POTSDAM INSTITUTE FOR CLIMATE IMPACT RESEARCH

Key Insights from IPCC‘s AR 5 – About Mapmakers and Navigators

Prof. Dr. Ottmar Edenhofer

„Science-based climate policy: from research to decision making“
Federal Ministry of Education and Research (BMBF)
Paris, 3 December 2015

Leibniz Gemeinschaft

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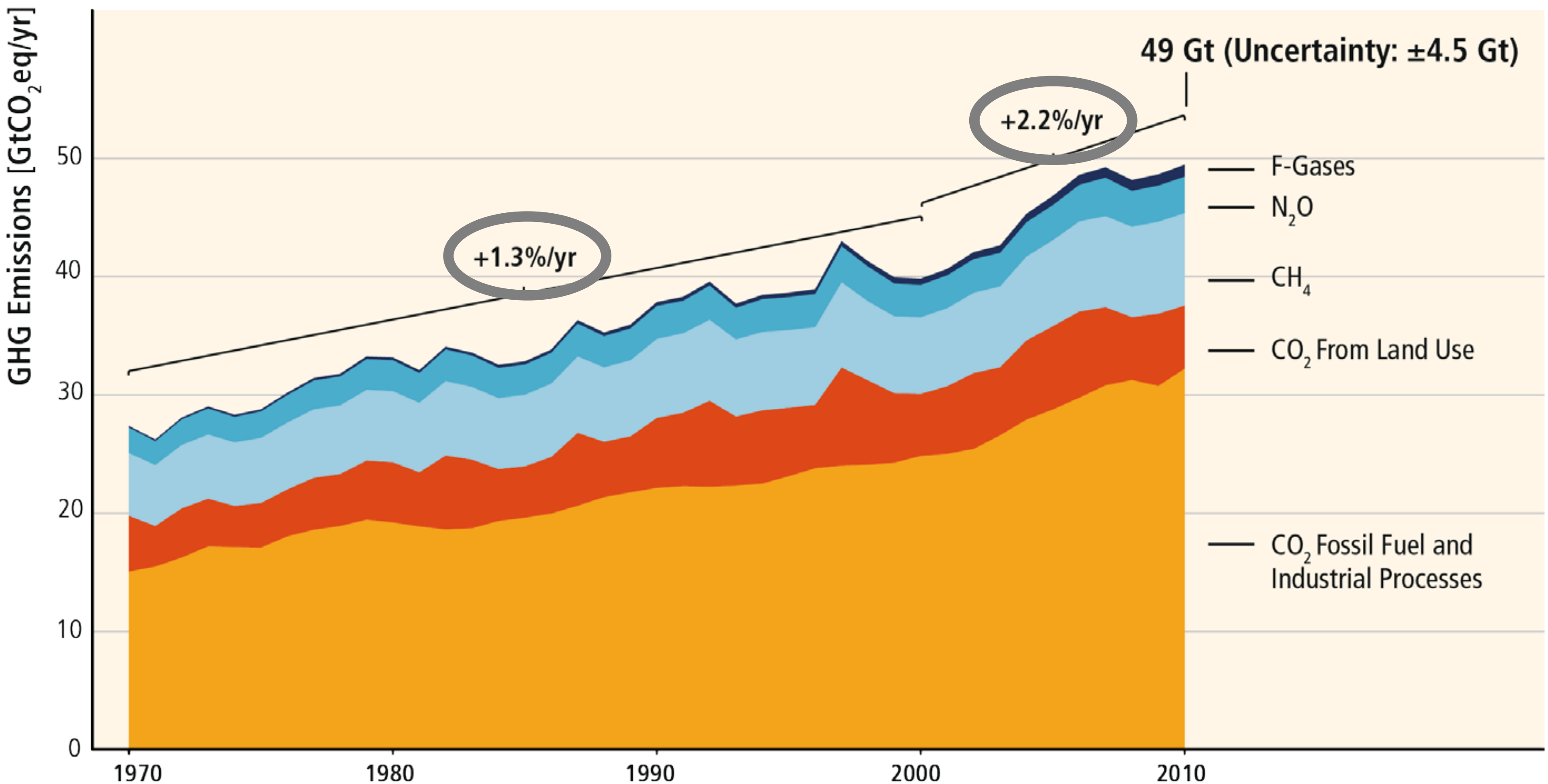
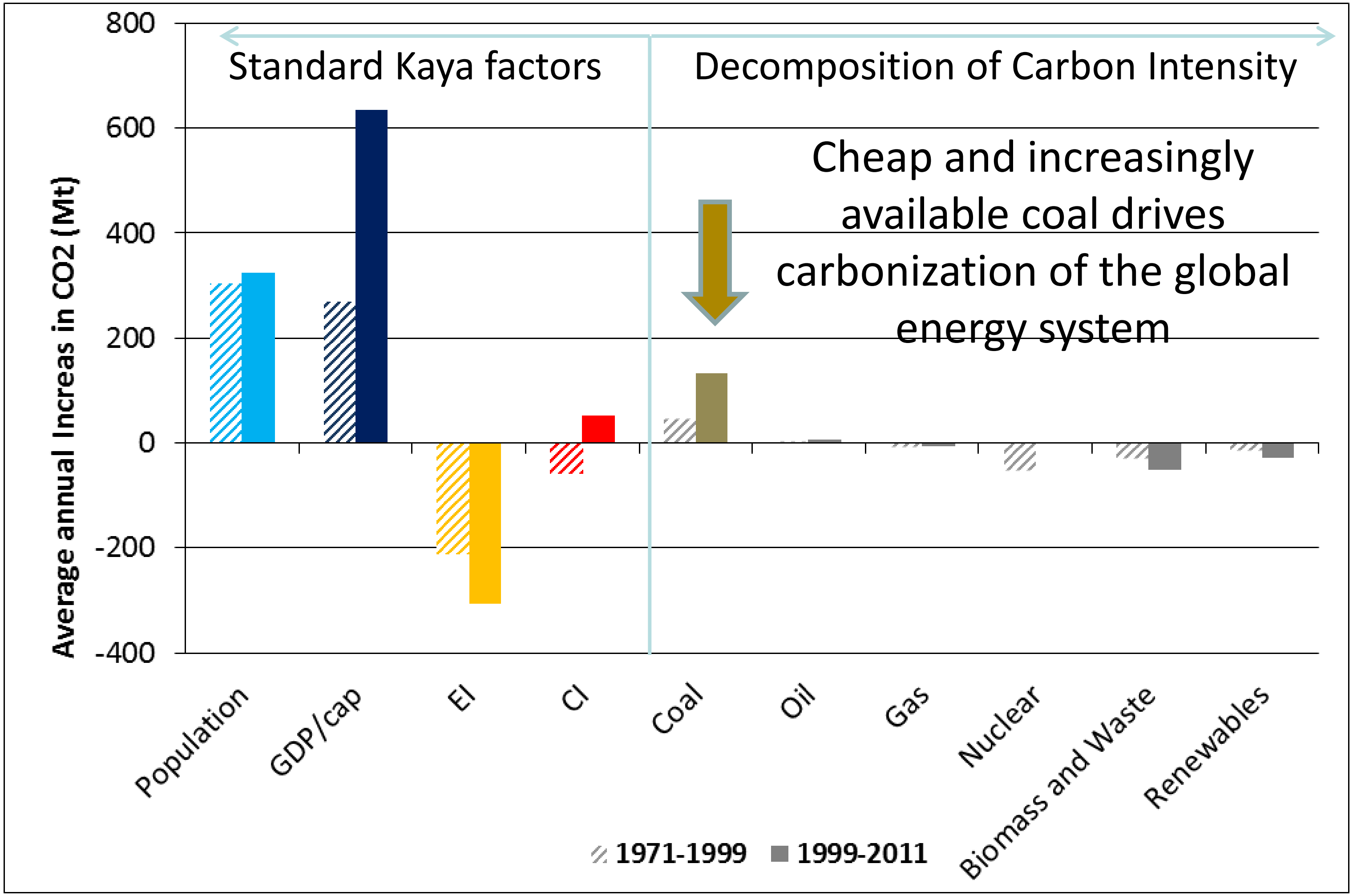
GHG emissions growth between 2000 and 2010 has been larger than in the previous decades.



Based on Figure 1.3

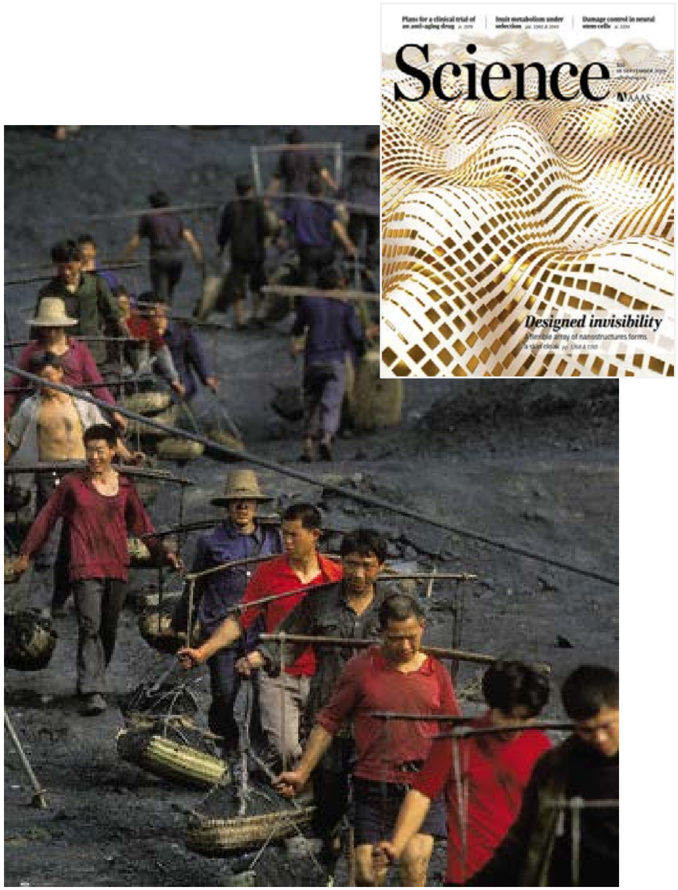
A renaissance of coal drives the global carbonization.



Steckel, Edenhofer and Jakob, in press

Renaissance of coal

Social costs vs subsidies



ENERGY

King Coal and the Queen of Subsidies

The window for fossil fuel subsidy reform is closing fast

By **Ottmar Edenhofer**

Coal is the most important energy source for the Chinese economy (see the photo). Other rapidly growing economies in Asia and Africa also increasingly rely on coal to satisfy their growing appetite for energy. This renaissance of coal is expected to continue in the coming years (*1*) and is one of the reasons that global greenhouse gas (GHG) emissions are increasing despite the undisputed worldwide technological progress and expansion of wide emissions are expected to continue to rise. After all, a reduction in coal demand in one region reduces world market prices, incentivizing an increasing demand in other regions (*6*).

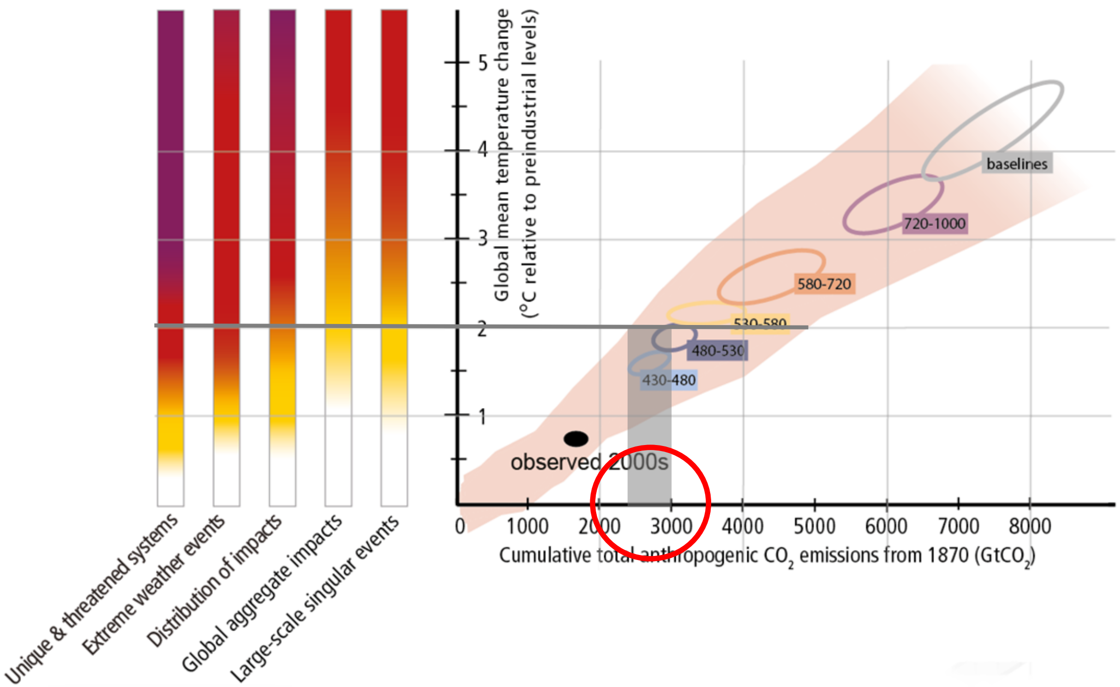
What explains this renaissance of coal? The short answer is the relative price of coal. The price of coal-based electricity generation remains much lower than that of renewable power when the costs of renewable intermittency are taken into account.

As a result of technological progress and economies of scale, the costs of generating

“one ton of CO_2 receives, on average, more than **150 US$** in subsidies ”

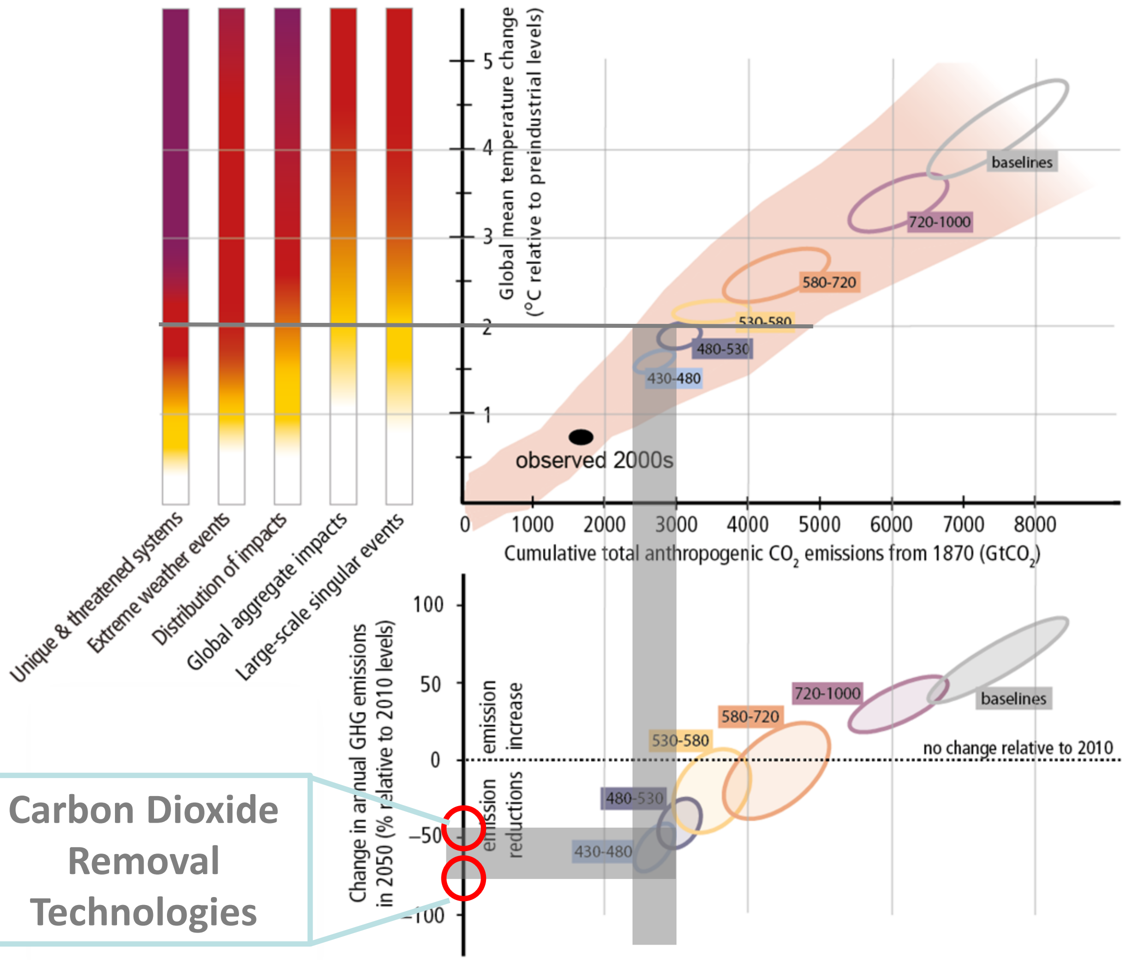
Source: Science, 18. September 2015, Vol 349, Issue 6254, 1286ff

Risks from climate change depend on cumulative CO_2 emissions...



Based on SYR Figure SPM.10

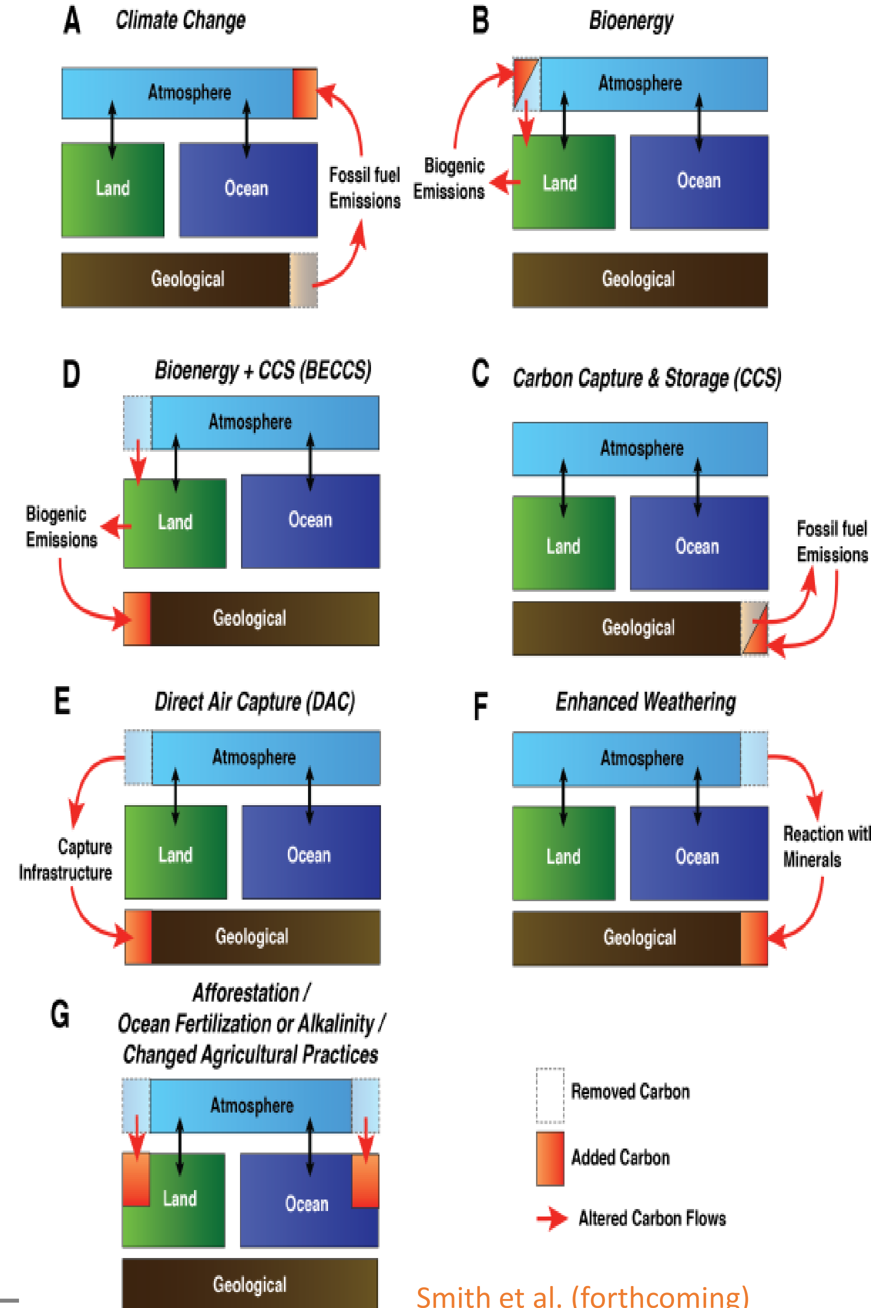
...which in turn depend on annual GHG emissions over the next decades.



Carbon Dioxide Removal Technologies

Basiert auf SYR IPCC AR5 Figure SPM.10

Summary of the carbon cycle impacts of different NETs



Smith et al. (forthcoming)

Limits and implied tradeoffs

NET	Global C removal (GtCeq./yr in 2100)	Mean (max), land requirement (Mha in 2100)	Estimated energy requirement (EJ/yr in 2100)	Mean (max), water requirement (km^3/yr in 2100)	Nutrient impact (ktN/yr in 2100)	Albedo impact in 2100
BECCS	3.3	380-700	-170	720	Variable	Variable
DAC	3.3	Very low (unless solar PV used for energy)	156	10-300	None	None
EW	0.2 (1.0)	2 (10)	46	0.3 (1.5)	None	None
AR	1.1 (3.3)	320 (970)	Very low	370 (1040)	2.2 (16.8)	Negative; or reduced GHG benefit where not negative

Source: Smith et al. (forthcoming)

- All NETs run into their limits and none is a silver bullet. A portfolio of NETs will probably be needed to ensure sustainable negative emissions.
- Existence of NETs in scenarios does NOT imply that we can continue on a BAU path: our ability to stabilise the climate at <2°C declines as cumulative emissions + side effects like ocean acidification increase!
- All AR5 low-stabilization scenarios using NETs go together with drastic 'standard' climate change mitigation in the short to medium run.

The Challenge of Comprehensive Assessment of CDR Technologies

Technology	CDR potential	Costs	Negative Side effects	Positive Side effects
BECCS	Unclear (biomass constraint)	Low	Land competition, CCS, water demand	
Afforestation	Unclear	Low	Land competition	Soil erosion
Direct air capture	High	High	CCS, water demand	
Enhanced Weathering	Low	Med to High	Trace metals (olivine), environmental costs of mining	Nutrient supply, increase coastal water pH

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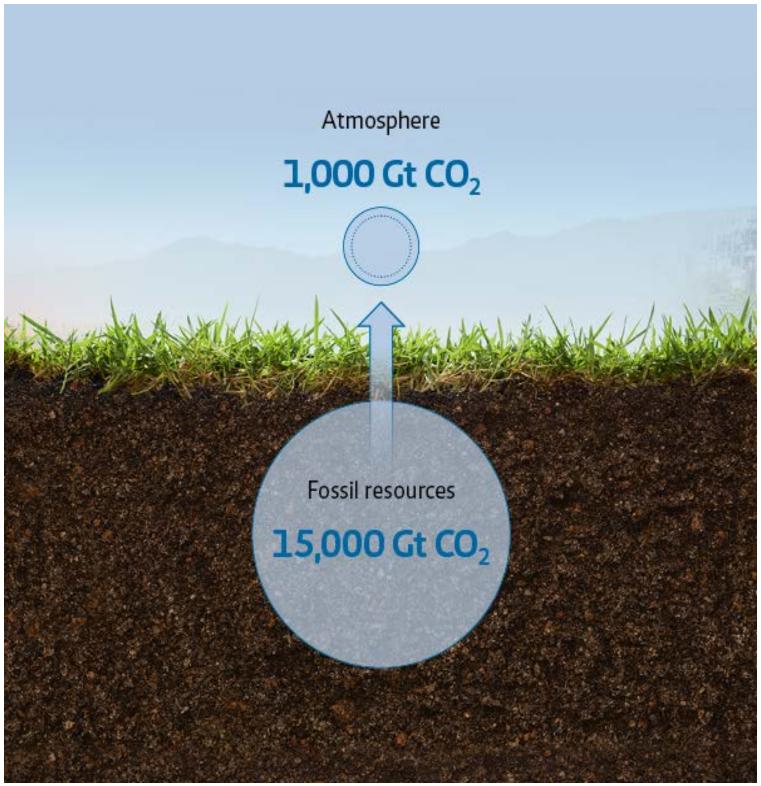
The climate problem at a glance



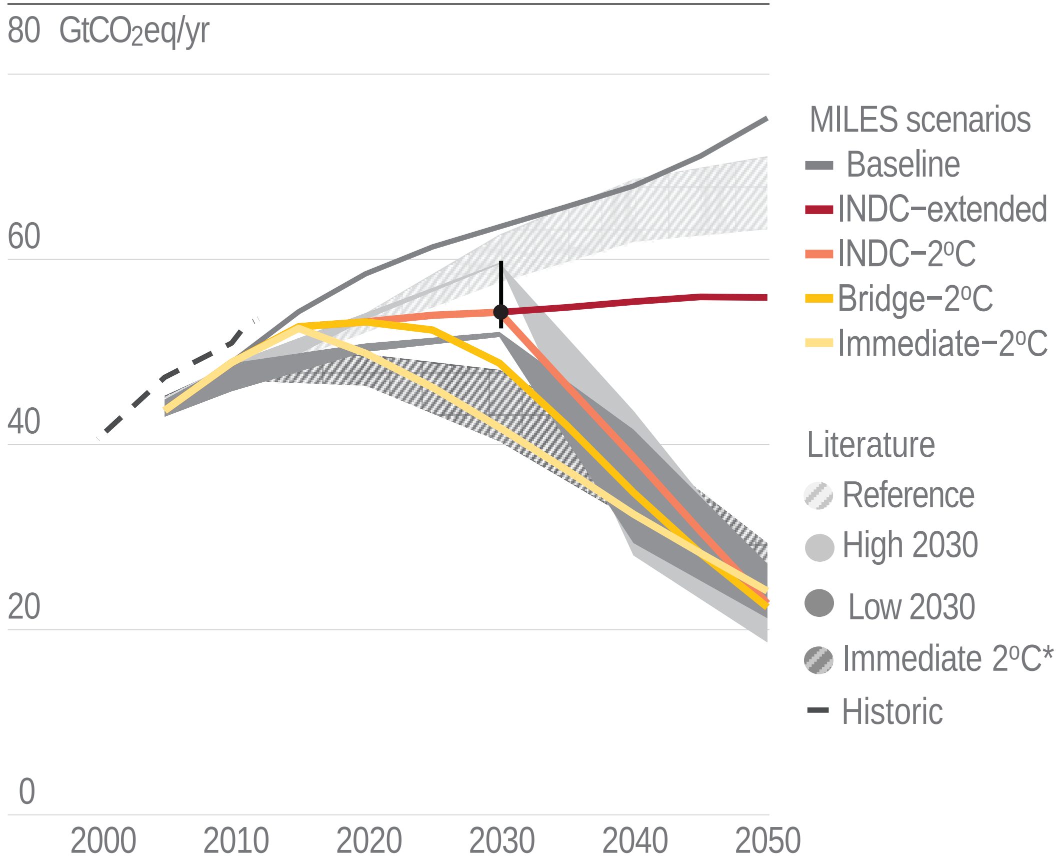
Resources and reserves to remain underground until 2100 (median values compared to BAU, AR5 Database)

Until 2100	With CCS [%]	No CCS [%]
Coal	70	89
Oil	35	63
Gas	32	64

Source: Bauer et al. (2014); Jakob, Hilaire (2015)

INDC scenarios

Greenhouse gas emissions



Source: REMIND model calculations, EDGAR (JRC/PBL, historical emissions), PBL INDC Tool calculations (www.pbl.nl/indc INDC range and best estimate, vertical black line and circle) and IPCC AR5 scenario database

* Figure D of the policy report „Beyond the numbers: Understanding the Transformation Induced by INDCs", October 2015, by the MILES project consortium

Baseline: SSP2 GDP and Pop. and no climate policy.

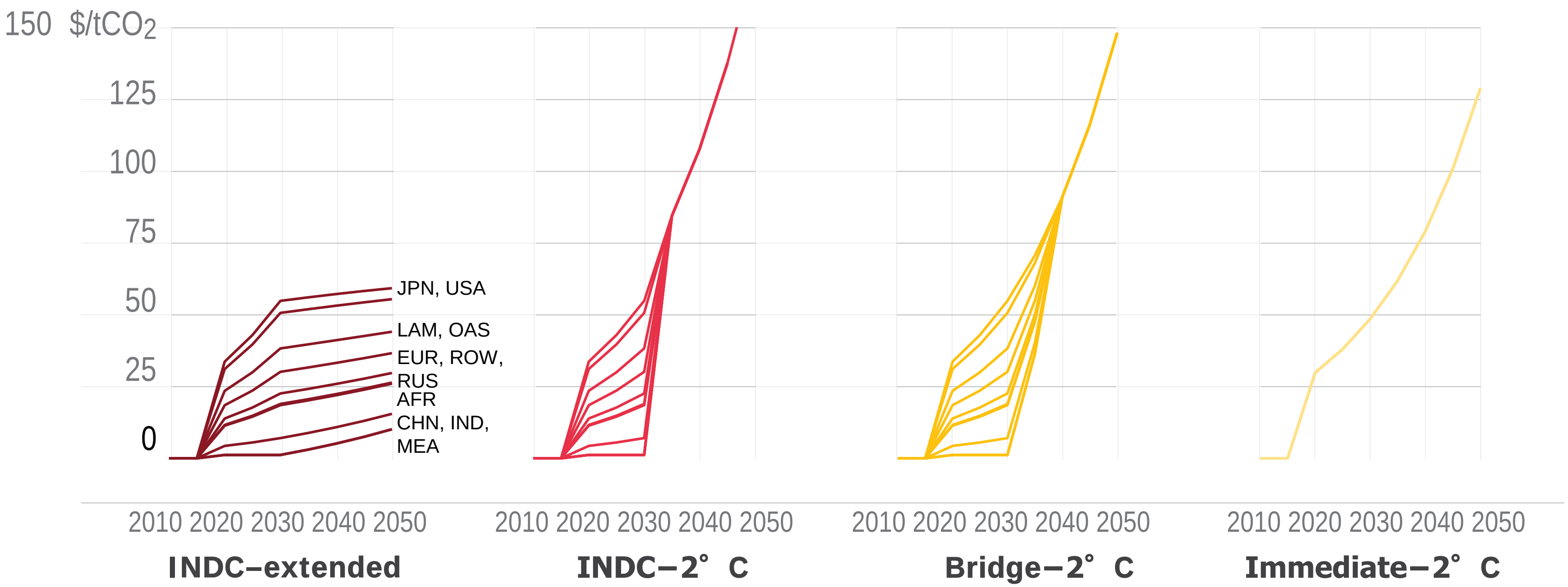
INDC-extended: conditional INDCs PBL best guess and extrapolation, assuming carbon price increase w. 1.5% after 2030, overlaid with convergence of carbon price across regions, so stronger growth rates in regions with low prices in 2030 (see next slide) and vice versa.

INDC-2ºC: until 2030 like above, after 2030 unanticipated phase-in of optimal carbon price globally to reach 2ºC (RCP 2.6)

Bridge-2ºC: until 2020 like above, after 2020 anticipation of optimal carbon pricing from 2035 onwards, but still the low INDC carbon prices in 2025 and 2030.

Immediate-2ºC: optimal pricing for 2ºC after 2015.

CO_2 prices in the MILES scenarios



Note: The implicit carbon prices shown here do not reflect the stringency level of the overall INDC of a region, as for some regions, additional policies are represented in the modelling that depress the prices shown here (see table 1 in the annex). As all countries are likely to implement dedicated technology policies, actual carbon prices in a trading scheme or a carbon tax scheme will be lower for regions for which the complementary policies are not yet represented. Monetary values are given in $US-2012. REMIND 2005 monetary values are scaled by 1.18 for conversion to 2012.

Source: REMIND model analysis

* Figure A1 of the policy report „Beyond the numbers: Understanding the Transformation Induced by INDCs", October 2015, by the MILES project consortium

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Global Minimum Carbon Price and Transfers

Ausweg aus der Klima-Sackgasse

Die Treibhausgasemissionen müssen sinken. Aber sie steigen. Ein Durchbruch ist auf dem Klimagipfel in Paris nicht in Sicht. Dabei ist kluge Klimapolitik ganz einfach.

26.10.2015, von OTTMAR EDENHOFER UND AXEL OCKENFELS

Source: Frankfurter Allgemeine Zeitung, online, 26.10.2015

Climate Policy and Poverty reduction - A contradiction?

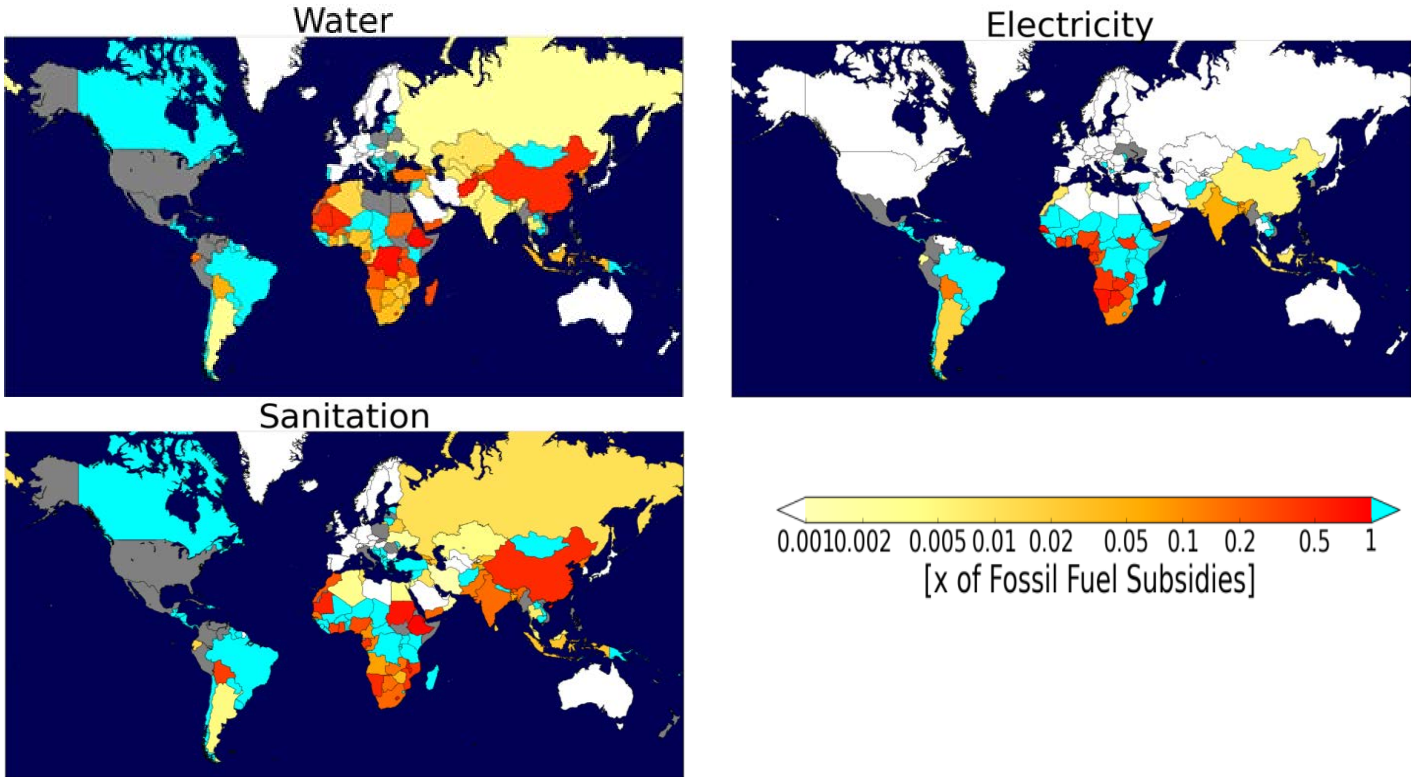
Water availability

Sanitation

Telecommunication

Access to electricity

Fossil Fuels Subsidy Reform



Jakob et al. (2015)

- Redirect fossil fuel subsidies to infrastructure from 2015 to 2030
- Roughly 80 countries do not have universal access to water, sanitation, and electricity
- Universal access to clean water could be provided in about 70 countries
- Improved sanitation in about 60 countries
- Access to electricity in about 50 countries

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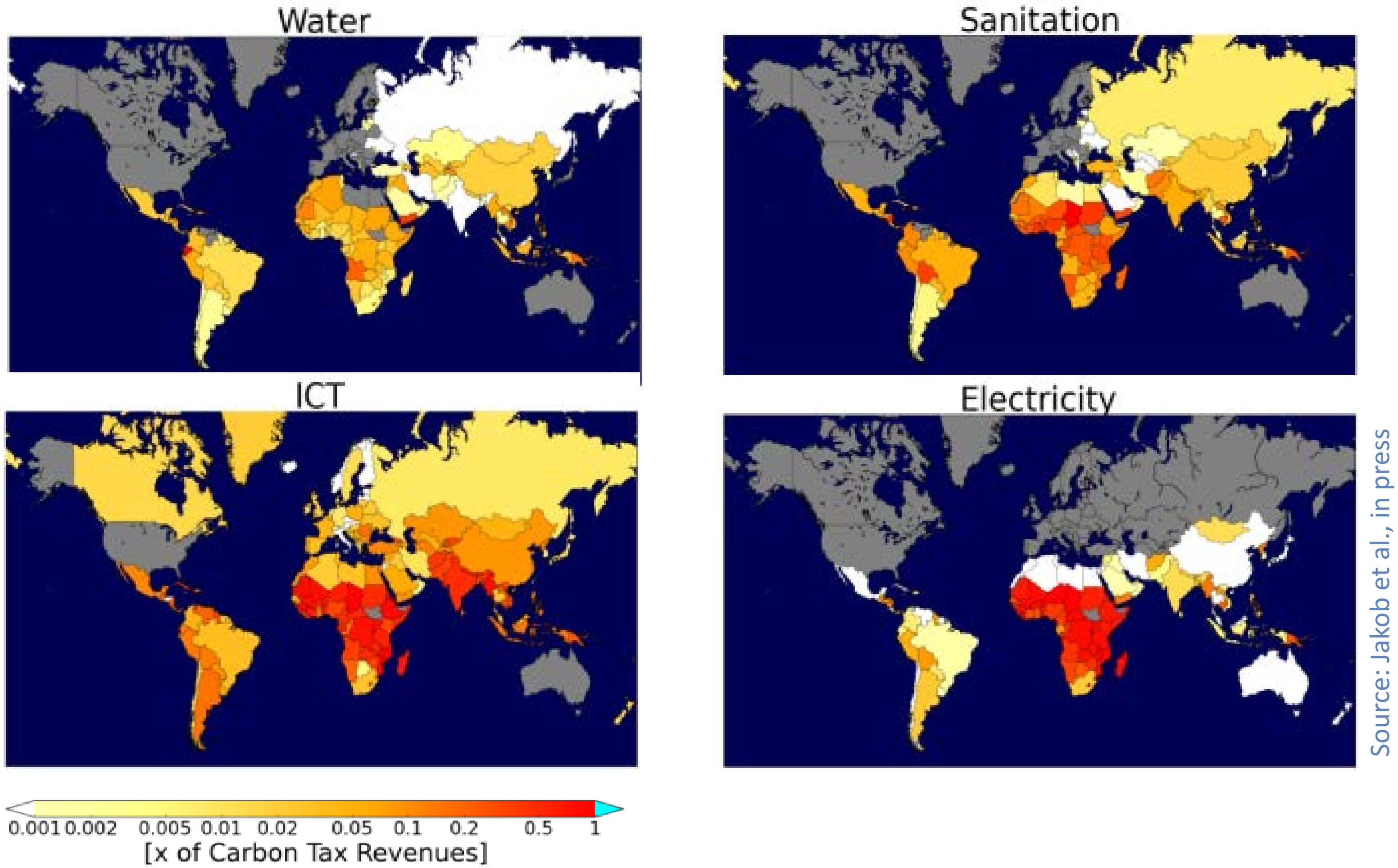
Carbon pricing revenues to close infrastructure gaps



Source: Jakob et al., in press

SCIENCE POLICY INTERFACE

Map makers & navigators, facts & values

- **Our research guides decision makers, thus we carefully distinguish framing, transformation pathways („maps“) and tools for implementation.**
- **Social learning is an important component of our work.**

Volume 345, Issue 6291: *Map Makers & Navigators, Facts & Values*
Volume 350, Issue 6256: *The IPCC at a Crossroads – Opportunities for Reform*