CLIMATE CHANGE 2014

Mitigation of Climate Change

"Mitigation of Climate Change: Key Insights from IPCC's AR5 and beyond"

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GHG emissions growth between 2000 and 2010 has been larger than in the previous three decades.

Based on Figure 1.3
GHG emissions rise with growth in GDP and population.
The long-standing trend of decarbonization has reversed.

Based on Figure 1.7
Regional patterns of GHG emissions are shifting along with changes in the world economy.

The following IPCC country delegations expressed their reservations to the WGIII report regarding income-based country groupings: Bahamas, Bolivia, Egypt, India, Iraq, Jordan, Malaysia, Maldives, Qatar, Saudi Arabia, Sudan, Syria, and Venezuela.

See also:
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See also:
About half of the cumulative anthropogenic CO$_2$ emissions between 1750 and 2010 have occurred in the last 40 years.
Changes in climate have caused impacts on natural and human systems on all continents and across the oceans.
Without additional mitigation, global mean surface temperature is projected to increase by 3.7 to 4.8°C over the 21st century.
Substantial emissions reductions over the next few decades can reduce climate risks in the 21st century and beyond.
Risks from climate change depend on cumulative CO$_2$ emissions...

Based on SYR Figure SPM.10
Mitigation involves some level of co-benefits and of risks due to adverse side-effects, but these risks do not involve the same possibility of severe, widespread and irreversible impacts as risks from climate change.
Stabilization of atmospheric GHG concentrations requires moving away from business as usual.

Based on Figure 6.7
Lower ambition mitigation goals require similar reductions of GHG emissions.
Many scenarios make it at least *about as likely as not* that warming will remain below 2°C relative to pre-industrial levels.

Based on Figures 6.32 and 7.16
Still, between 2030 and 2050, emissions would have to be reduced at an unprecedented rate...

Based on Figures 6.32 and 7.16
...implying a rapid scale-up of low-carbon energy.

Based on Figures 6.32 and 7.16

Before 2030
GHG Emissions Pathways [GtCO₂eq/yr]

After 2030
Rate of CO₂ Emission Change [%/yr]
Share of Low-Carbon Energy [%]

Annual GHG Emissions in 2030
- <50 GtCO₂eq

Past 1900-2010
- Future 2030-2050

ARS Scenario Range
Interquartile Range and Median of Model Comparisons with 2030 Targets

2010

2030 2050 2100 2030 2050 2100

Based on Figures 6.32 and 7.16
Delaying emissions reductions increases the difficulty and narrows the options for mitigation.

Based on Figures 6.32 and 7.16
Delivering emissions reductions increases the difficulty and narrows the options for mitigation.

Based on Figures 6.32 and 7.16
Delaying emissions reductions increases the difficulty and narrows the options for mitigation.

Current Cancún Pledges imply increased mitigation challenges for limiting warming to 2°C relative to pre-industrial levels.
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 CO₂eq Scenarios)
Baseline scenarios suggest rising GHG emissions in all sectors, except for CO₂ emissions from the land-use sector.

Based on Figure TS.15
Mitigation requires changes throughout the economy. Systemic approaches are expected to be most effective.

Based on Figure TS.17

450 ppm CO₂ eq with Carbon Dioxide Capture and Storage
Mitigation efforts in one sector determine efforts in others.

Based on Figure TS.17

450 ppm CO$_2$ eq without Carbon Dioxide Capture and Storage

Direct GHG Emissions [GtCO$_2$ eq/yr]
Global costs rise with the ambition of the mitigation goal.

Percentage Point Reduction in Annualized Consumption Growth Rate over 21st Century

- 0.03 (0.01-0.05)
- 0.04 (0.01-0.09)
- 0.06 (0.03-0.13)
- 0.06 (0.04-0.14)

Based on Table SPM.2
What are the consequences for international energy and climate policy?

A few personal thoughts:
The climate problem at a glance

Resources and reserves to remain underground:

- 80% Coal
- 40% Gas
- 40% Oil

Source: Bauer et al. (2014); Jakob, Hilaire (2015)
There is far more carbon in the ground than emitted in any baseline scenario.

Source: Edenhofer, Hilaire, Bauer
The scarcity rent of CO₂ emissions

- Fossil fuel rents decrease with the ambition of climate policy.
- If the optimal CO₂ price is implemented globally, this loss is over-compensated by the carbon rent.
- The revenues of the carbon tax or auctioning of emission permits can be used to finance tax reductions, infrastructure investments or debt reduction.

Bauer et al. (2013)
The Globalization Paradox: a trilemma

Gilded cage

- Hyper-Globalization
- National Sovereignty
- Compromise of Bretton-Woods
- Global Federalism
- Democracy
Mobility of capital

- International markets
- Flight of capital undermines infrastructure investments
- Undersupplying national public goods

No legitimization

Voting

Democracy
CO$_2$-taxes free economic potential

Mobility of capital and trade of resources

- International markets
- CO$_2$-Tax
- Optimal supply for national public goods
- Expression of national preferences possible
- Voting
- Democracy
A modelling study illustrates the economic potential of CO₂-taxes.

Franks et al. (2015)
Massive infrastructure investments are needed globally.

- Telecommunication
- Access to electricity
- Water availability
Infrastructure investments

- 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
CO$_2$-tax and infrastructure

Quelle: Jakob et al., 2015
Taxing of resource rents and supplying infrastructure

Quelle: Jakob et al., 2015
Climate change mitigation can result in co-benefits for human health and other societal goals.

Based on Figures 6.33 and 12.23
Are emission trading schemes and their linkages a solution?

Based on Figure 13.4
The EU Emissions Trading Scheme: ex-post analysis

Fall in the CO₂ Price

€/tCO₂

2005 2009 2013

CO₂ Price
There is a legally binding cap on GHG emissions. However, it remains ineffective as long as emissions do not reach this limit.

Grosjean et al. 2014
Empirical analysis of the drivers of the certificate price

- Only 10% of the monthly changes in price can be explained with the basic demand-side data (Renewables deployment, economic crisis, CDM...)
- If “political events” (e.g., backloading vote) are accounted for, this share increases from 10% to 44%
ETS lack dynamical cost efficiency.

- Falling CO₂ price
- No increase expected before 2020
ETS lack dynamical cost efficiency.

- The price expectations for 2020 can serve as a benchmark for the evaluation of the dynamical cost efficiency of the ETS.
- There is a gap between expectations and models showing a cost-efficient price of more than 20 €/tCO$_2$ in 2020.

EUA Nearest Contract and Futures

Cost-efficient CO$_2$ price from models

Knopf et al. (2013)
Introduction of a price corridor

- Reliable environment for investment decisions
- Instrument: Introduction of an auction reserve price