 2020



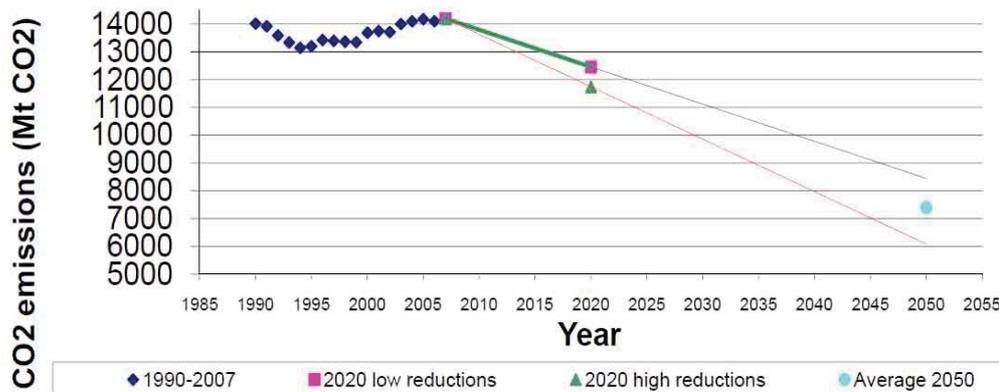
◆ 1990-2007 ■ 2020 low reductions ▲ 2020 high reductions

Based on the past 17 years, the 2020 targets appear somewhere between difficult and impossible to achieve. From 1990 to 1995, there is a significant decrease in the emissions, but this is almost all due to the hot air brought by the downfall of the Soviet Union. Since 1995, the emissions of these Annex 1 countries have continued to increase, though stabilization appears to have occurred in the four years before the recession.

In order to achieve the 2020 targets, the Annex 1 countries will require significant changes in their policies. Going from a continually increasing CO₂ emissions value, except for the last few years where emissions have stagnated, to one that is markedly lower than the CO₂ emissions of the past 17 years will require unprecedented efforts. While the 2008 and 2009 values are not yet available, these most likely indicate a decrease in emissions due to the world financial crisis.

Based on the 2020 targets, it is possible to project out to 2050, using a linear progression of these reduction targets. As seen below, this once again creates a spread of the emissions in 2050. The method of extrapolation is primitive but gives a rough estimate of the order of magnitude of the emissions.

Annex 1 Countries in 2050

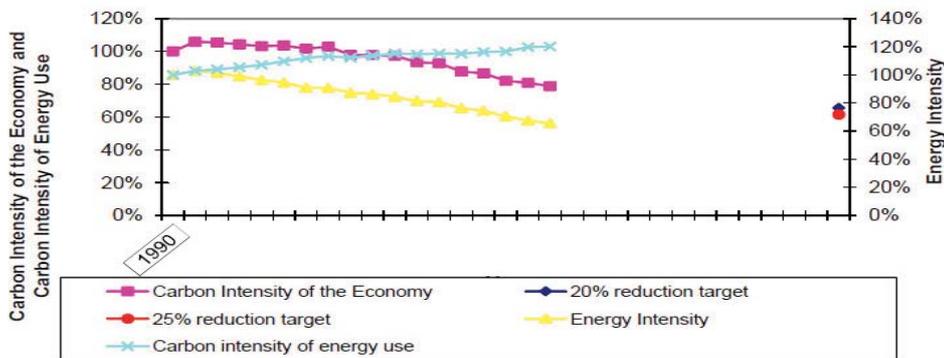


The average of this spread would represent approximately a 7400 Mt CO₂ emissions of the annex 1 countries by 2050. This represents a little less than a 50% reduction by the year 2050 based on 2005 numbers.

India

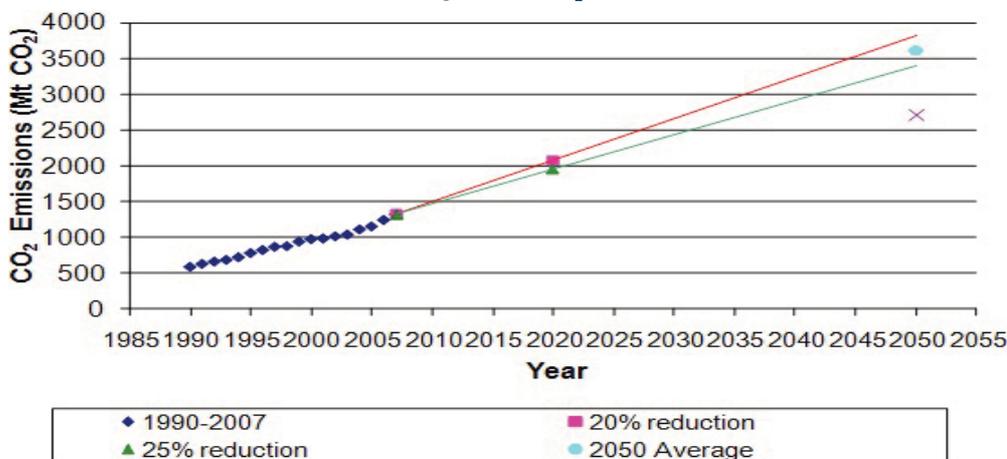
In looking at non-annex 1 countries, it is important to look at the heavy emitters and future economic poles, notably China and India. By the year 2020, India has pledged to reduce the 2005 value of its carbon intensity of the economy by 20 to 25%³. The carbon intensity of the economy is the ratio of CO₂ emissions to the GDP of a country. The progression⁴ from 1990 to 2007, and the 2020 target, can be seen on the graph below.

India Targets Relative to 1990 Levels



As seen by the line of squares (in pink), the carbon intensity of the economy has steadily decreased over the past years. Based on this trend, it seems achievable for India to achieve its targets for 2020. However, seeing as this value is a ratio, it does not give precise estimates of what India's CO₂ emissions will be in 2020. With a decreasing energy intensity and an increasing carbon intensity of energy use, India is not using less carbonated energy sources, but rather using less energy to generate GDP. In order to estimate approximately what India's CO₂ emissions would look like in 2020, this paper used an average per year GDP growth rate of 5% between the years of 2007 and 2020. Based on the set-out carbon intensity of the economy value, the projected CO₂ emissions are seen below. By 2020, assuming this growth rate, India could have CO₂ emissions of anywhere between 1948 and 2080 Mt of CO₂. This result is assuming a rate of 5% of GDP growth per year, which is lower than many of the projections for the Indian economy.

India Pledges 2020 CO₂ Emissions

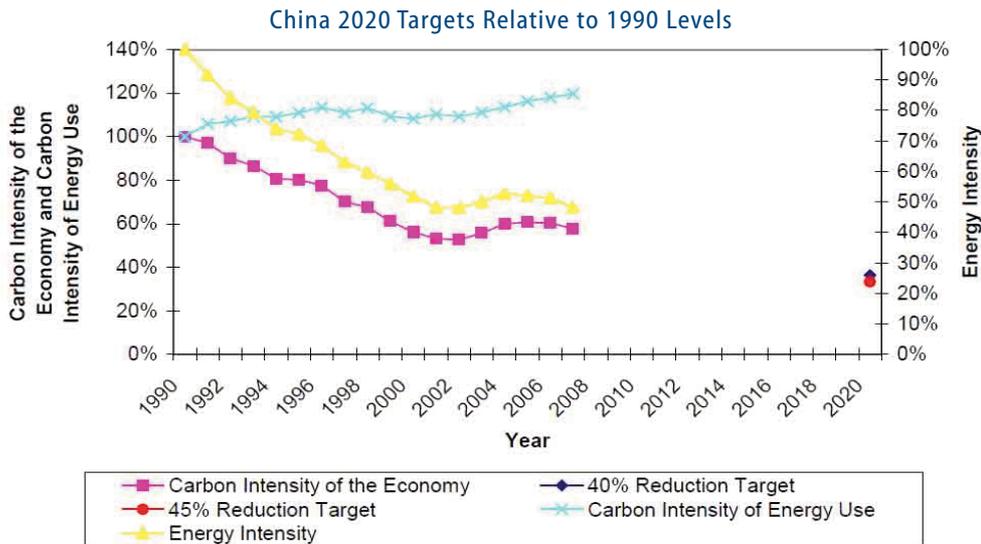


Projecting out the 1990–2020 trend to 2050, the average of the projected emissions is slightly over 3600 Mt CO₂, a 172% increase from 2007. Assuming the 5% growth rate of Indian GDP, the CO₂ emissions will increase significantly by 2050, even in complying with its proposed reduction of carbon intensity. The above graph shows us how difficult it is to estimate Indian CO₂ emissions, and it indicates that even with its Copenhagen accord pledge, India will

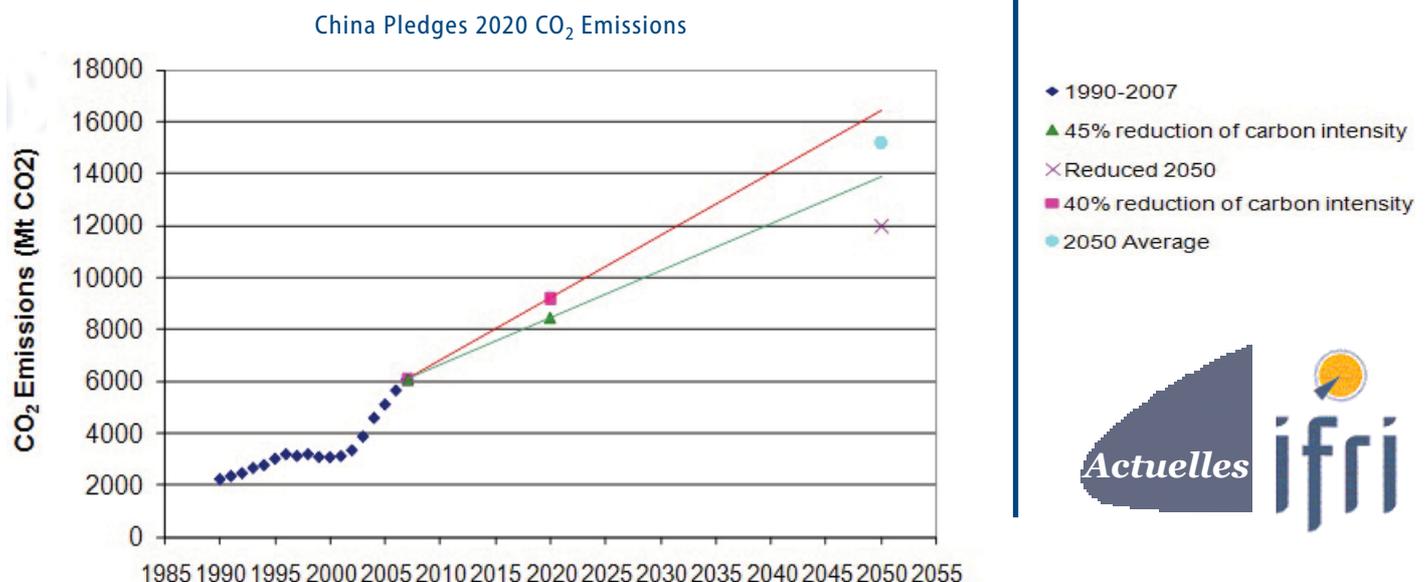
experience considerable emissions growth by 2050. Even with a moderate rate of growth of 5% of GDP per year, and abiding by its Copenhagen Accord pledge, India is still on course to drastically increase its emissions by the year 2050. However, if India's carbon reductions efforts are progressively intensified, a figure around 2700 Mt CO₂ seems possible (as seen by the X on the figure).

China

As an emerging economic power and the world's largest emitter of CO₂, it is crucial to look at China's pledge and projected path to 2050. As a non-Annex 1 country, China pledged to reduce its carbon intensity by 40 to 45% by 2020 based on its 2005 value⁵. The graph below illustrates the progression of China so far as well as its 2020 target⁶.



As seen above, China has managed to reduce its energy intensity over the period of 1990 to 2007, even in spite of a brief period of increase from 2002 to 2006. While the overall carbon intensity of the economy was steadily decreasing, it began increasing in 2003 but then slightly decreased again after 2005. China's carbon intensity of energy use, however, has increased over the same period. While China is using less energy and less carbon to generate GDP, the energy mix it is using to generate this GDP is more carbon intensive. With the recent variations in China's carbon intensity of the economy, it will require efforts for China to attain its objective⁷. In order to estimate what China's emissions will look like by 2020 and beyond, this paper has used the reduced carbon intensity value and estimated that China will experience an average yearly economic growth of 7%. The resulting graph can be seen below.

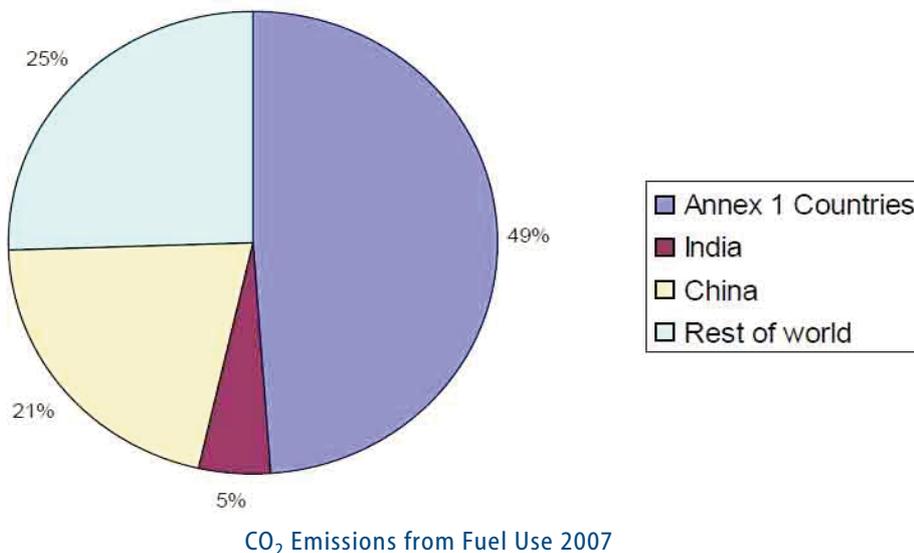


With a 7% economic growth, China's CO₂ emissions increase considerably by 2020, even while it attains its intensity objective. Assuming this 7% growth rate, China's CO₂ emissions can be anywhere between 8440 and 9200 Mt, a 65 to 80% increase based on its 2005 value. Following the same path, the average projected value in 2050 of China's CO₂ emissions would be around 15000 Mt. This would mean that China has doubled its CO₂ emissions from the year 2005 to 2050. While a 7% growth rate is very significant and is perhaps too high over such a long period of time, China is still on the path of a drastic increase in its CO₂ emissions. However, from 2020 to 2050, the emissions growth rate may progressively decline, leading for instance to China's 2050 emissions of 12,000 Mt CO₂ (see X on graph).

450 ppm Scenario

In order to have a realistic chance at containing global warming to less than 2 degrees Celsius, scientific consensus points towards achieving a cap of 450 ppm of carbon dioxide concentration in the atmosphere. According to the International Energy Agency's 2009 *World Energy Outlook*, emissions would need to decline to 14 Gt of CO₂ by 2050 to reach the 450 ppm scenario⁸.

As seen in the graph below, in 2007, the Annex 1 countries, in addition to China and India, contributed to 75% of the world's carbon dioxide emissions from fuel use. As such, these countries will be the main parties responsible for attaining the 450 ppm scenario, as well as the 14 Gt of CO₂ by 2050.



Based on the simple calculations and linear progression done for the three regions in the paragraphs above, attaining the 14 Gt of CO₂ by 2050 seems extremely difficult. If, we assume, that these three regions progress after 2020 until 2050 as they will towards 2020, the combined CO₂ emissions will be over 26 Gt of CO₂. This is excluding the emissions from other countries and is only taking into consideration emissions from fuel use. With the reduced emissions indicated by a cross for China and India, this figure declines to 22 Gt of CO₂.

While this paper has approached the country's engagements through simple calculations, based on growth estimates and continued trends, it reveals the resulting numbers from the countries' projections from the Copenhagen Accord to 2050. While the Copenhagen Accord already represents a considerable effort from these

countries, far more will need to be undertaken in order to cap emissions at 14 Gt by 2050. The engagements of Copenhagen are by no means insignificant, but will need to be followed by exponential decreases in the years following 2020. With the reduced emissions signaled by the X's in the graphs, the figure could decline to 22 Gt of CO₂.

We should not forget that exponential curves grow slowly at the start but increase afterwards more and more quickly. Therefore the trend in CO₂ emissions around 2020 will be a crucial indicator for the future.

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1. Commitments by Annex 1 are available on <http://unfccc.int/home/items/5264.php>.
 2. CO₂ Emissions from Fuel Use in the years 1990–2007 were found on <http://data.iea.org/IEASTORE/DEFAULT.ASP> for Australia, Canada, the European Union (EU 27 in both 1990 and 2007), Japan, Russia, Belarus, Croatia, Iceland, New Zealand, Switzerland, Norway, Ukraine, Kazakhstan and the United States.
 3. http://unfccc.int/files/meetings/application/pdf/indiacphaccord_app2.pdf.
 4. CO₂ emissions from fuel use, primary energy supply and GDP data are available on <http://data.iea.org>.
 5. http://unfccc.int/files/meetings/application/pdf/chinacphaccord_app2.pdf.
 6. CO₂ emissions from fuel use, primary energy supply and GDP data are available on <http://data.iea.org>.
 7. Maïté Jauréguy-Naudin, "Getting Carbon Out : Tougher Than It Looks", Note de l'Ifri, February 2010, available on http://ifri.org/?page=detail-contribution&id=5864&id_provenance=103&provenance_context_id=16.