Potsdam Institute for Climate Impact Research

What can we expect from COP21 in Paris?

Prof. Dr. Ottmar Edenhofer

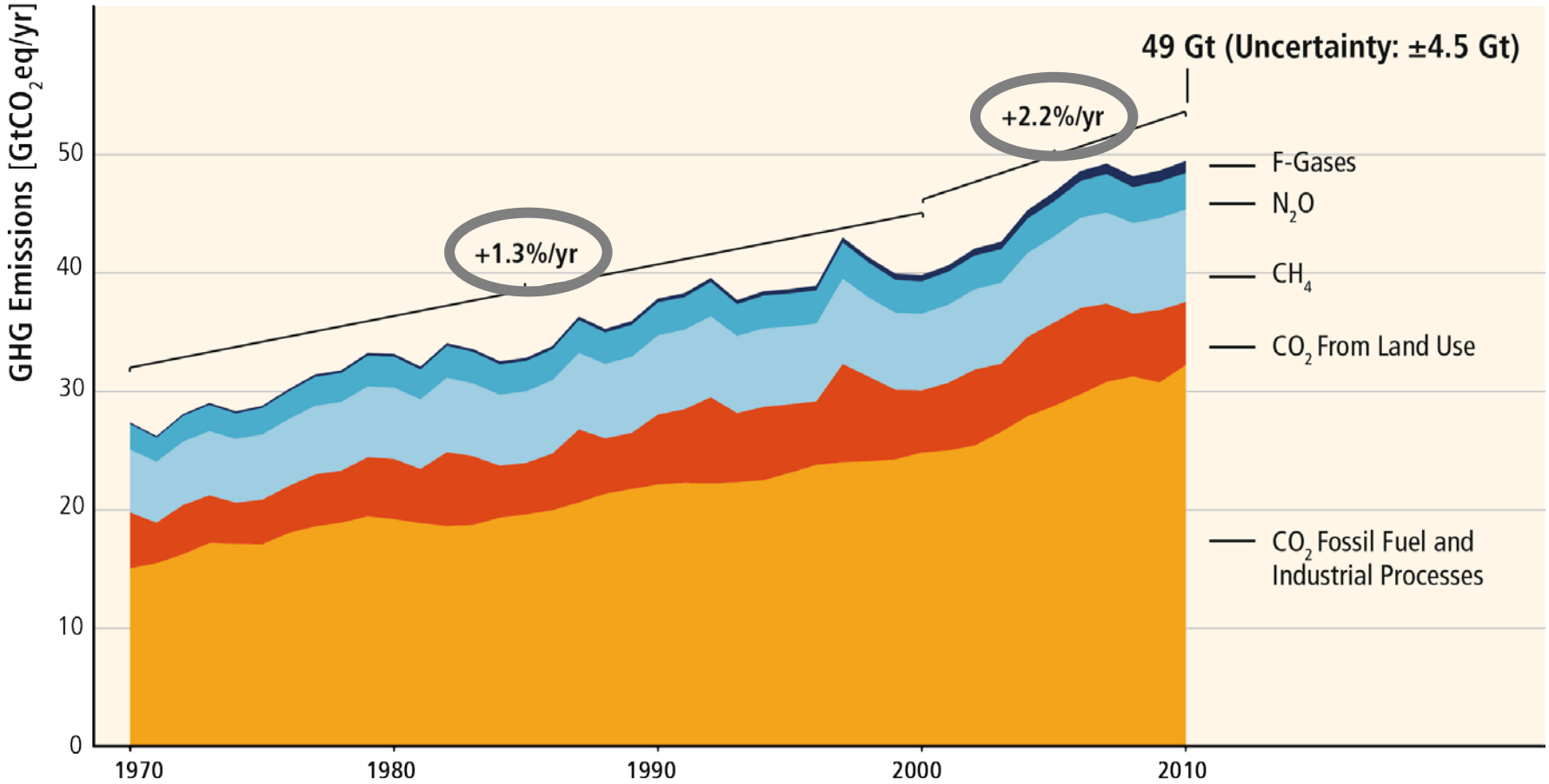
PIK Journalisten-Workshop
Berlin, 03 November 2015

Leibniz Gemeinschaft

MCC
Mercator Research Institute on Global Commons and Climate Change

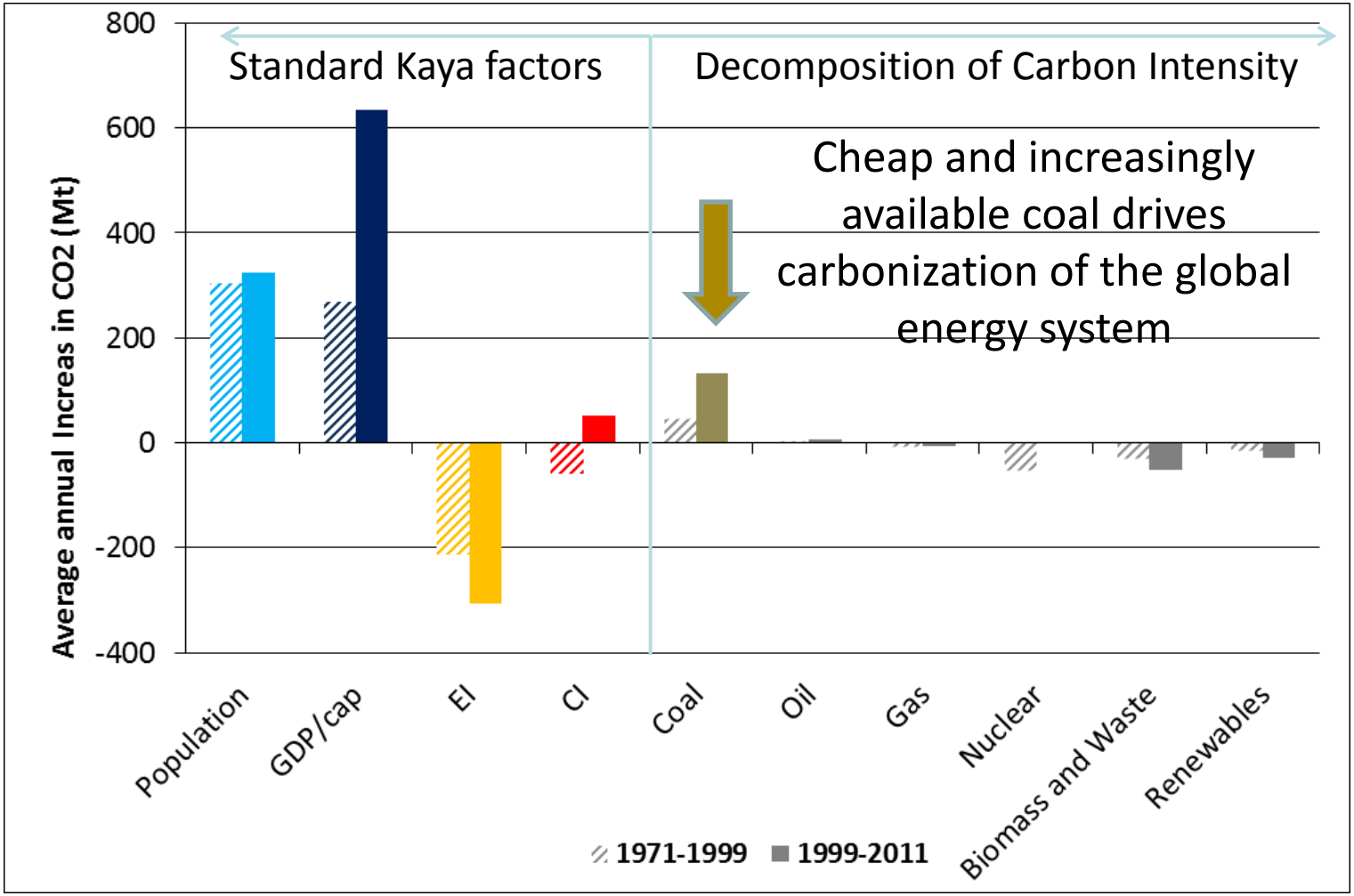
Technische Universität Berlin

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



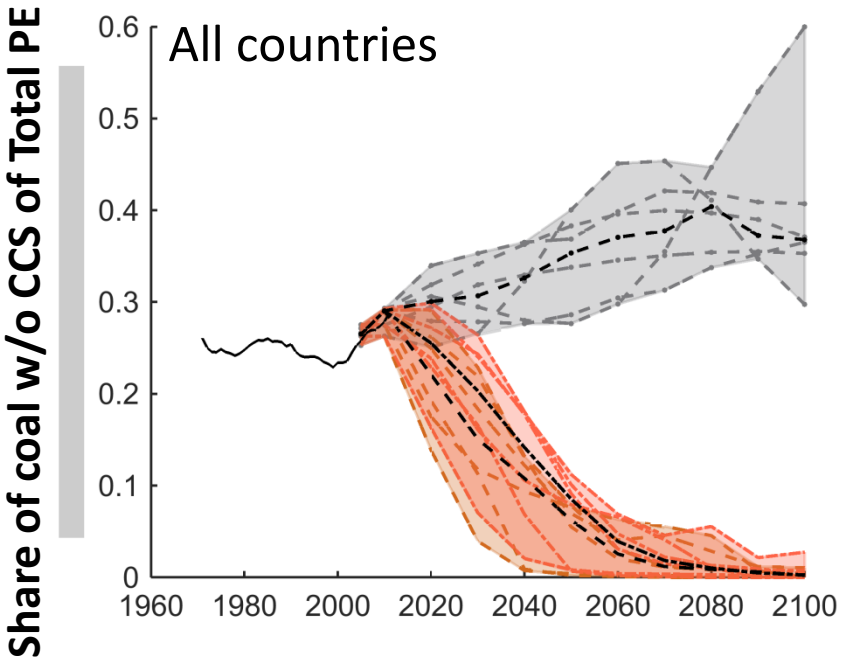
Based on Figure 1.3

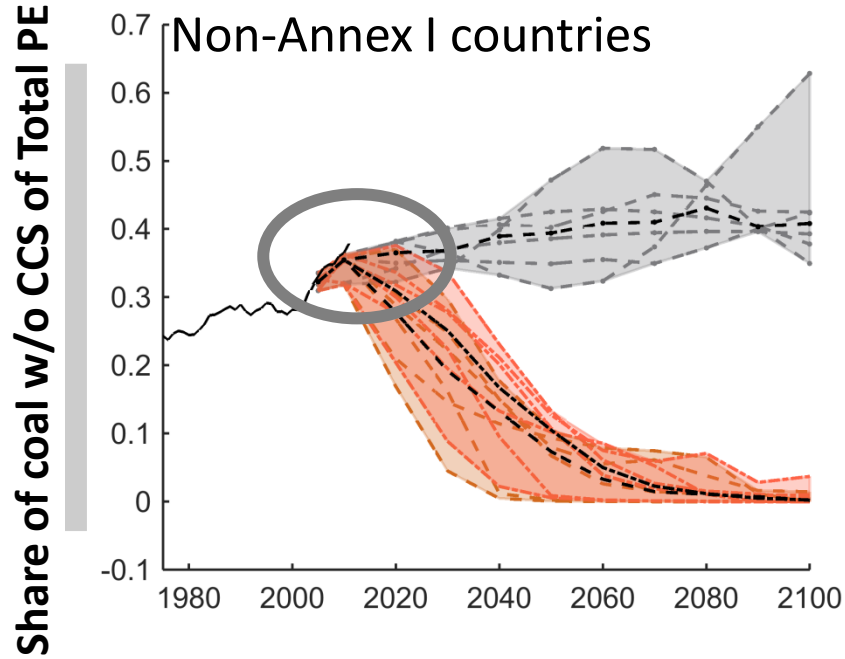
A renaissance of coal drives the global carbonization.



Steckel, Edenhofer and Jakob, in press

Renaissance of coal is majorly driven by poor, fast growing countries.

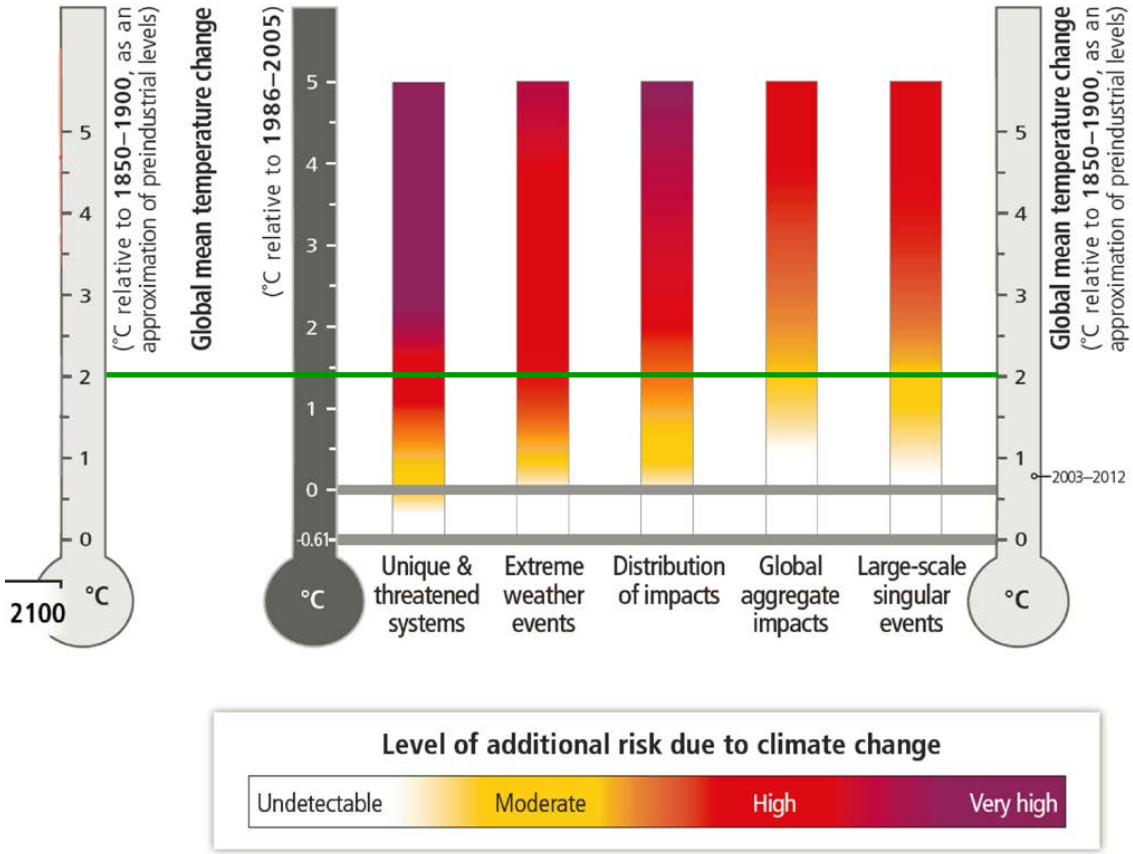




Steckel, Edenhofer and Jakob, in press

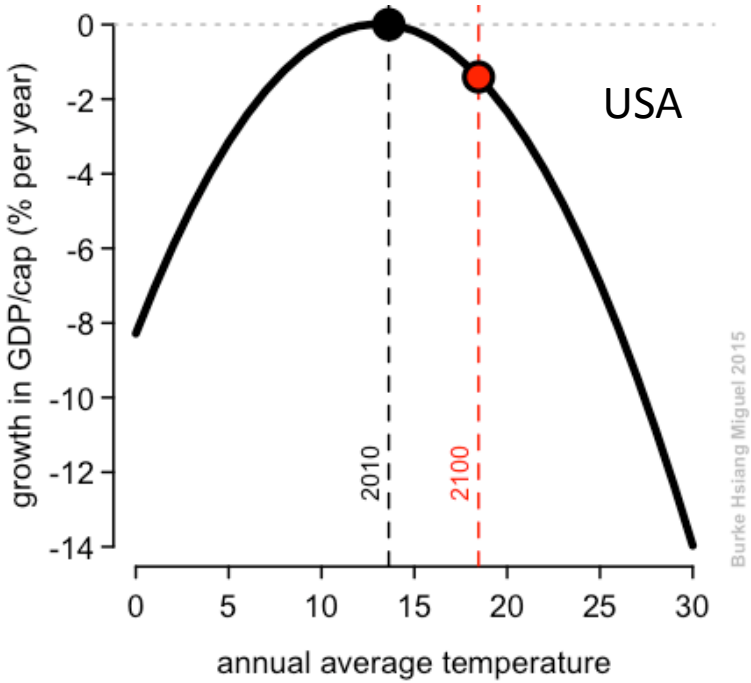
- Non Annex I countries have increased their coal share in the energy mix **faster than foreseen in available baseline scenarios**
- Carbonization by coal is **not limited to China**, but applies structurally to poor, fast growing countries

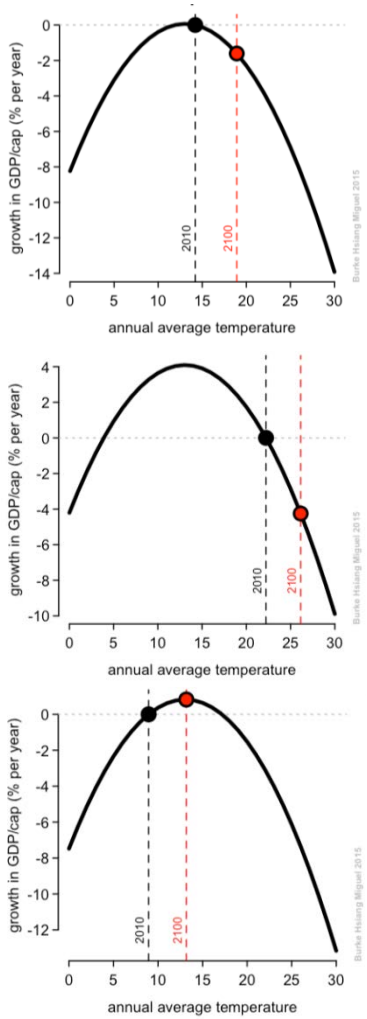
Climate Projections and Associated Risks



Slide by H. J. Schellnhuber

Growth vs. temperature





China

Brazil

Germany

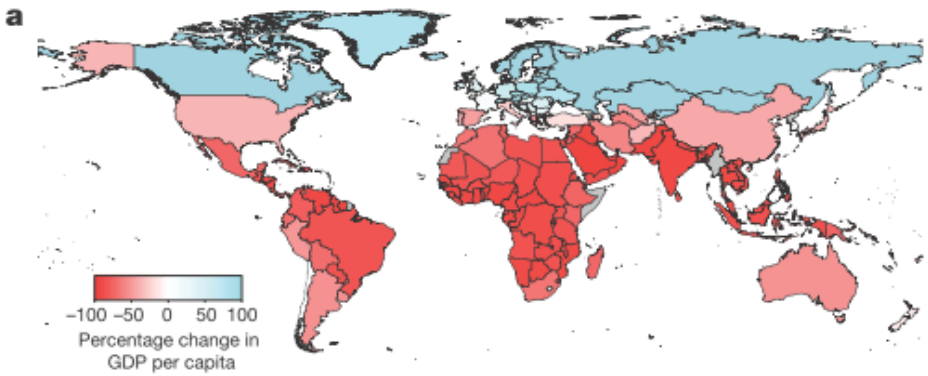
http://web.stanford.edu/~mburke/climate/map.php

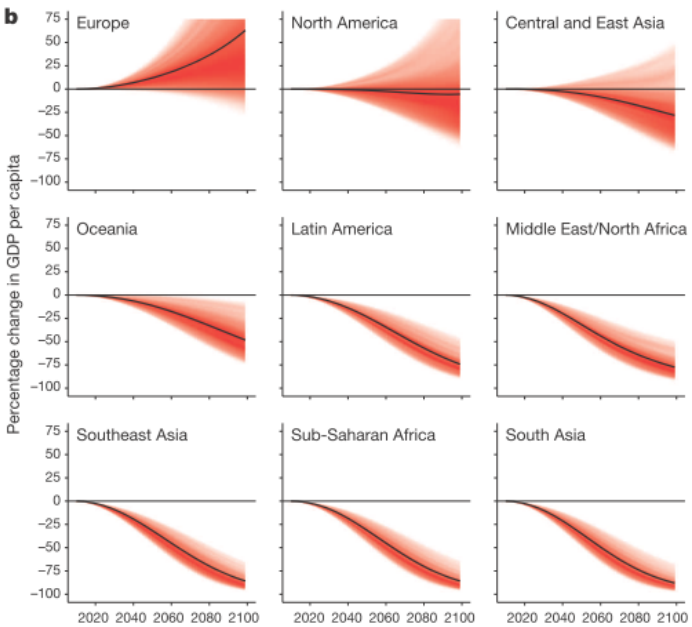
LETTER

nature

Global non-linear effect of temperature on economic production

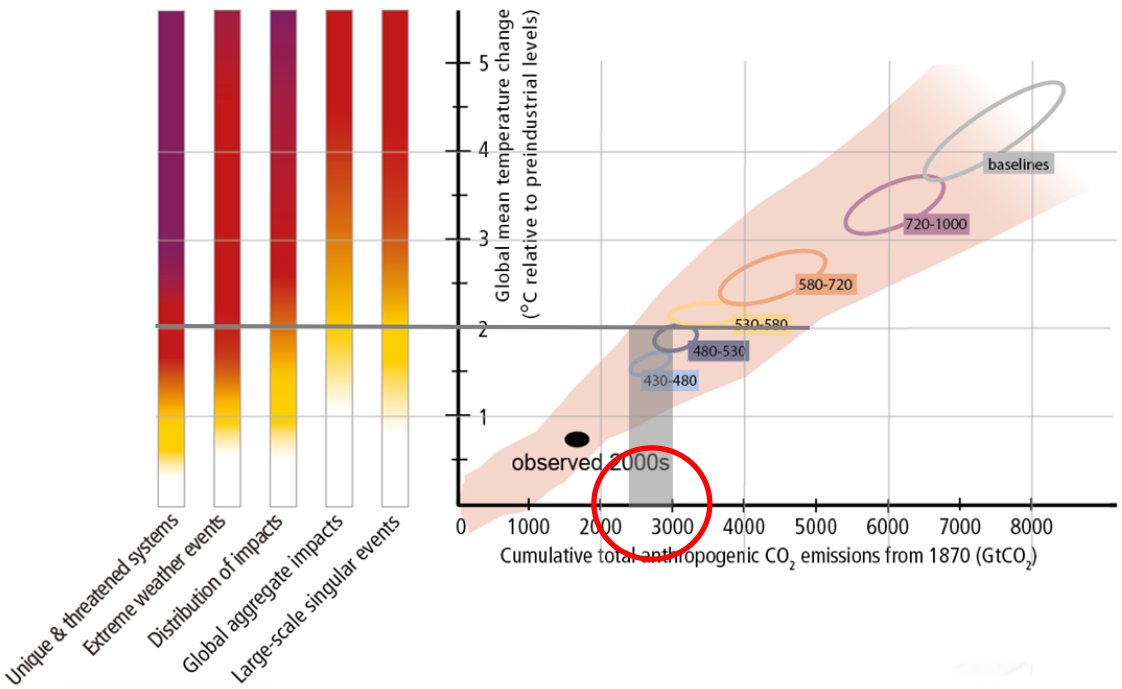
Marshall Burke[1,2]*, Solomon M. Hsiang[3,4]* & Edward Miguel[4,5]





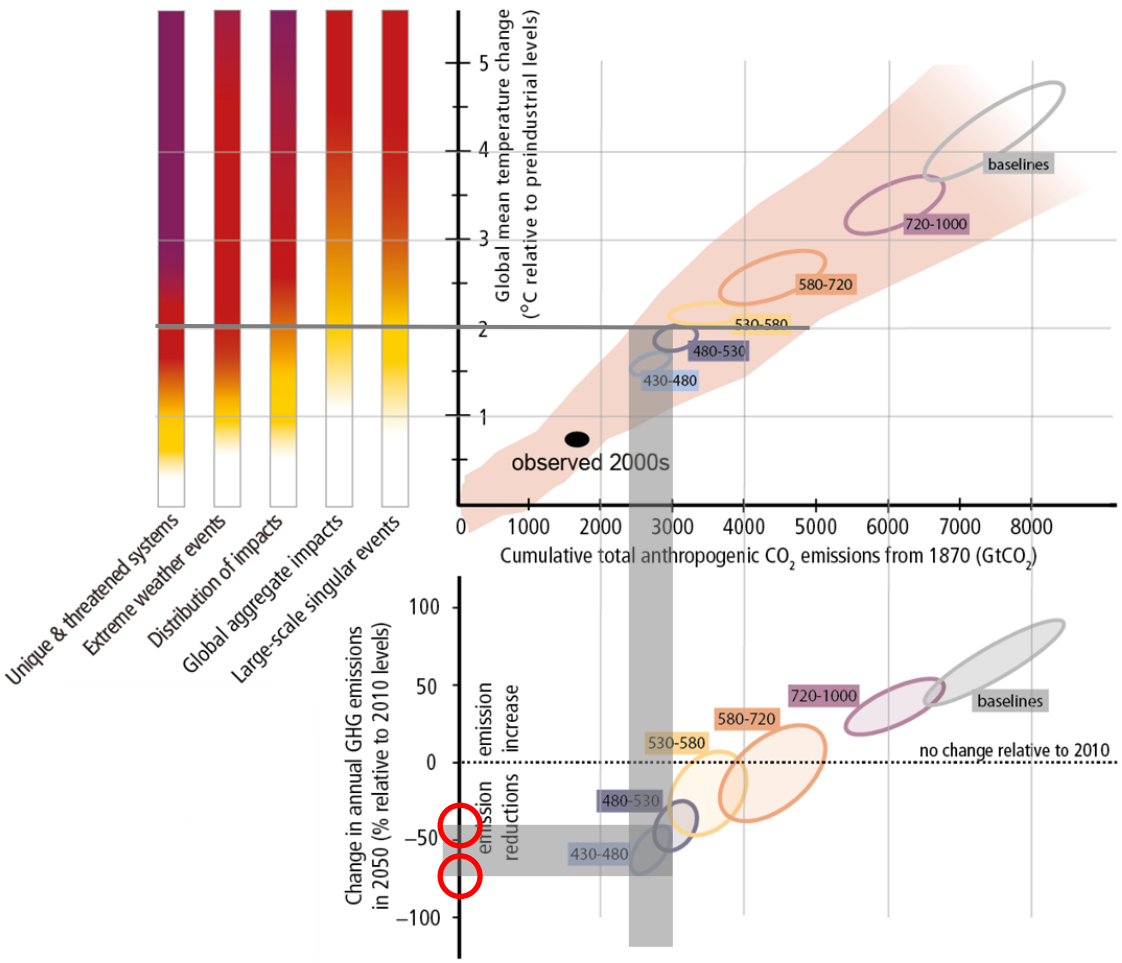
Quelle: Nature, doi:10.1038/nature15725

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



Based on SYR Figure SPM.10

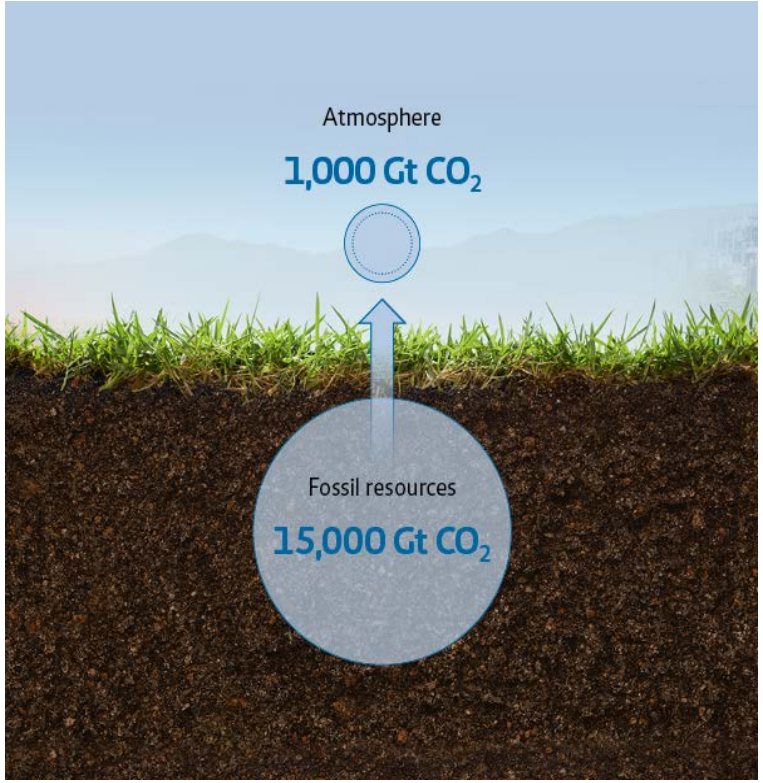
...which in turn depend on annual GHG emissions over the next decades.



Based on SYR Figure SPM.10

What are the consequences for international energy and climate policy?

The climate problem at a glance



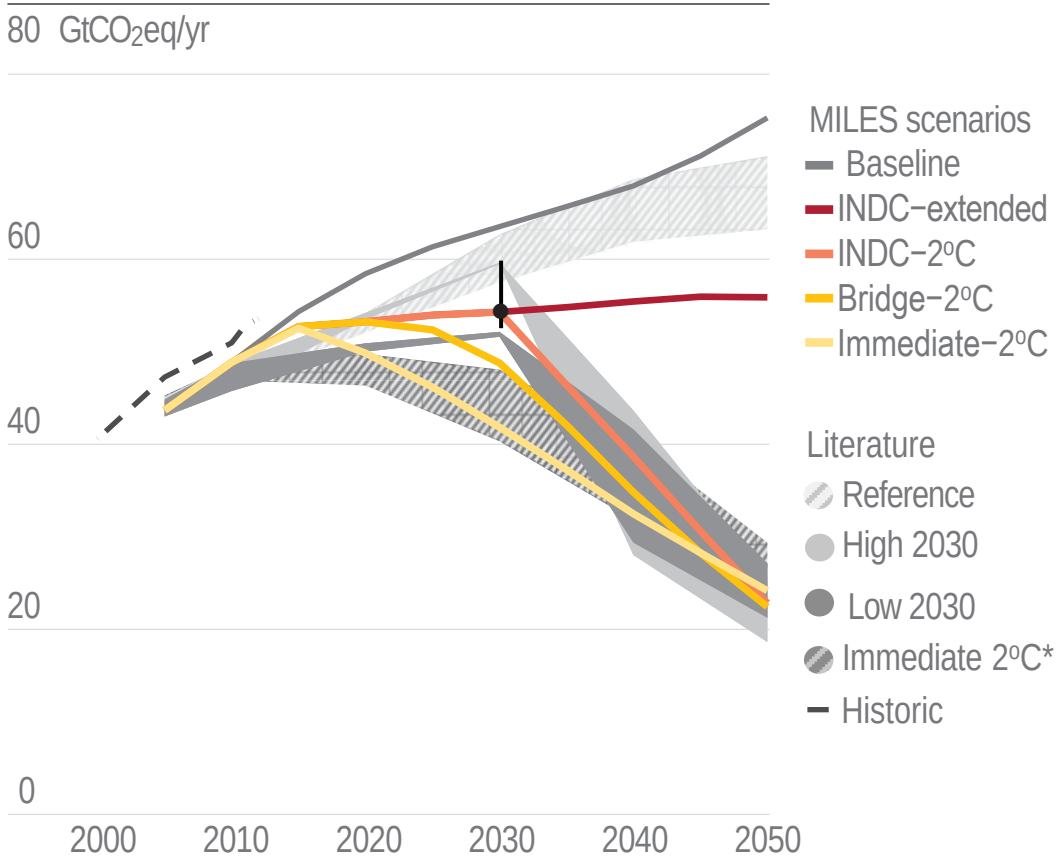
Resources and reserves to remain underground until 2100 (median values compared to BAU, AR5 Database)

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**.**

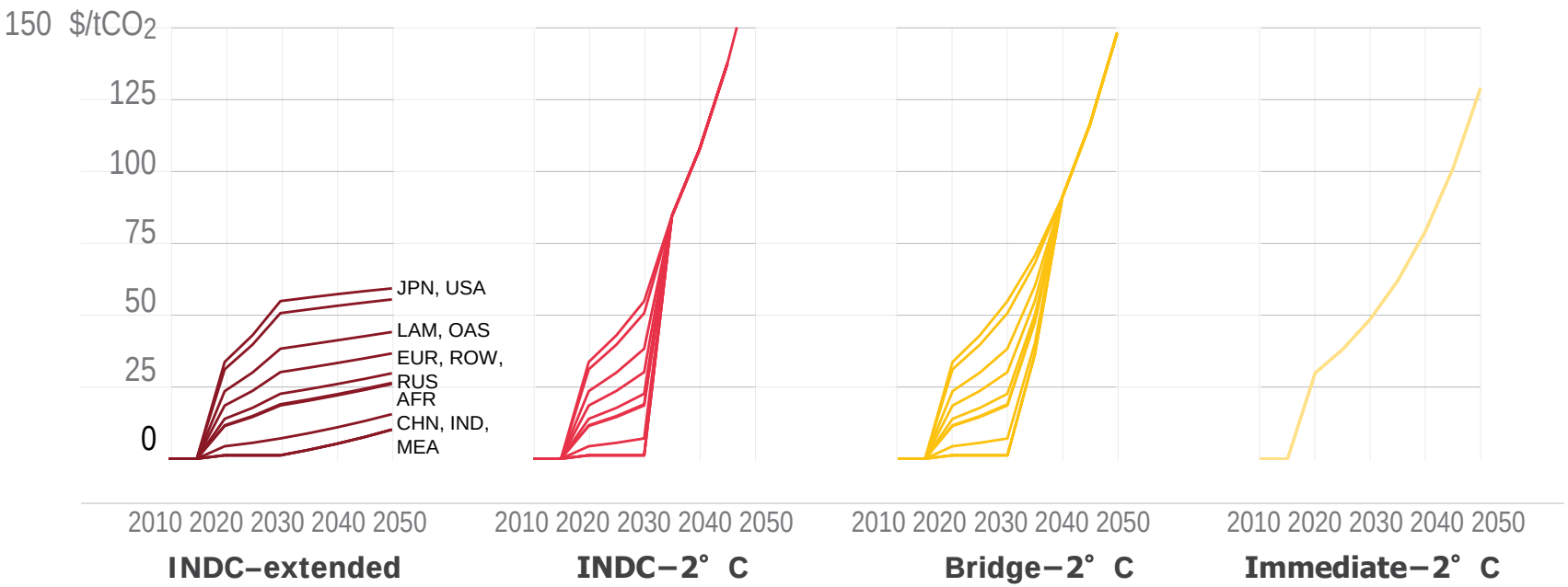
INDC-extended: conditional INDCs PBL best guess and extrapolation, assuming carbon price increase w. 1.5% after 2030, overlaid with convergence of carbon price across regions, so stronger growth rates in regions with low prices in 2030 (see next slide) and vice versa.

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

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

Quelle: Frankfurter Allgemeine Zeitung, online, 26.10.2015

King Coal and the Queen of 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 renewable technologies (*2*). The implications for long-term GHG emissions are serious because, once installed, a coal power plant will emit for decades. Fossil fuel subsidies support investments in coal capacities around the globe and thereby threaten the achievement of climate change mitigation goals. Targeted reform of these subsidies could yield benefits for climate change mitigation as well as other development objectives.

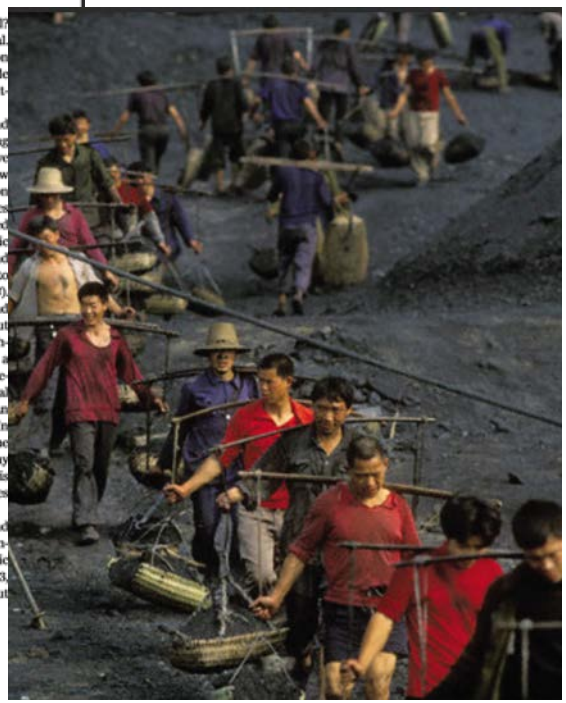
The existing global energy infrastructure already commits 729 gigatons of CO_2 ($GtCO_2$) of future cumulative emissions over its lifetime. Aims to limit global temperature increase to 2°C allow for a total of 1000 $GtCO_2$ to be released into the atmosphere. If only one-third of currently planned coal capacity is installed successfully, an additional 113 $GtCO_2$ emissions are committed, nearly depleting the budget allowed by such mitigation targets (*3*).

Over the past year, many nations have made commitments to reduce their domestic GHG emissions. The U.S. government has announced plans to reduce emissions in the power sector by 32% below 2005 levels in 2030 through its Clean Power Plan (*4*). The 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 electricity from wind and solar power have declined substantially. Wind generation now costs 70 US$ per megawatt-hour (MWh) on average, and geographically favorable sites can compete with the costs of coal-fired power (~50 US$/MWh). Solar photovoltaic projects have reached 80 US$/MWh and within a few years can also be expected to match the costs of coal generation (*7*, *8*). However, the costs of intermittency of wind and solar add an additional markup of about 30 US$/MWh (*9*) in cases where these technologies are deployed on a large scale as a result of increasing backup capacity requirements. Because of these additional costs, coal becomes more attractive for investors than renewable sources in many countries. In addition, coal is increasingly traded on the world market, dashing the hopes of many concerned with climate change that coal is only economically viable for a few countries with large domestic endowments (*1*).

At the same time, finance ministers around the globe subsidize fossil fuels, mostly by enabling the sale of these fuels on the domestic market below world market prices. In 2013, these pretax subsidies amounted to about



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

Climate Policy and Poverty reduction - A contradiction?

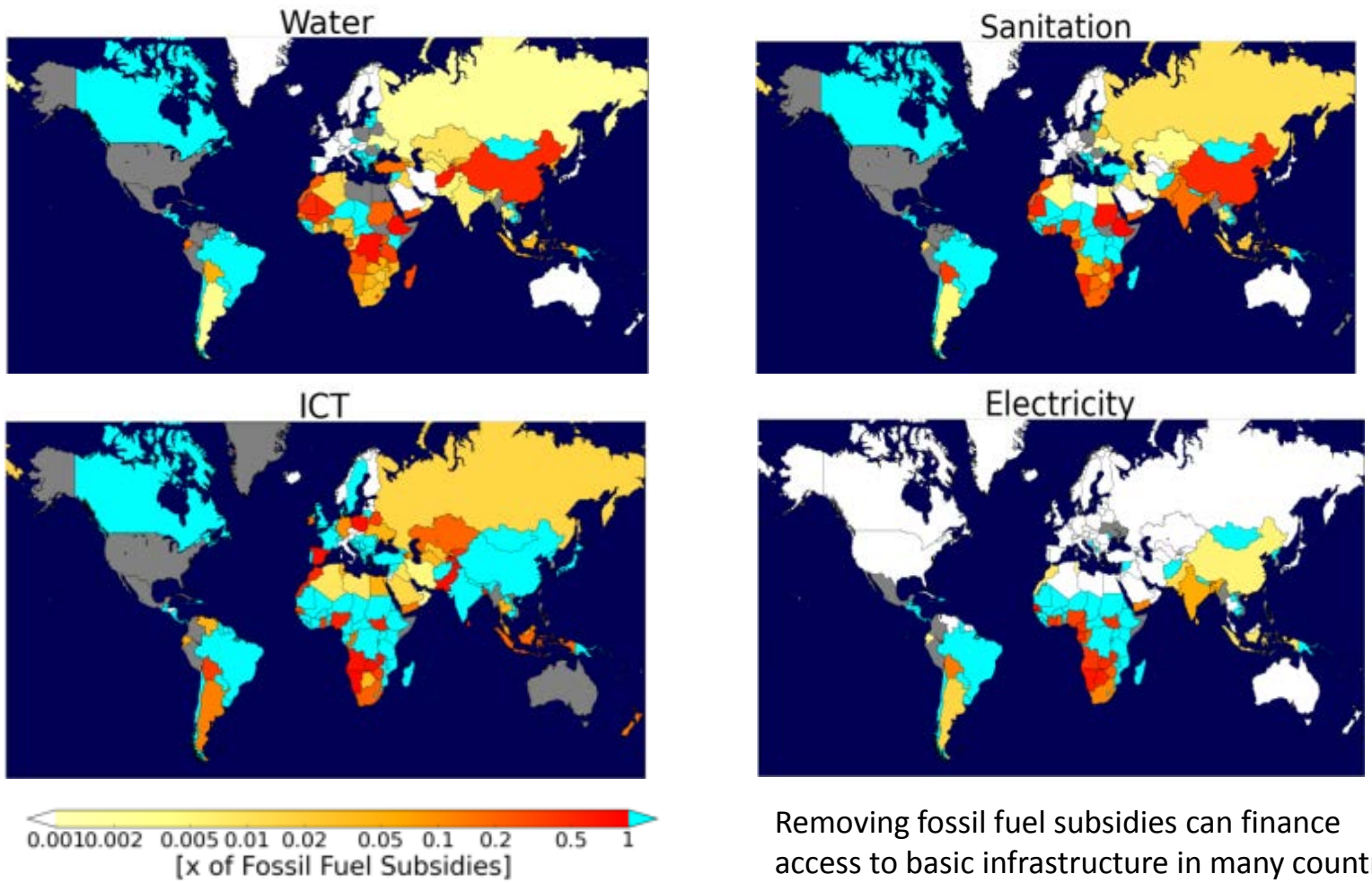
Water availability

Sanitation

Telecommunication

Access to electricity

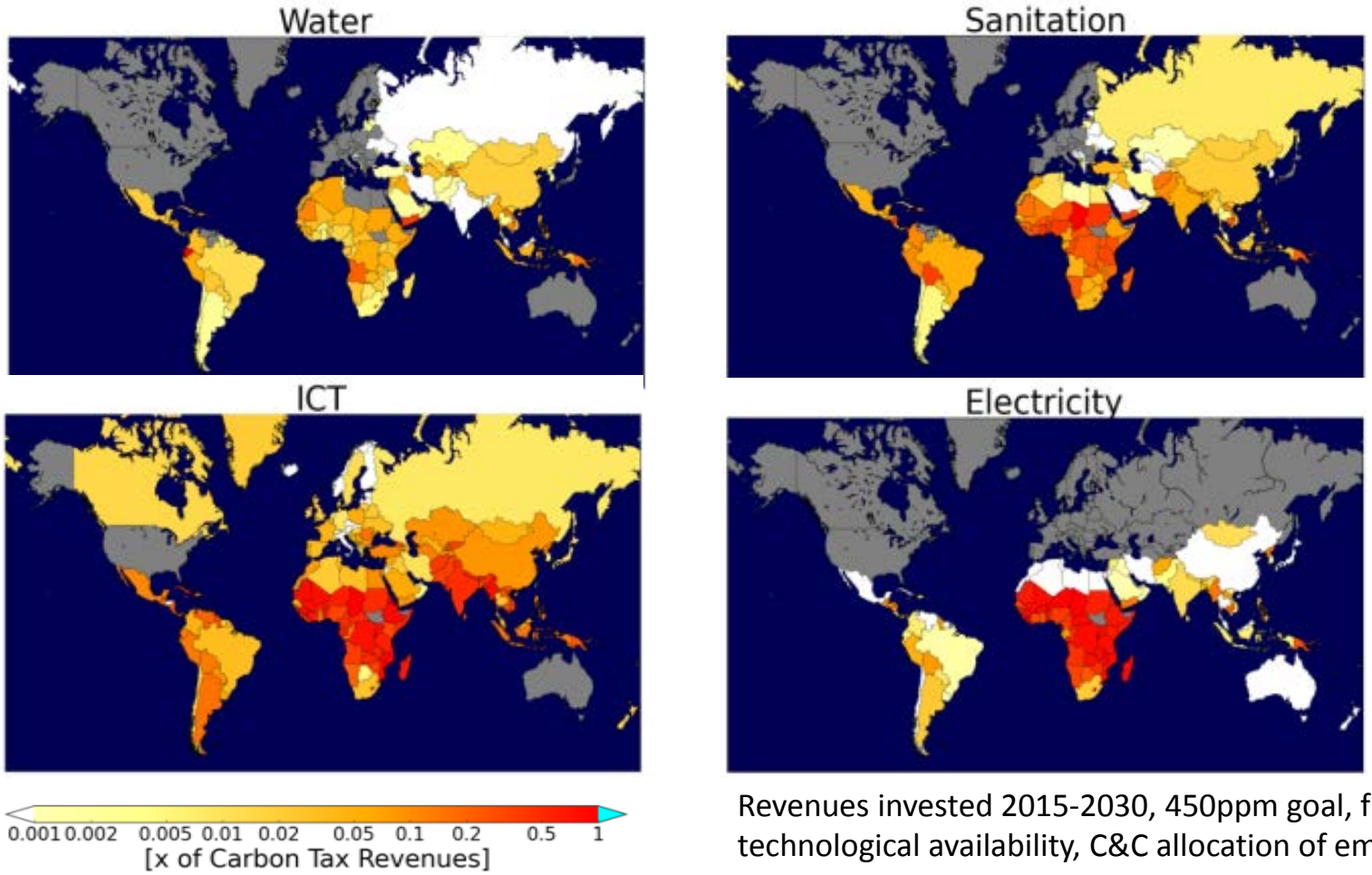
Removing fossil fuel subsides to close infrastructure gaps



Source: Jakob et al., in press

Removing fossil fuel subsidies can finance access to basic infrastructure in many countries

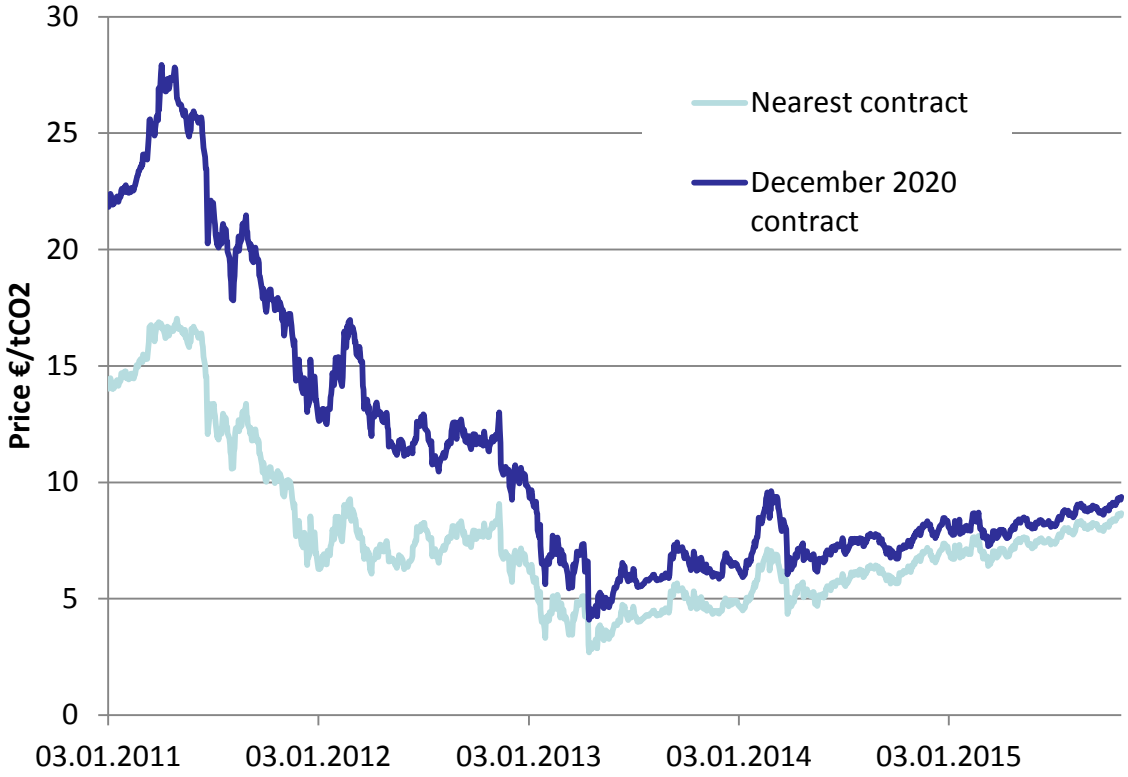
Carbon pricing revenues to close infrastructure gaps



Source: Jakob et al., in press

Revenues invested 2015-2030, 450ppm goal, full technological availability, C&C allocation of emission permits

ETS lack dynamical cost efficiency

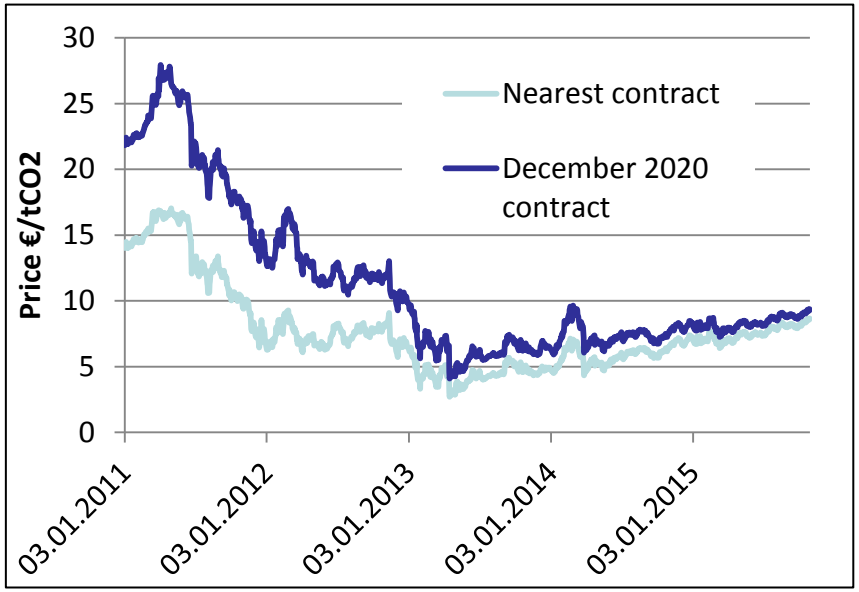


- **Falling CO_2 price**
- **No increase expected before 2020**
- **Market Stability Reserve will be implemented, but effect might be limited**

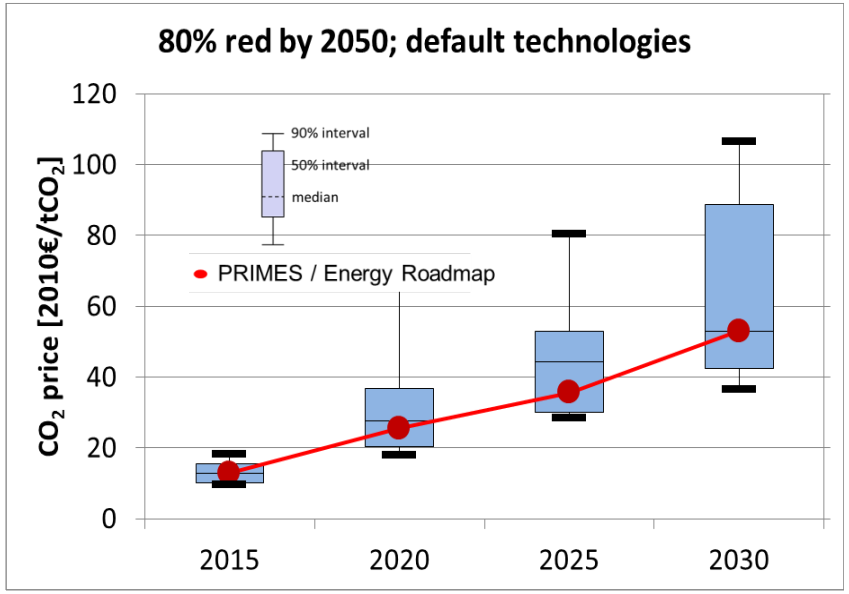
ETS lack dynamical cost efficiency

- 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 €/tCO2 in 2020

EUA Nearest Contract and Futures



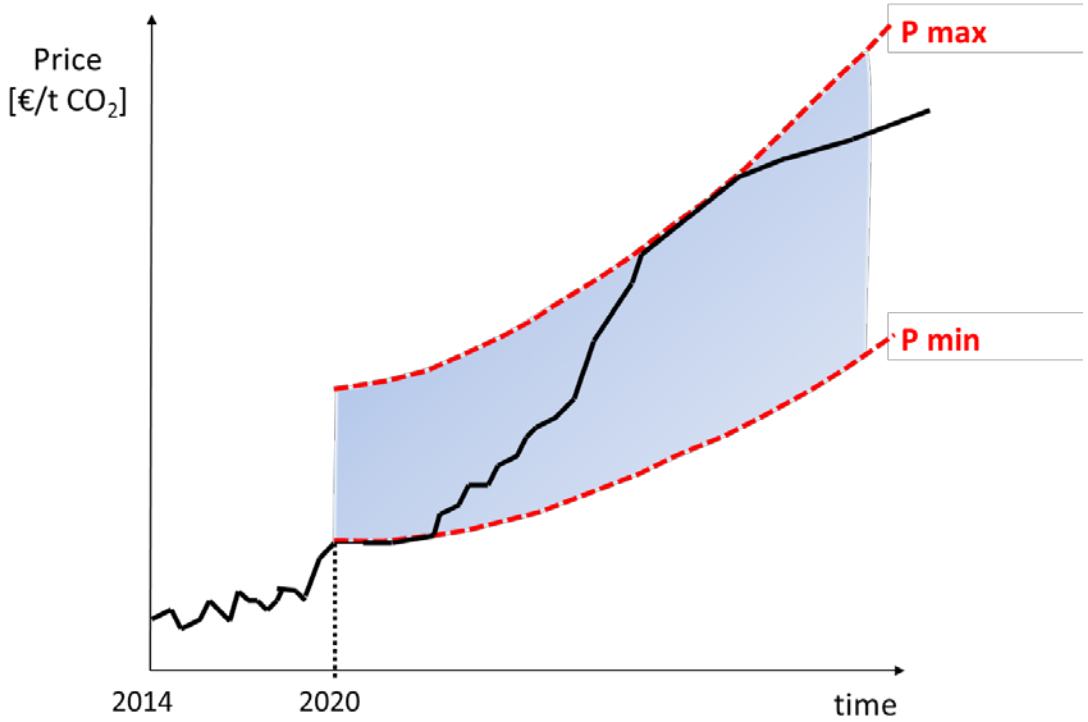
Cost-efficient CO2 price from models



Knopf et al. (2013)

Introduction of a price corridor

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



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Thank you for your attention!

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