

The 2- degree Target: is it realistic?

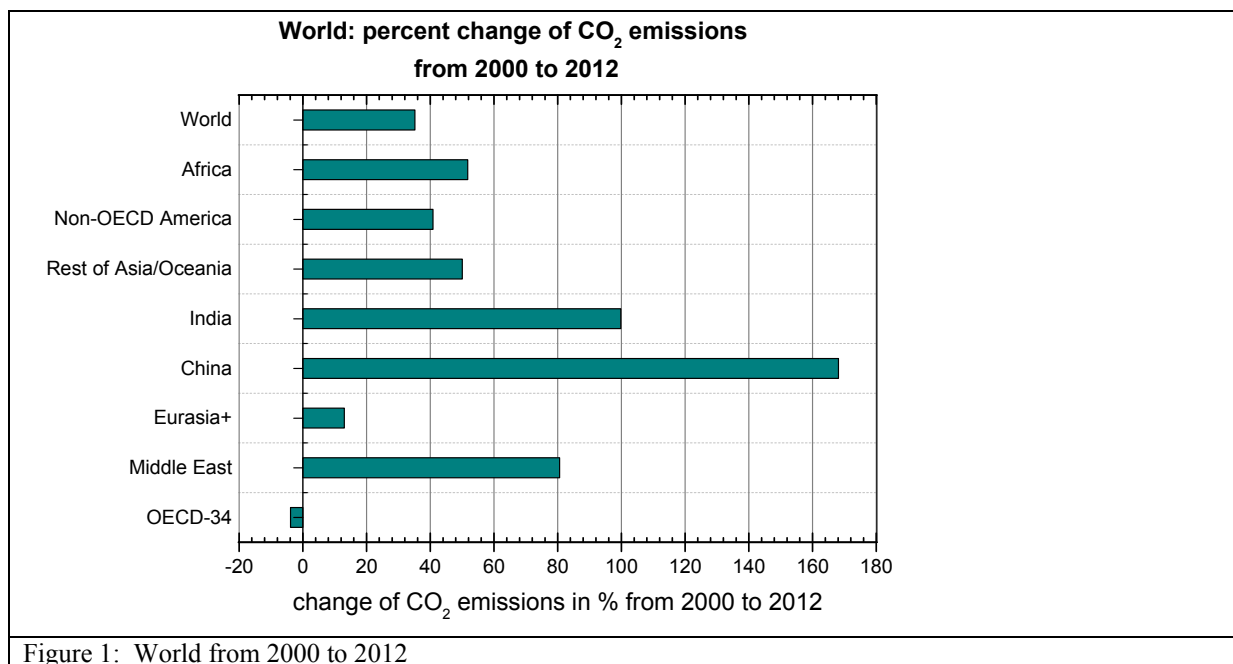
Valentin Crastan

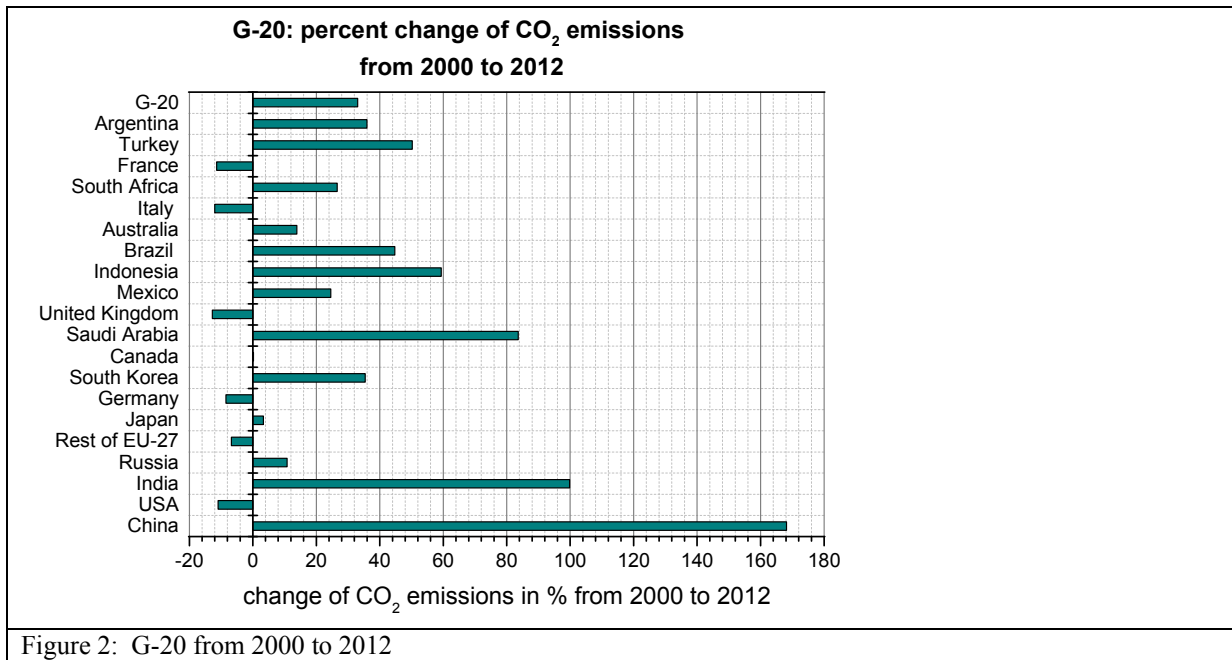
Climate science requires global warming to be limited to 2°C, or even less if possible, relative to the pre-industrial era, as reported both in the latest IPCC climate report of the United Nations [1] and in other studies. The reports confirm to us once again that the increased greenhouse effect is man-made and is about 75% due to the unchecked burning of fossil fuels.

The goal can only be achieved with rapid and radical measures in the field of energy conversion and use, which will have economic consequences that encounter political resistance. That is why there is a temptation to give up this goal in favour of easier 2.5- or 3-degree targets or to suggest that we should simply adapt. Often the debate is purely emotional, and does not refer sufficiently to the global energy situation and the corresponding emissions. With this in mind, we present below some conclusions of the Reports 2014 [2] and 2015 [3],[4] hoping to increase understanding of the conditions that must be fulfilled to achieve the 2-degree target.

Conditions to be respected and current status

The 2°C target can, according to climate science, be achieved with 66% probability, if the global total of CO₂ emissions, from 1870 to 2100, related to burning of coal, oil and gas, does not exceed 800 GtC (billion tons of carbon). Note that the cumulative value up to 2012 is about 350 GtC. Current global emissions are nearly 9 GtC/a and are still growing. Even if these emissions remained constant until 2050, a cumulative value of 692 GtC would be reached by then, a value not far from the tolerable limit in 2100. The more accurate calculation in [2] and [4] shows that to achieve the desired goal, the cumulative emissions up to 2050 should not exceed 620-640 GtC. Average emissions up to 2050 should therefore decrease by at least 1.5 GtC/a. What are the current trends? Figure 1 shows the change in percent of CO₂ emissions from 2000 to 2012 for the different regions of the world. Overall, for this 12-year period, there was an increase of 35%. For the important G-20 group, responsible for 80% of global emissions, the increase was 33% (Figure 2).

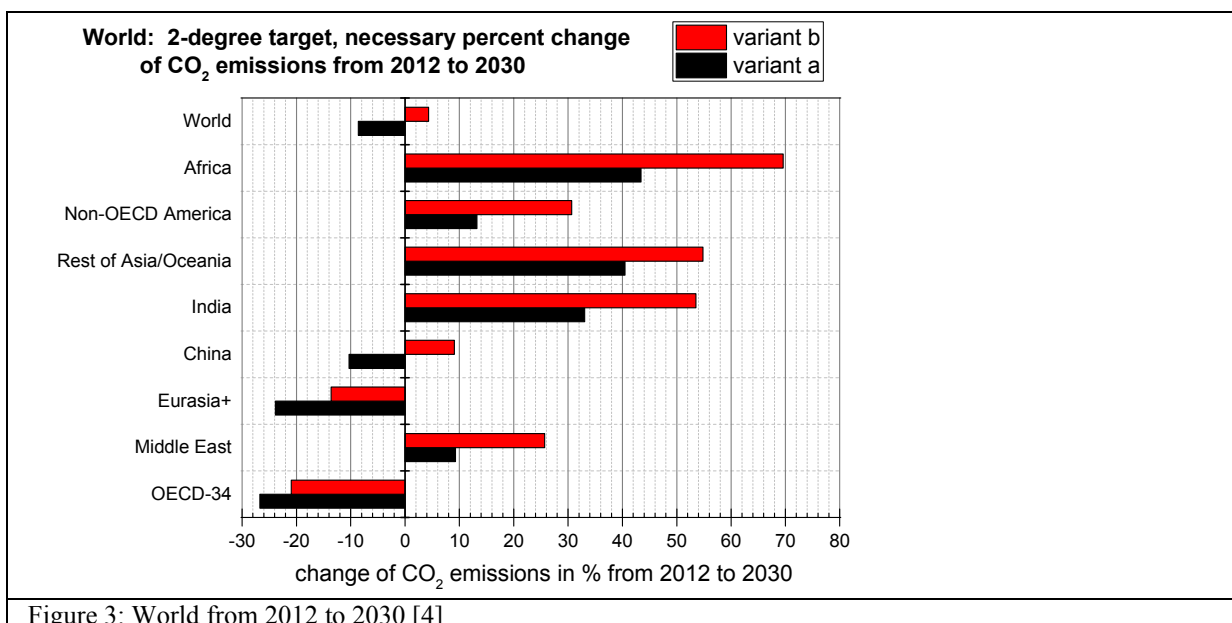




Only the OECD-34 group shows a slight decrease of about 5%. The decrease is primarily borne by the USA and the EU-27. The increase in Japan is caused by the Fukushima accident (shutdown of nuclear power plants).

Required emissions change by 2030

The next 15 years are extremely important in achieving the objectives because it is in this period that very big changes of trend must be implemented. The concrete measures in respect of energy efficiency and the CO₂ intensity of energy use are presented and explained in detail in the reports cited, for countries and regions worldwide. Figure 3 shows the necessary, and probably achievable, evolution across the world from 2012 to 2030. The stricter variant *a* calls for a 9% reduction, the milder variant *b* simply reduces the increase to not more than 4%. Besides the industrialized countries China (-10%) and Russia (Eurasia) in particular are called to contribute, as is also shown by the corresponding diagram for the G-20 group (Figure 4).



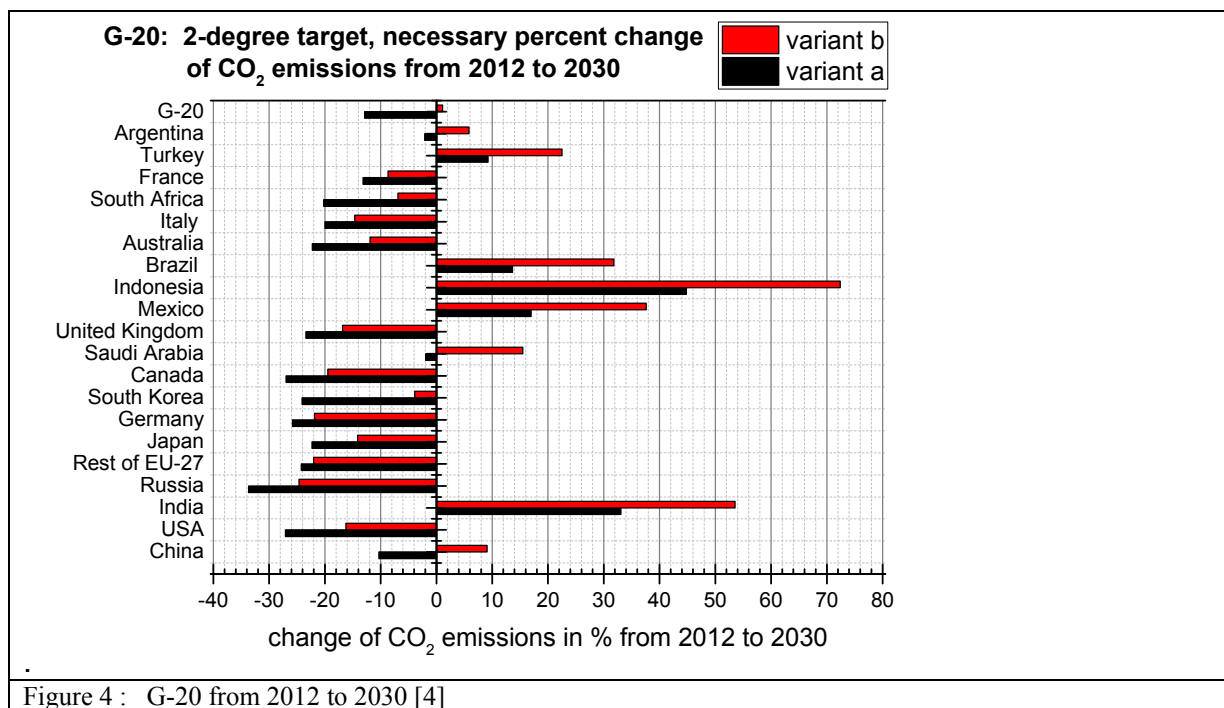


Figure 4 : G-20 from 2012 to 2030 [4]

The G-20 group has to achieve a reduction of 13% (variant *a*), with the contribution of the industrialized countries and Russia being located rather around 20 - 30%. The alternative, less stringent variant *b*, requires for the whole group simply a stabilization of the level of emissions. But this variant then requires more stringent reductions in the subsequent period to 2050, if the climate protection target is to be achieved.

Necessary reductions in the period 2030-2050

Limiting the cumulated emissions to 800 GtC in 2100 can only be achieved if the CO₂ emissions from 2030 to 2050, in all regions of the globe are reduced as shown in Figure 5, which is 40 to 50% overall. India and the rest of Asia/Oceania are called upon to make their contribution, unlike the period from 2012 to 2030. A similar reduction must be guaranteed by the entire G-20 group (Figure 6).

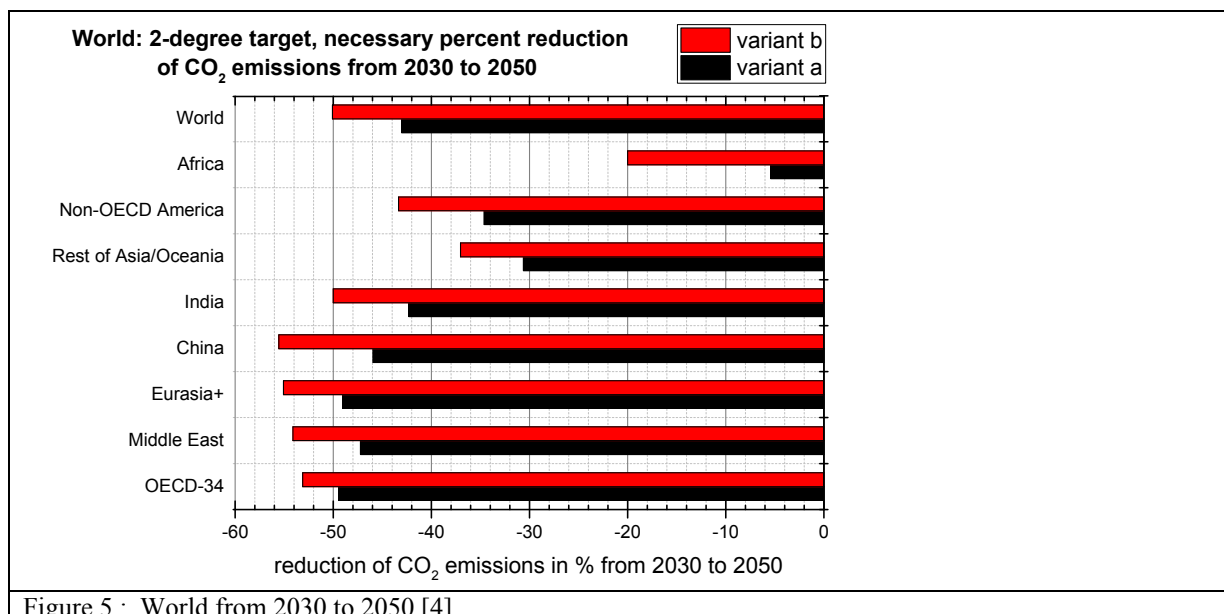
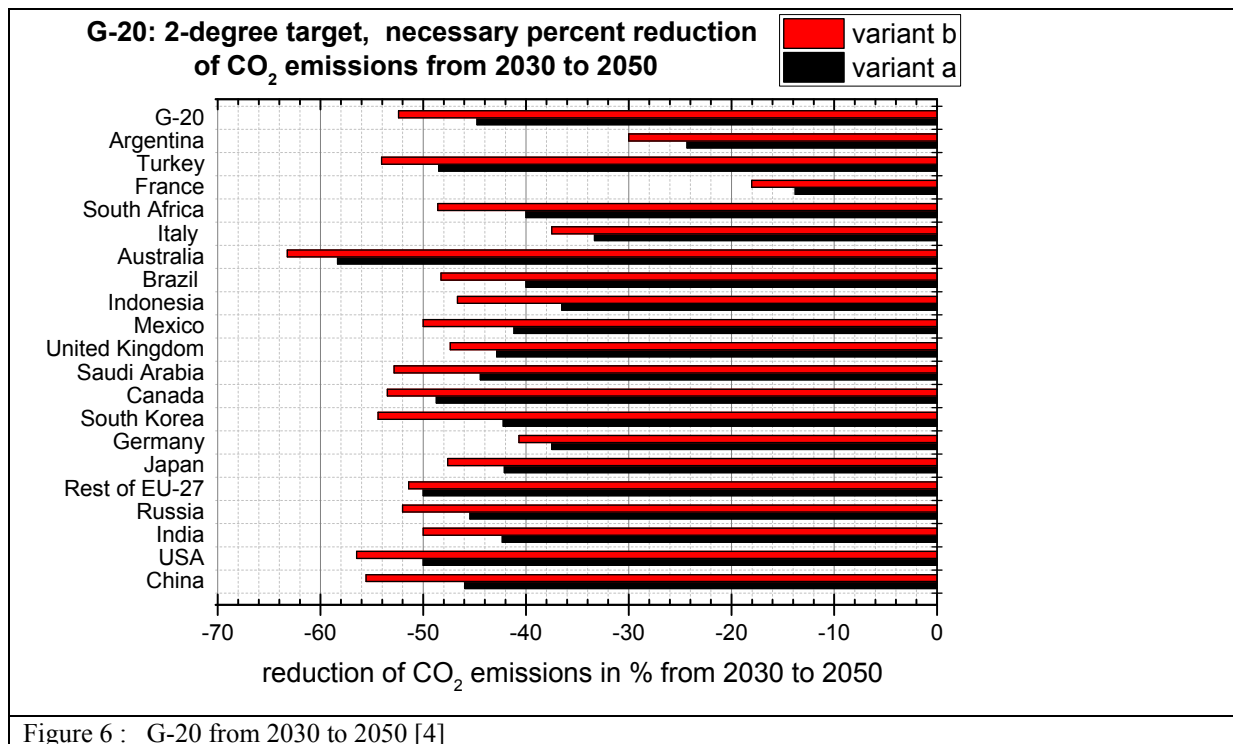


Figure 5 : World from 2030 to 2050 [4]



If in 2012-2030 we comply with variant *a*, there is even the possibility, by achieving the strictest variant *b* for the period 2030-2050, of improving climate protection by limiting global warming to less than 2-degrees, as suggested in several studies, for example of the Bern Oeschger center [5] and of other organizations.

Final considerations

The analysis shows that meeting the 2-degrees target is a challenge, but not impossible. Describing this goal as unrealistic or impossible, demonstrates a destructive alarmism that does not match the encouraging trends that can be observed in the US, in the EU-27 and China; trends concerning *energy efficiency* and *CO₂ intensity of energy*. The latter can be improved by replacing fossil fuels with renewable energies (hydropower, solar, wind and geo-thermal energy), in the transition period also by nuclear energy and if necessary by CCS (carbon capture and storage). Also the other industrialized countries and emerging and developing countries, somewhat later, will join this evolution, perhaps voluntarily, but also under bilateral and multilateral pressure and aid from leading countries. The situation is now critical in the Middle East and Africa. However, their contribution to the worlds CO₂ emissions is only around 3%. In the medium term we can hope for a return of these areas to normality.

The climate conference to be held in Paris in December 2015, will most likely come to similar conclusions. It will be successful only if it succeeds in its intention of achieving a legally binding agreement, essentially corresponding to the diagram above, and applying to all leading and demographically important countries.

References

- [1] IPCC (Intergovernmental Panels on Climate Change) 5th report, 2013/2014
- [2] Crastan V.: Global Energy Demand and 2-degree Target, Springer, 2014
- [3] Crastan V.: Weltweiter Energiebedarf und 2-Grad-Ziel, Report 2015, Cracon, Juni 2015
- [4] Crastan V.: Demande mondiale d'énergie et objectif 2°C, Rapport 2015, Cracon, juin 2015
- [5] Steinacher M., Joos F., Stocker T.F. Allowable carbon emissions lowered by multiple climate targets. Nature 499, 2013

links

www.climate-protection.info

www.climate.unibe.ch/~stocker/papers/stocker13sci.pdf

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