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
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; long-standing trend of decarbonisation of energy reversed.
GHG emissions rise with growth in GDP and population; long-standing trend of decarbonisation of energy reversed.

Based on Figure 1.7
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.
Stabilization of atmospheric concentrations requires moving away from the baseline – regardless of the mitigation goal.

Based on Figure 6.7
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.
Delivering mitigation increases the difficulty and narrows the options for limiting warming to 2°C.

Before 2030

GHG Emissions Pathways [GtCO₂eq/yr]

After 2030

Rate of CO₂ Emission Change [%/yr]

Share of Low Carbon Energy [%]
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.
Delaying mitigation is estimated to increase the difficulty and narrow the options for limiting warming to 2°C.

Current Cancun Pledges imply increased mitigation challenges for reaching 2°C.
Mitigation cost estimates vary, but do not strongly affect global GDP growth.
Global costs rise with the ambition of the mitigation goal.
Availability of technology can greatly influence mitigation costs.

Based on Figure 6.24

Increase in Mitigation Cost Relative to Default Technology Assumptions [%]

- No Carbon Dioxide Capture & Storage
- Nuclear Phase Out
- Limited Solar/Wind
- Limited Bioenergy

- 530-580 ppm CO₂eq
- 430-480 ppm CO₂eq

Max: 75%
Median: 25%
Min: -
Working Group III contribution to the
IPCC Fifth Assessment Report

Low stabilization scenarios are dependent upon a full decarbonization of energy supply in the long term.
In low CO₂ concentration stabilization scenarios, fossil fuel use without CCS is phased out in the long-term.
Decarbonization of energy supply is a key requirement for limiting warming to 2°C.

**Contributions of Low Carbon Technologies to Energy Supply (430-530 ppm CO₂ eq Scenarios)**

- **Coal w/ CCS**
- **Gas w/ CCS**
- **Nuclear**
- **Biomass w/o CCS**
- **Biomass w/ CCS**
- **Solar**
- **Wind**
- **Geothermal**
- **Hydro**

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
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO₂ emissions in the land-use sector.

Based on Figure TS.17
Mitigation requires changes throughout the economy. Systemic approaches are expected to be most effective.

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
Empirical evaluation of price drivers of EU emission allowances

- 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
Evaluation of the environmental effectiveness

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

Grosjean et al. 2014
Dynamic cost-effectiveness of ETS is lacking

- Declining CO\textsubscript{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 enough, 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
Mitigation can result in large co-benefits for human health and other societal goals.

Based on Figures 6.33 and 12.23


- Black Carbon
- Sulfur Dioxide

Change from 2005 [%]

- Baseline
- 430-530 ppm CO₂ eq by 2100

PM₁₀ Pollution
- Medium
- High
- Very High

Exposure
- Low
- High

Based on Figures 6.33 and 12.23
• 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)
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)