"Climate Change – Mitigation of Climate Change: Key Insights from the AR5"

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Working Group III contribution to the IPCC Fifth Assessment Report
IPCC reports are the result of extensive work of many scientists from around the world.

1 Summary for Policymakers
1 Technical Summary
16 Chapters
235 Authors
900 Reviewers
More than 2000 pages
Close to 10,000 references
More than 38,000 comments
GHG emissions growth has accelerated despite reduction efforts.
GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.

Based on Figure 1.3

- F-Gases
- \(N_2O\)
- \(CH_4\)
- \(CO_2\) From Land Use
- \(CO_2\) Fossil Fuel and Industrial Processes

49 Gt (Uncertainty: ±4.5 Gt)

+2.2%/yr

+1.3%/yr
About half of cumulative anthropogenic CO₂ emissions between 1750 and 2010 have occurred in the last 40 years.
Regional patterns of GHG emissions are shifting along with changes in the world economy.

Based on Figure 1.6
GHG emissions rise with growth in GDP and population.

Based on Figure 1.7
The long-standing trend of decarbonisation has reversed.
Limiting warming to 2°C involves substantial technological, economic and institutional challenges.
Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.

Based on WGII AR5 Figure 19.4
Observed impacts of climate change are widespread and consequential.
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.

Based on Figure 6.7
Stabilization of atmospheric GHG concentrations requires moving away from the baseline, regardless of the mitigation goal.
Stabilization of atmospheric GHG concentrations requires moving away from the baseline, regardless of the mitigation goal.
Delaying mitigation increases the difficulty and narrows the options for limiting warming to 2°C.

“Immediate Action”
Delaying mitigation increases the difficulty and narrows the options for limiting warming to 2°C.
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**Before 2030**
GHG Emissions Pathways [GtCO₂eq/yr]

**After 2030**
- Rate of CO₂ Emission Change [%/yr]
- Share of Low Carbon Energy [%]
  - Past 1900-2010
  - Future 2030-2050
  - 2010
  - 2030, 2050, 2100

*Annual GHG Emissions in 2030*<50 GtCO₂eq
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.

“Delayed Mitigation”

“Immediate Action”
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.
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Current Cancún Pledges imply increased mitigation challenges for reaching 2°C.

Based on Figures 6.32 and 7.16
Mitigation cost estimates vary, but do not strongly affect global GDP growth.
Global costs rise with the ambition of the mitigation goal.
Technological limitations can increase mitigation costs.

Based on Figure 6.24
Low stabilization scenarios depend on a full decarbonization of energy supply.
In low CO₂ concentration stabilization scenarios, fossil fuel use without CCS is phased out in the long-term.

Based on Figure 7.15b
Decarbonization of energy supply is a key requirement for limiting warming to 2°C.

Based on Figure 7.11
Energy demand reductions can provide flexibility, hedge against risks, avoid lock-in and provide co-benefits.

Based on Figure 7.11

Contribution of Low Carbon Technologies to Energy Supply (430-530 ppm CO$_2$eq Scenarios)
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO$_2$ emissions in the land-use sector.
Mitigation requires changes throughout the economy. Systemic approaches are expected to be most effective.

Based on Figure TS.17

450 ppm CO$_2$ eq with Carbon Dioxide Capture & Storage

- Max
- 75%
- Median
- 25%
- Min

Based on Figure TS.17
Mitigation efforts in one sector determine efforts in others.

Based on Figure TS.17
Effective mitigation will not be achieved if individual agents advance their own interests independently.
Substantial reductions in emissions would require large changes in investment patterns and appropriate policies.

Based on Figure 16.3
... what does this imply for European climate and energy policy?

- Own thoughts -
There is far more carbon in the ground than emitted in any baseline scenario.

Based on SRREN Figure 1.7
Are emission trading schemes part of the solution?
The EU ETS: ex-post Analysis

Strong decline of CO₂ price

€/tCO₂

2005 2009 2013

CO₂ Price
Evaluation of the environmental effectiveness

- Emission cap was legally binding. But has not been physically binding as emissions stayed below the cap.

Grosjean et al. 2014
Only 10% of price formation can be explained by market fundamentals (renewable deployment, economic crisis, CDM, ...)

But when taking into consideration policy events dummies (e.g. backloading vote) explanatory power jumps from 10% to 44%.

In the situation with the non-binding cap, the standard price formation does not work
Dynamic cost-effectiveness of ETS is lacking

- Declining CO$_2$ price
- Currently, no substantial price increase expected for 2020 (only little spread between nearest contract and future contract for 2020)
Dynamic cost-effectiveness of ETS is lacking

- Consider the price in 2020 as a benchmark for evaluating dynamic cost-effectiveness of the ETS
- There is a gap between expectations and models that suggest a cost-effective price higher than 20€ / tCO₂ in 2020

**EUA nearest contract and Futures 2020**

**Cost-effective CO₂ price from modeling**

Knopf et al. (2013)
Setting a price collar

- Gives reliable framework for investment decisions
Granted. International climate policy may not be effective. But do we need climate policy at all? Aren’t there many more important problems?
Massive infrastructure investments are needed globally.

- Telecommunication
- Access to electricity
- Water availability
Climate change mitigation can result in co-benefits for human health and other societal goals.

Based on Figures 6.33 and 12.23
Infrastructure investment

• Achieve universal energy access by 2030: US$ 36-41 bln per year (Riahi et al. 2012)
• “Great convergence” of global health standards by 2035: about US$ 40 bln per year (Jameson et al. 2013)

data from 2009, Source: WDI online
The carbon rent: Emission pricing revenues could overcompensate profit losses of fossil fuel owners.

- Fossil resource rents decrease with climate policy ambition
- For a globally optimal carbon price, over-compensation by carbon rent (=permit price or tax * emissions)
- Carbon rent appropriated domestically via auctioned permits or tax
- Receipts from a CO₂-tax or auctioning could be used to lower taxes, for investments in infrastructure or to reduce debts

Bauer et al. (2013)