RCP2.6 Aggressive Emission Reduction
Bruce Parker
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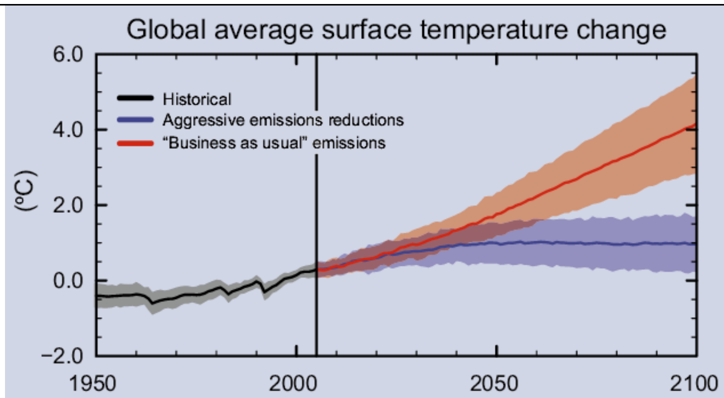
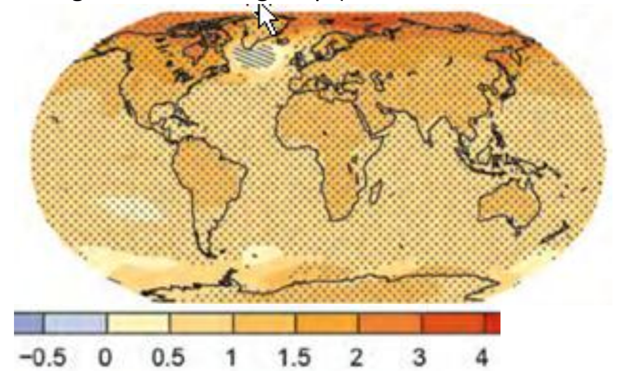
RCP 2.6 was designed to limit the increase of global mean temperature to 2°C by 2100 and is the most aggressive of all the RCP scenarios in reducing greenhouse gas emissions.



Change in Annual Avg Tmp (1986-2005 to 2081-2100)



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Summary of conclusions

- Emissions need to be reduced rapidly (around 4% of 2000 emissions annually) over a period of decades
- This requires an improvement of greenhouse gas intensity of around 5–6% per year, considerably above the historical rates of around 1–2% per year.
- Stringent emission reductions are already required in the current decade.
- Global emissions need to peak around 2020
- Emission reductions cannot be achieved without broadening participation beyond OECD countries in the short run
- CO_2 emissions from fossil fuel use are reduced by a combination of energy efficiency, increased use of renewables and nuclear power, use of carbon capture and storage and increased use of bioenergy.
- An important assumption is that new technologies can be implemented swiftly (limited only by the capital turnover rate) and can be rapidly transferred to different parts of the world.
- As the required emission reductions are close to the maximum emission reduction potential, excluding options and/or reducing their potential can easily imply that the required emission reductions cannot be achieved
- Excluding BECCS (Bio-energy with carbon **capture** and storage) could easily imply that the 2.6 W/m^2 profile is out of reach in current models
- Non-CO_2 gases are strongly reduced.
- Negative emissions from energy use will likely be required in the second half of the 21st century.

http://tntcat.iiasa.ac.at:8787/RcpDb/dsd?Action=htmlpage&page=welcome

The RCP 2.6 is developed by the IMAGE modeling team of the Netherlands Environmental Assessment Agency. The emission pathway is representative for scenarios in the literature leading to very low greenhouse gas concentration levels. It is a so-called "peak" scenario: its radiative forcing level first reaches a value around 3.1 W/m2 mid-century, returning to 2.6 W/m2 by 2100. In order to reach such radiative forcing levels, greenhouse gas emissions (and indirectly emissions of air pollutants) are reduced substantially over time. The final RCP is based on the publication by Van Vuuren et al. (2007).

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RCP2.6: exploring the possibility to keep global mean temperature increase below 2°C

Detlef P. van Vuuren[1,2], Elke Stehfest[1], Michel G. J. den Elzen[1], Tom Kram[1], Jasper van Vliet[1],Sebastiaan Deetman[1], Morna Isaac[1], Kees Klein Goldewijk[1], Andries Hof[1], Angelica Mendoza Beltran[1],Rineke Oostenrijk[1] and Bas van Ruijven[1]
(1)
PBL Netherlands Environmental Assessment Agency, PO BOX 303, 3720 BA Bilthoven, The Netherlands
(2)
Department of Geography, Utrecht University, Utrecht, The Netherlands

Detlef P. van Vuuren
Email: detlef.vanvuuren@pbl.nl
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Abstract
The RCP2.6 emission and concentration pathway is representative of the literature on mitigation scenarios aiming to limit the increase of global mean temperature to 2°C. These scenarios form the low end of the scenario literature in terms of emissions and radiative forcing. They often show negative emissions from energy use in the second half of the 21st century. The RCP2.6 scenario is shown to be technically feasible in the IMAGE integrated assessment modeling framework from a medium emission baseline scenario, assuming full participation of all countries. Cumulative emissions of greenhouse gases from 2010 to 2100 need to be reduced by 70% compared to a baseline scenario, requiring substantial changes in energy use and emissions of non-CO_2 gases. These measures (specifically the use of bio-energy and reforestation measures) also have clear consequences for global land use. Based on the RCP2.6 scenario, recommendations for further research on low emission scenarios have been formulated. These include the response of the climate system to a radiative forcing peak, the ability of society to achieve the required emission reduction rates given political and social inertia and the possibilities to further reduce emissions of non-CO_2 gases.

3.4 Discussion

First of all, emissions need to be reduced rapidly (around 4% of 2000 emissions annually) over a period of decades. This requires an improvement of greenhouse gas intensity of around 5–6% per year, considerably above the historical rates of around 1–2% per year. In fact, in order to avoid a too large overshoot and/or extremely rapid reduction rate requirements in the second half of the century, stringent emission reductions are already required in the current decade. In the RCP2.6, IMAGE but also most other model calculations show that global emissions need to peak around 2020 (Van Vuuren and Riahi *2011*). As shown earlier in the EMF-22 model experiments, and in earlier publications of the RCP2.6, such emission reductions cannot be achieved without broadening participation beyond OECD countries in the short run (Clarke et al. *2010*; Van Vuuren et al. *2010c*) and certainly without the participation of important OECD countries like the USA.

Secondly, achieving the ambitious emission reductions associated with the RCP2.6 requires sufficient potential to reduce emissions for all major emission sources. In RCP2.6, CO_2 emissions from fossil fuel use are reduced by a combination of energy efficiency, increased use of renewables and nuclear power, use of carbon capture and storage and increased use of bioenergy. An important assumption is that new technologies can be implemented swiftly (limited only by the capital turnover rate) and can be rapidly transferred to different parts of the world. As the required emission reductions are close to the maximum emission reduction potential, excluding options and/or reducing their potential can easily imply that the required emission reductions cannot be achieved (Edenhofer et al. *2010*; Van Vuuren et al. *2010c*). Bioenergy plays an important role in this context. The option of BECCS to achieve negative emissions in the second half of the century allows avoiding even more stringent emission reductions in the short term than already included in the scenario (Azar et al. *2010*; Read and Lermit *2005*). In fact, several papers have shown that excluding BECCS could easily imply that the 2.6 W/m^2 profile is out of reach in current models (Tavoni and Tol *2010*; Van Vuuren and Riahi *2011*).

Obviously, the use of BECCS is uncertain: it depends on the uncertainties related to both large-scale bioenergy use and CCS. Current literature on large scale bioenergy use indicates that there might be a potential trade-off with food production and biodiversity (Bringezu et al. *2009*; Van Vuuren et al. *2010a*). Therefore, large-scale bioenergy use seems only feasible if 1) the expansion of agricultural areas for food production is limited (requiring high agricultural productivity) and 2) greenhouse gas emissions associated with bioenergy use are limited. The latter above all requires that no or very little deforestation for bioenergy production occurs via indirect routes (Searchinger et al. *2008*). This may be achieved by setting sustainability criteria for bioenergy production. CCS potential is also uncertain and depends on the total storage capacity that allows for safe (i.e. permanent) storage of CO_2, but also on sufficient societal support. Finally, the additional (technical) challenges related to using bioenergy in combination with CCS seem to be relatively small compared to those already associated with CCS and bioenergy individually.

The third important condition is that non-CO_2 gases are strongly reduced. An important finding of the RCP2.6 is that by 2100, most of the remaining greenhouse gas emissions are non-CO_2 gases (which obviously depends on our current estimates of reduction potentials). In other words, further emission reduction, strongly hinges on the question whether further emission reduction can be achieved here. The IMAGE estimates of long-term non-CO_2 emission reduction have been described in detail by Lucas et al. (*2007*), and are based on the assumption that technical reduction potentials discussed for the next decades can be implemented by 2100. This assumption, obviously, involves major uncertainties that require further research.

Finally, baseline trends play a crucial role in the ability to reach low radiative forcing levels. Different assumptions on baseline emissions could easily lead to much higher or lower costs or even make the 2.6 W/m^2 target infeasible (Fisher et al. *2007b*; O'Neill et al. *2010*). For land-use scenarios, key uncertainties surround the development of food crop yields, and food demand. For energy, key uncertainties are related to technology development, the potential of technologies with zero/low greenhouse gas emissions and issues related to their penetration in the larger energy system. More in general, key factors include population growth and development patterns.

Table of the Results (from IPCC AR5 CLIMATE CHANGE 2013 - The Physical Science Basis WORKING GROUP)

RCP2.6	Anthropogenic CO2 Emissions (PgC/year)			Natural Emissions (PgC/year)		C02 (PPM)	Methane (PPB)
Year	FF+Ind	AFL	Total	Land	Ocean	Atmosphere	Atmosphere
2000	6.82	1.21	8.03	−1.02 ±0.8	−2.09 ± 0.19	368.9	1751
2010	8.61	1.09	9.70	−1.49 ±1.0	−2.44 ± 0.22	389.3	1773
2020	9.00	0.97	9.97	−1.24 ±1.3	−2.70 ± 0.26	412.1	1731
2030	7.21	0.79	8.00	−1.28 ±1.5	−2.59 ± 0.30	430.8	1600
2040	4.79	0.51	5.30	−1.21 ±1.3	−2.22 ± 0.32	440.2	1527
2050	3.21	0.29	3.50	−1.00 ±1.5	−1.83 ± 0.33	442.7	1452
2060	1.55	0.55	2.10	−0.76 ±0.8	−1.52 ± 0.30	441.7	1365
2070	0.26	0.55	0.81	−0.68 ±0.8	−1.23 ± 0.23	437.5	1311
2080	-0.39	0.55	0.16	−0.15 ±0.8	−0.99 ± 0.27	431.6	1285
2090	-0.81	0.59	-0.22	−0.03 ±0.9	−0.85 ± 0.26	426.0	1268
2100	-0.92	0.50	-0.42	0.36 ±0.9	−0.77 ± 0.26	420.9	1254

FF+Ind - Fossil fuels and other industrial sources

AFL - Agriculture,Forestry,Land Use

Emissions - Values for for decadal mean values; 2010 =average 2005-2014

RCP2.6	Effective Radiative Forcing (Watts/square meter)				Global Mean Surface Temperture Above Preindustrial (Degees C)				
Year	CO2	Methane	Other	Total	5%	17%	50%	83%	95%
2000	1.51	0.47	-0.53	1.45			0		
2010	1.80	0.48	-0.47	1.81	1.39	1.53	1.56	1.72	1.82
2020	2.11	0.47	-0.33	2.25	1.56	1.65	1.75	2.01	2.27
2030	2.34	0.42	-0.24	2.52	1.67	1.76	1.94	2.22	2.44
2040	2.46	0.39	-0.20	2.65	1.71	1.88	2.08	2.45	2.7
2050	2.49	0.36	-0.21	2.64	1.69	1.91	2.14	2.57	2.85
2060	2.48	0.32	-0.25	2.55	1.56	1.89	2.13	2.68	2.91
2070	2.43	0.30	-0.26	2.47	1.4	1.9	2.09	2.69	2.91
2080	2.35	0.29	-0.23	2.41	1.35	1.82	2.14	2.64	2.99
2090	2.28	0.28	-0.21	2.35	1.38	1.78	2.14	2.73	2.99
2100	2.22	0.27	-0.19	2.30			2.14		

Surface temperature results here are a statistical summary of the spread in the CMIP ensembles for each of the scenarios. They do not account for model biases and model dependencies, and the percentiles do not correspond to the assessed uncertainty in Chapters 11 (11.3.6.3) and 12 (12.4.1). The statistical spread across models cannot be interpreted as uncertainty ranges or in terms of calibrated language (Section 12.2).