

Tackling the Challenge of Climate Change

A Near-Term Actionable Agenda

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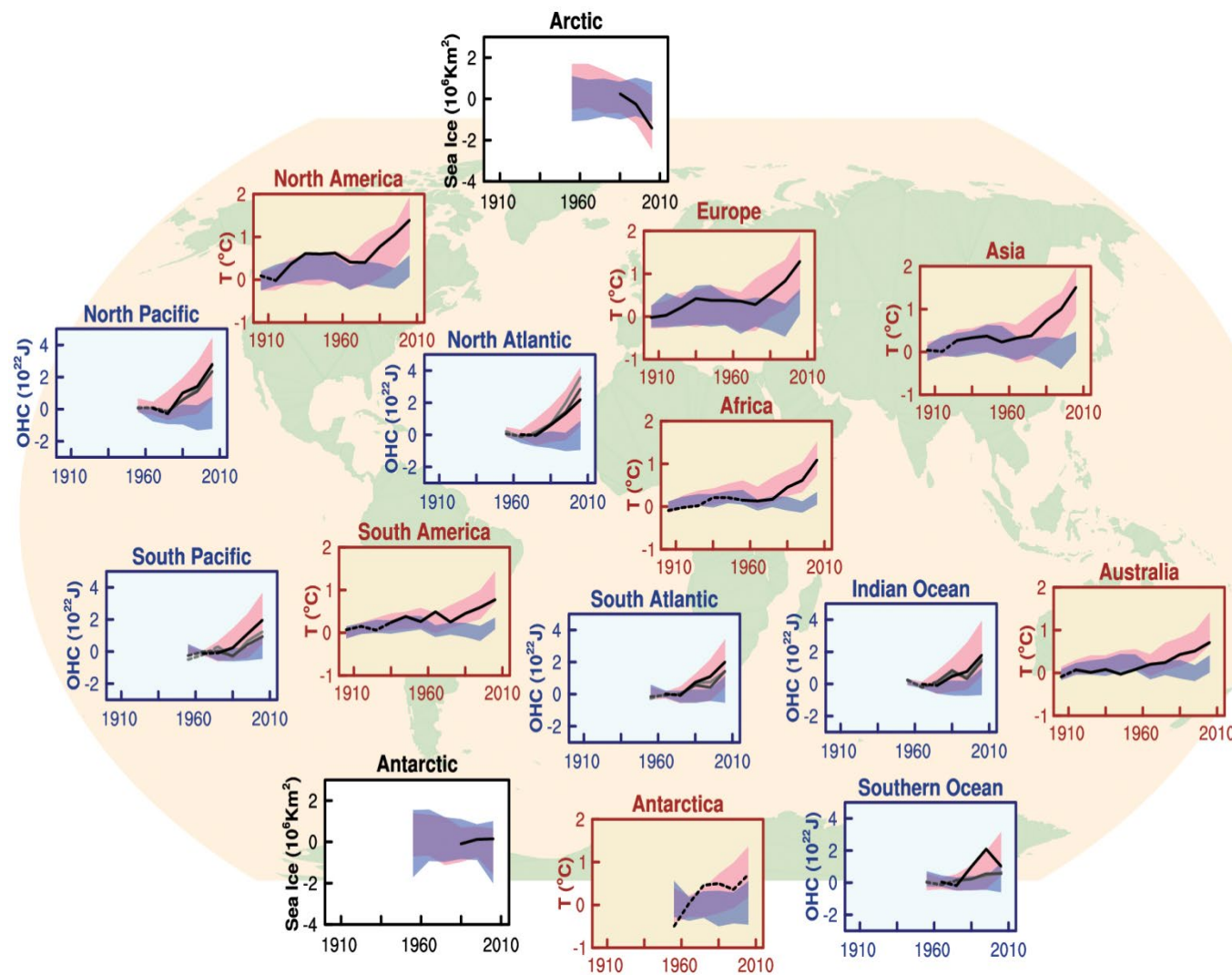
Former Chair of IPCC

Rutgers University

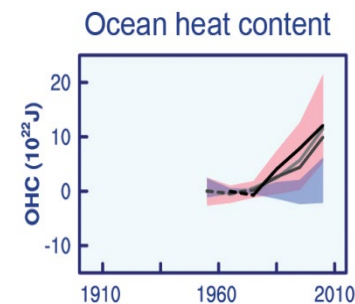
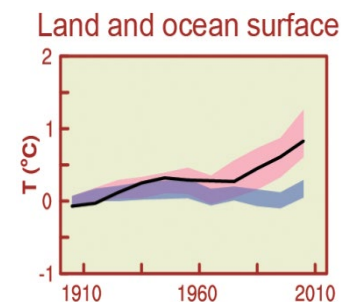
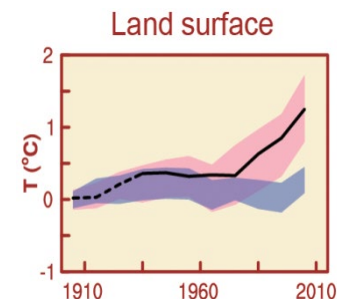
4 May 2016

Observed and Simulated Trends in Temperature

All Figures © IPCC 2013



Global averages

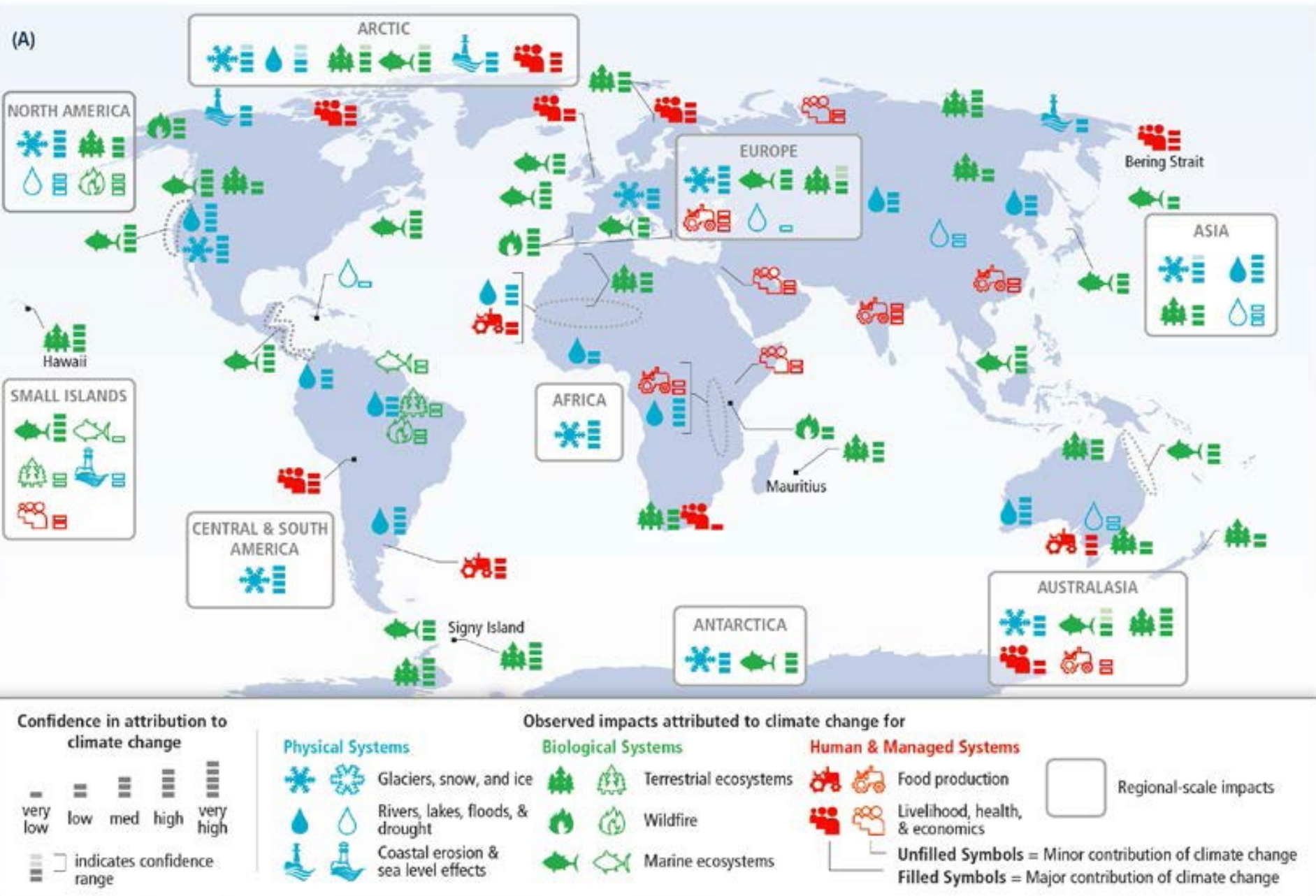


≡ Observations

■ Models using only natural forcings

■ Models using both natural and anthropogenic forcings

Observed Impacts Due to Climate Change



ipcc
INTERGOVERNMENTAL PANEL ON climate change

CLIMATE CHANGE 2014

Synthesis Report



SYNTHESIS REPORT OF THE
FIFTH ASSESSMENT REPORT OF THE
INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE



Tackling the Challenge of **CLIMATE CHANGE**

A NEAR-TERM ACTIONABLE MITIGATION AGENDA

COMMISSIONED BY THE REPUBLIC OF NAURU,
CHAIR OF THE ALLIANCE OF SMALL ISLAND
STATES (AOSIS)



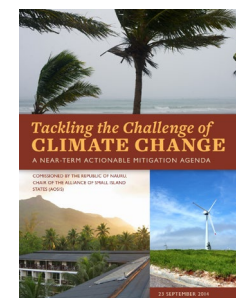
23 SEPTEMBER 2014

Global Energy Assessment

Toward a Sustainable Future



The scale of the challenge is beyond anything we have yet considered.



- **We can and must act boldly now to reduce greenhouse gas emissions to keep the political goal of 1.5–2°C goal within reach,**
- **avoid increased costs of mitigation and adaptation and technological lock-in,**
- **provide universal access to modern energy, and**
- **realize multiple health and development co-benefits.**

Elements of the 2015 Paris Agreement

Article 2: Limit the global temperature increase to below 2 degrees C, and pursue efforts to limit the temperature increase to 1.5 degrees C above pre-industrial levels.

Article 4: Global emissions of greenhouse gases should peak as soon as possible, and anthropogenic emissions by sources and removal by sinks should balance by the second half of this century

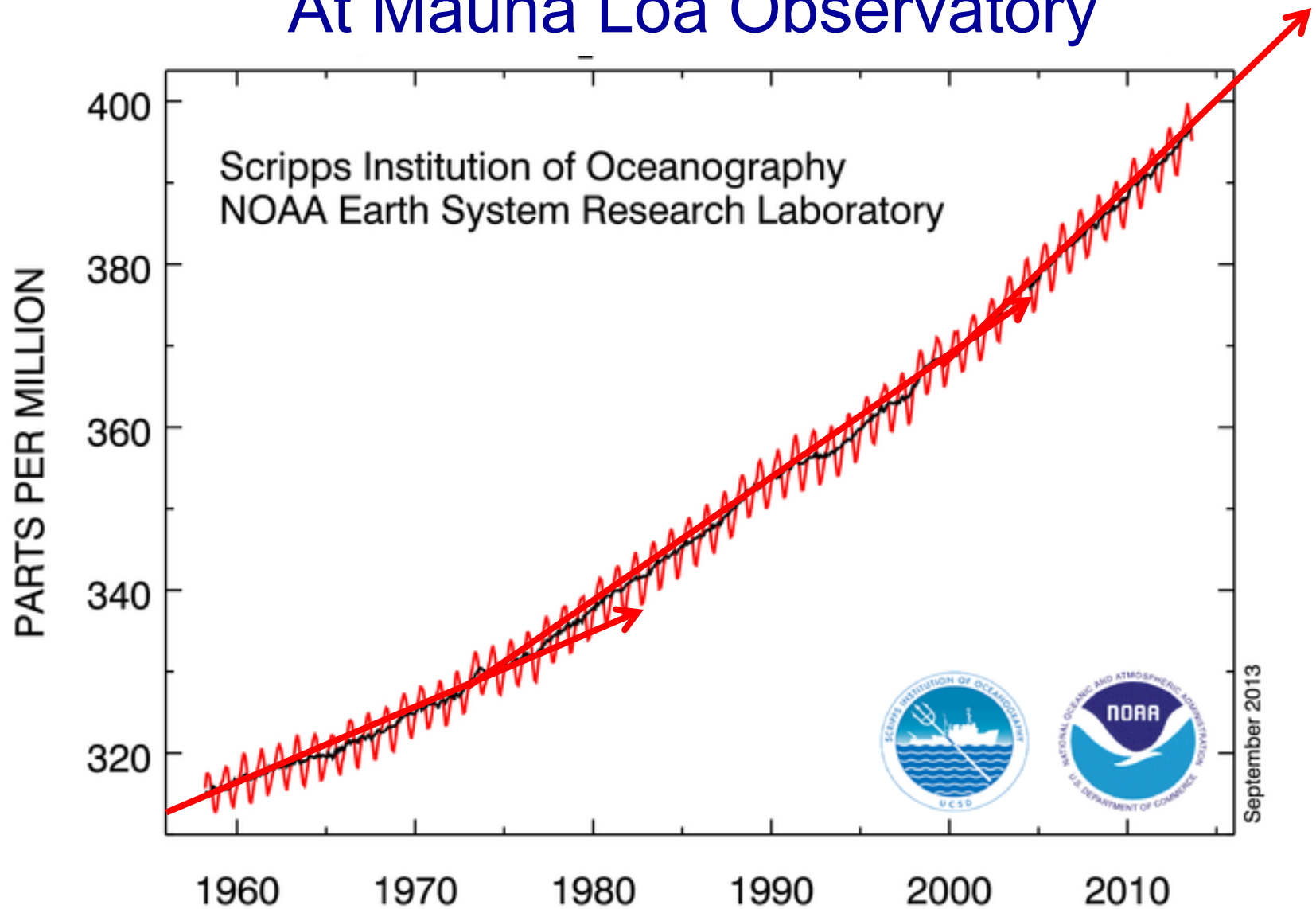
Article 4.2: Each Party must prepare Nationally Determined Contributions (NDCs)

Article 7: A recognition that there is a significant need for adaptation

Article 9: Developed countries will provide financial resources to assist developing countries with respect to mitigation and adaptation, with a floor of US\$100B per year

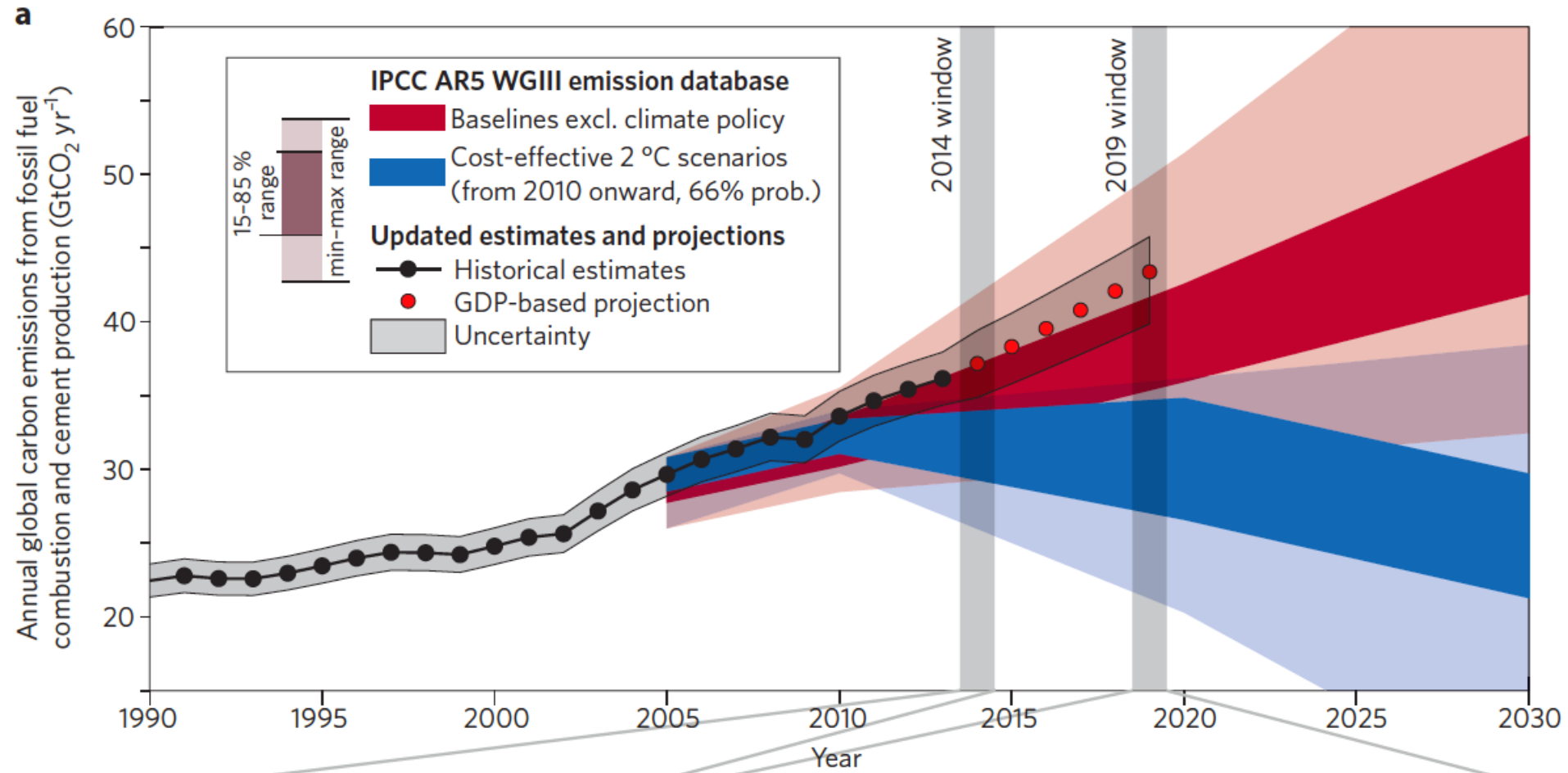
Articles 4.9/14: A global stock take will take place every 5 years, starting in 2023

CO₂ Concentrations At Mauna Loa Observatory



Source: NOAA, 2013 and IPCC WGI, 2013

Current global emissions are following the IPCC high scenario



Friedlingstein

Global CO₂ Emissions

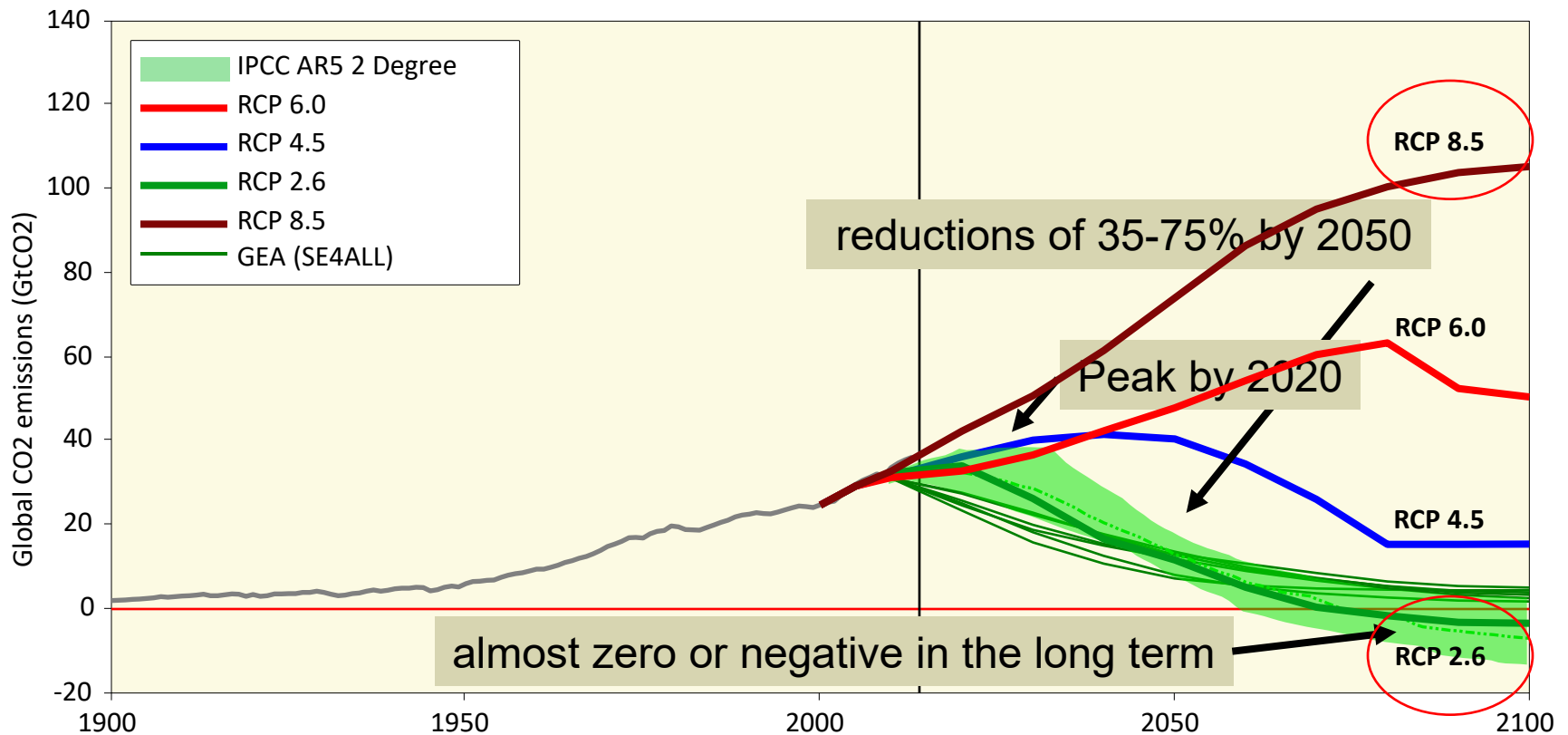
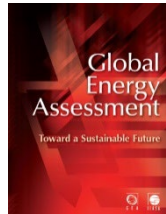
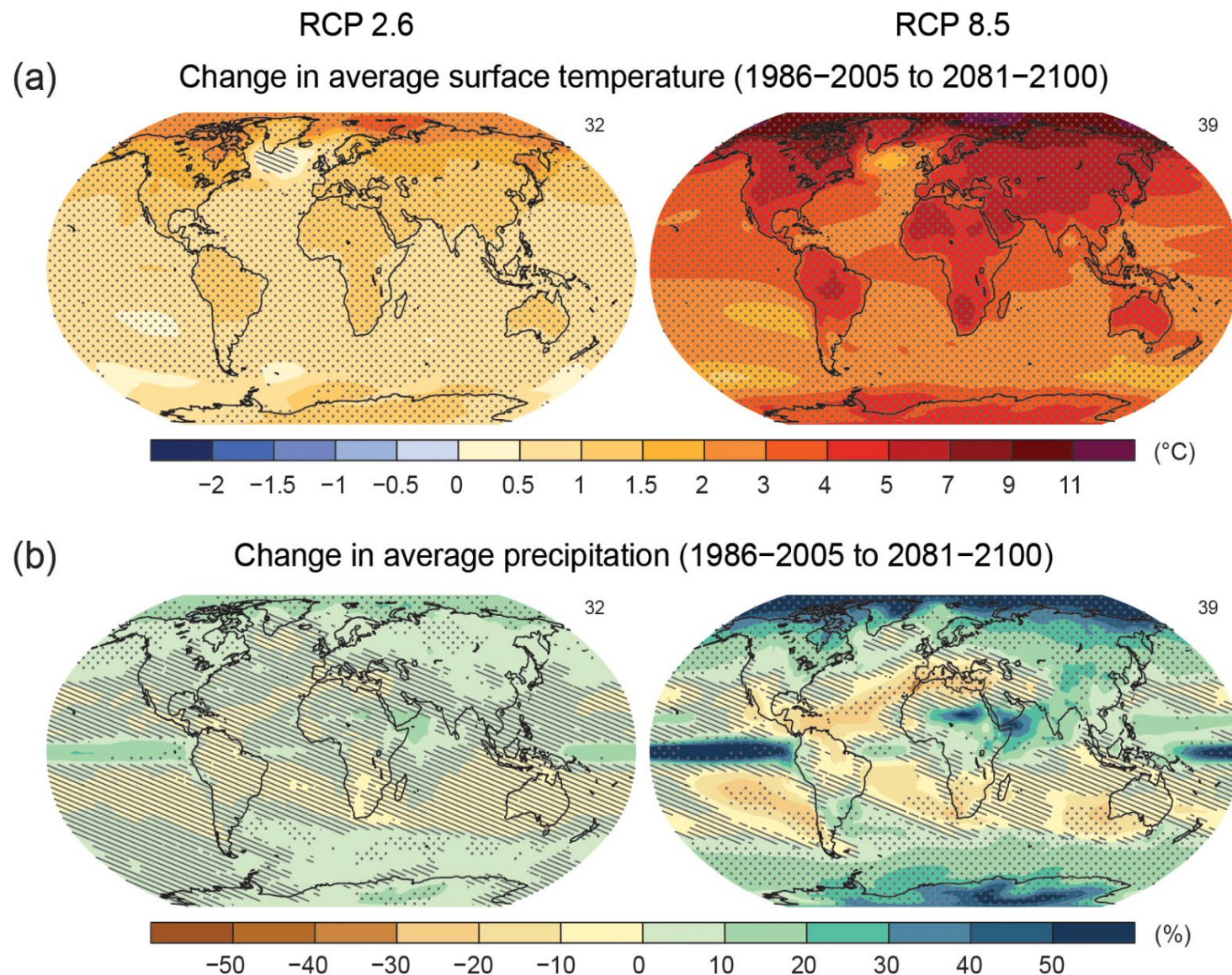
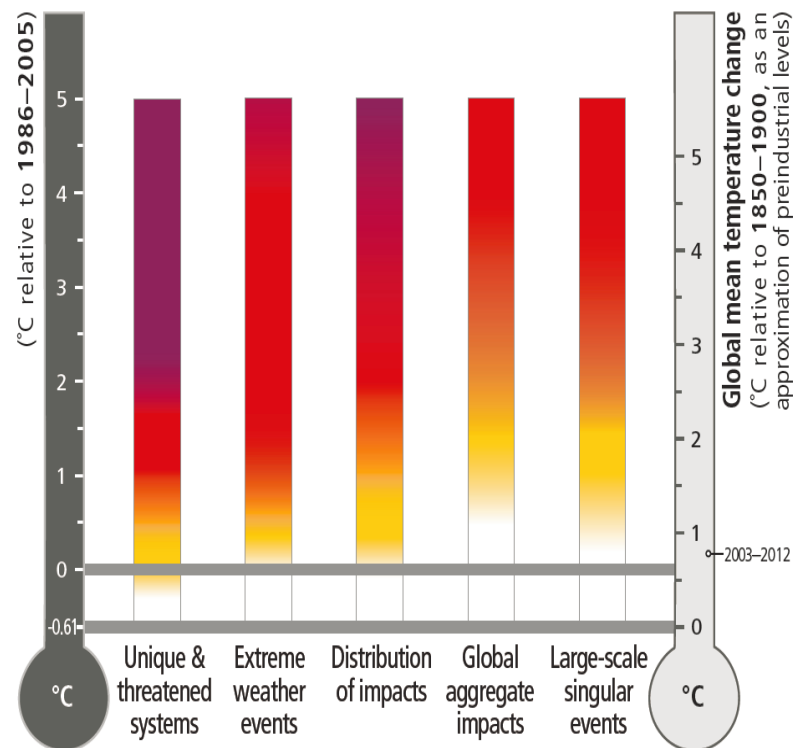
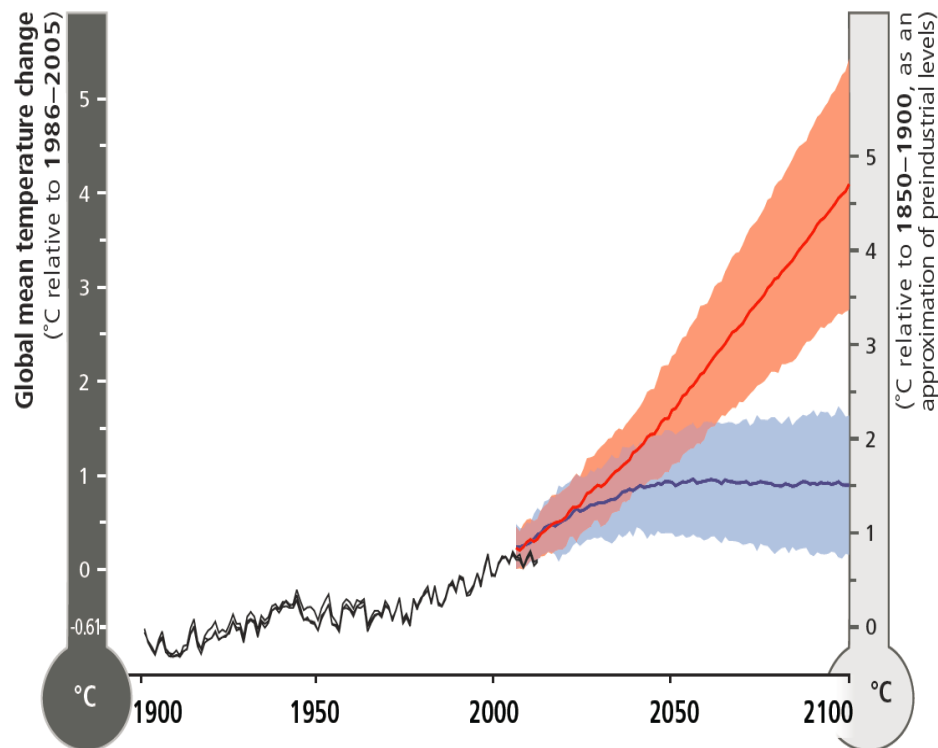


Figure SPM.8a,b
Maps of CMIP5 multi-model mean results

All Figures © IPCC 2013

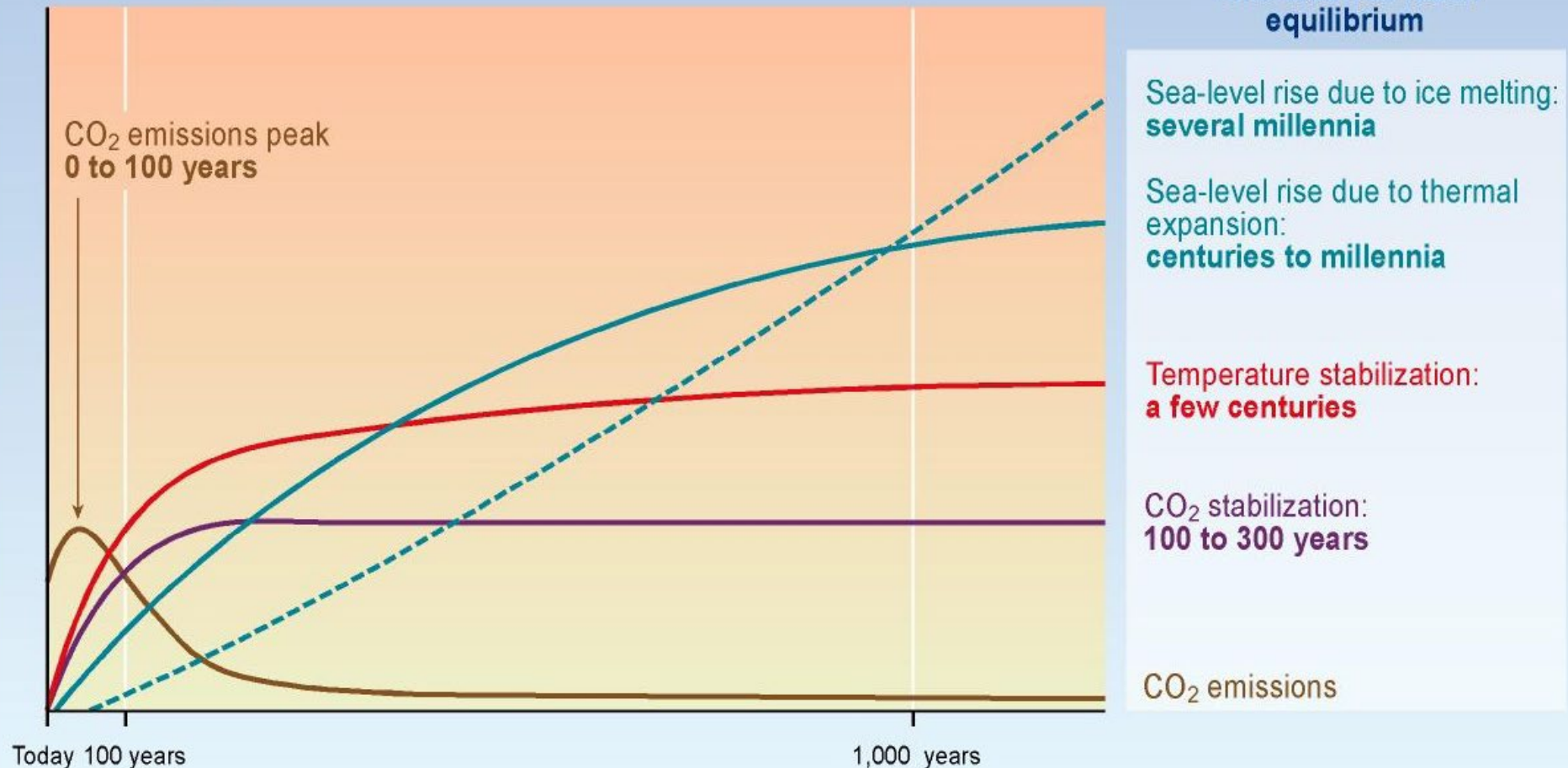




CO₂ concentration, temperature, and sea level continue to rise long after emissions are reduced

Magnitude of response

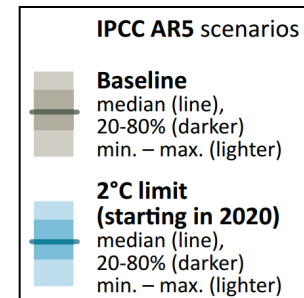
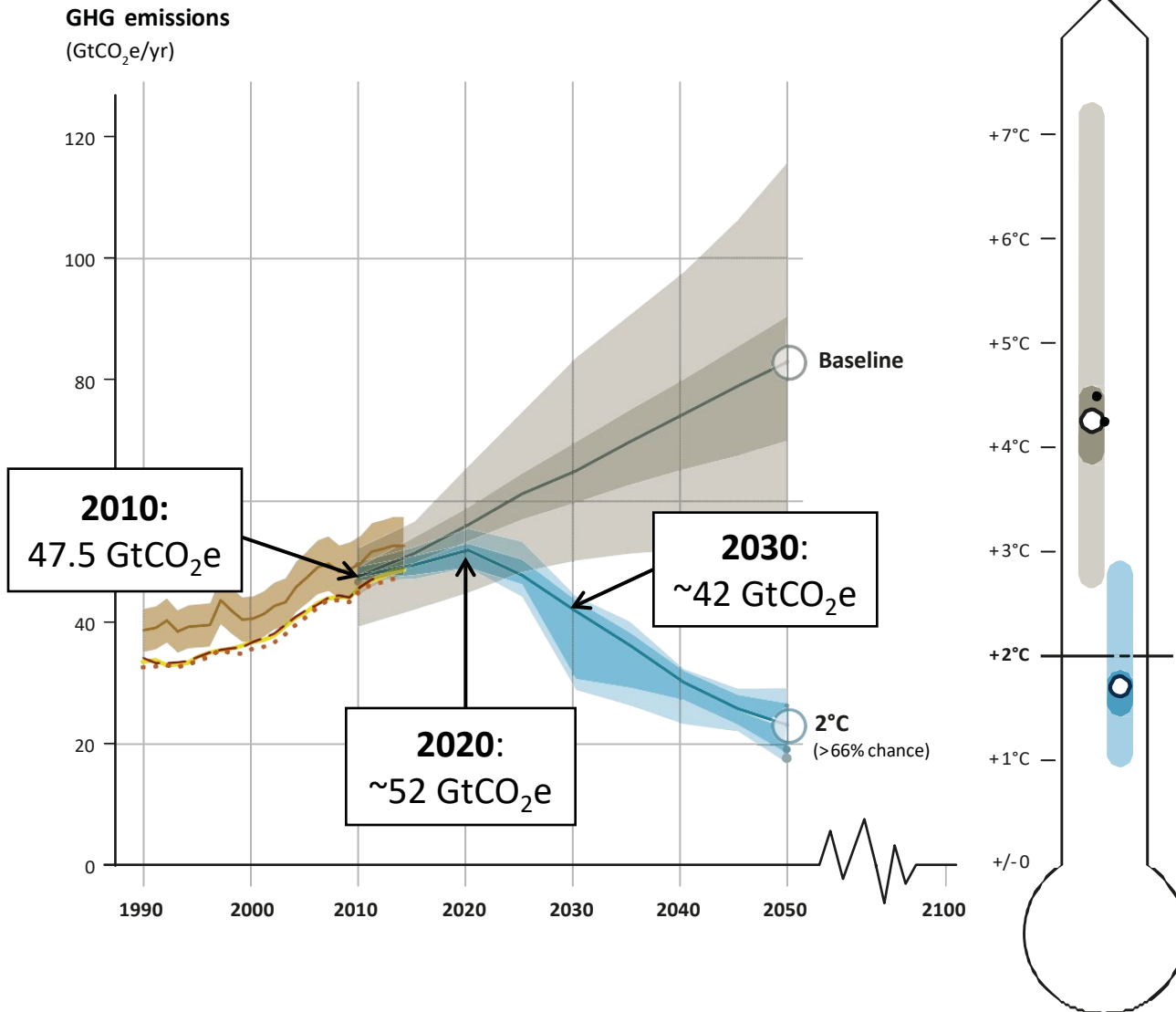
Time taken to reach equilibrium



Staying within the 2°C target



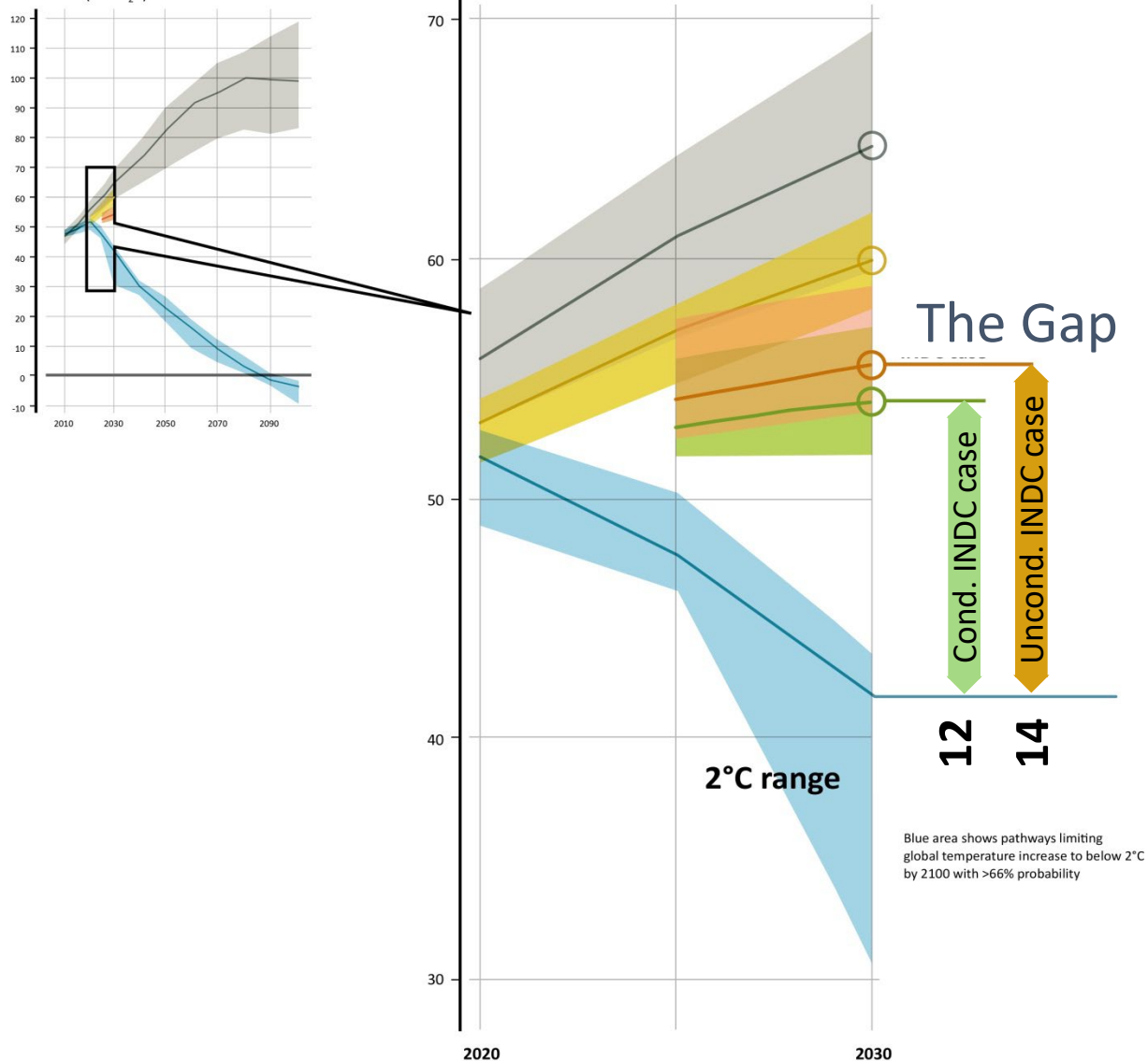
Estimated
global
warming by
2100
(°C rel.
1850-1900)



Credit: UNEP, 2015 https://www.dropbox.com/sh/vk018yr6h5xulnc/AAB-ISJFv_Xy7BFF4uBKIUVWa?dl=0

INDC contributions and the emissions gap

Annual Global Total Greenhouse Gas Emissions (GtCO₂e)



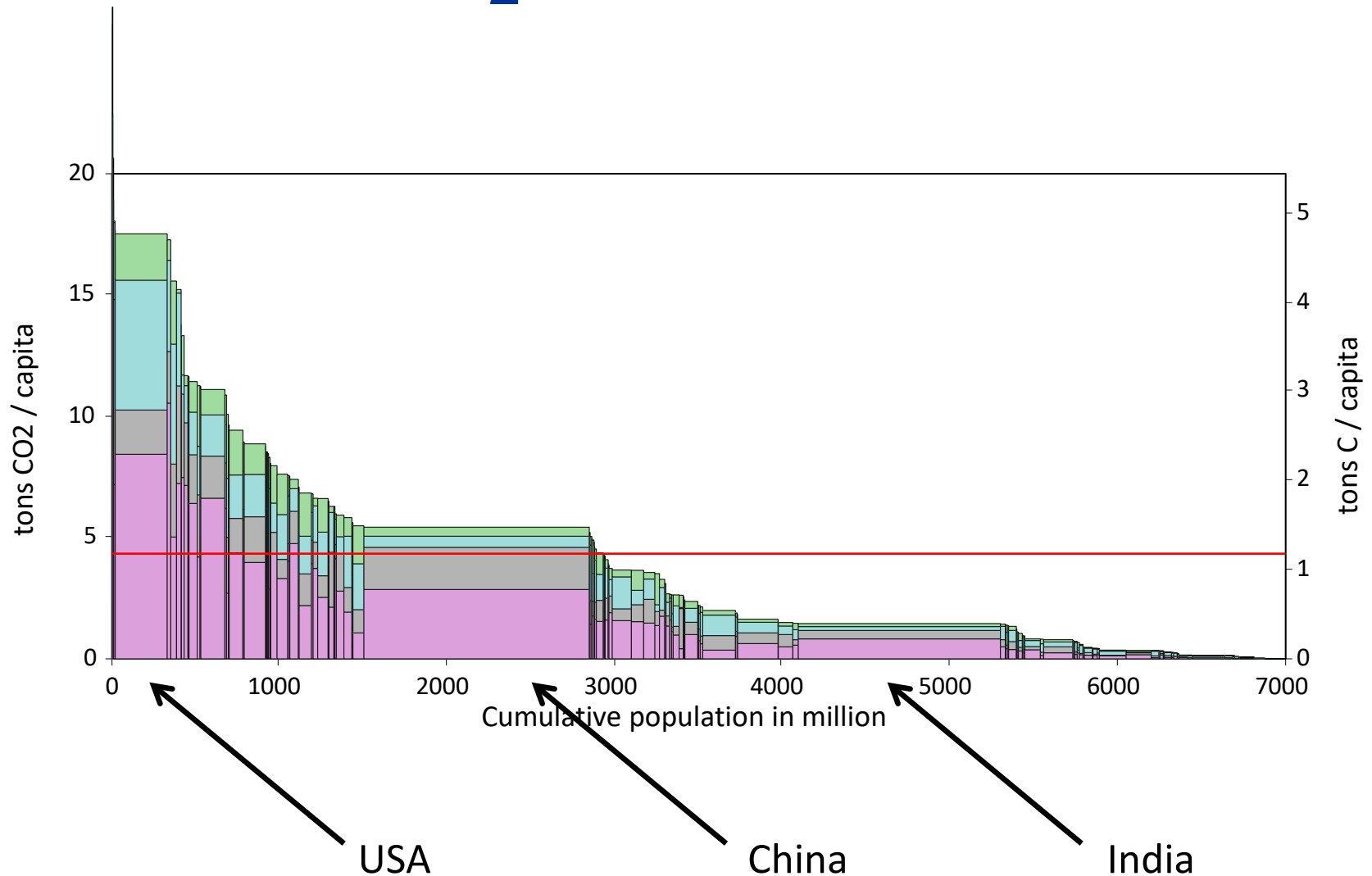
Unconditional INDC case
Gap= 14 GtCO₂e

Conditional INDC case
Gap= 12 GtCO₂e

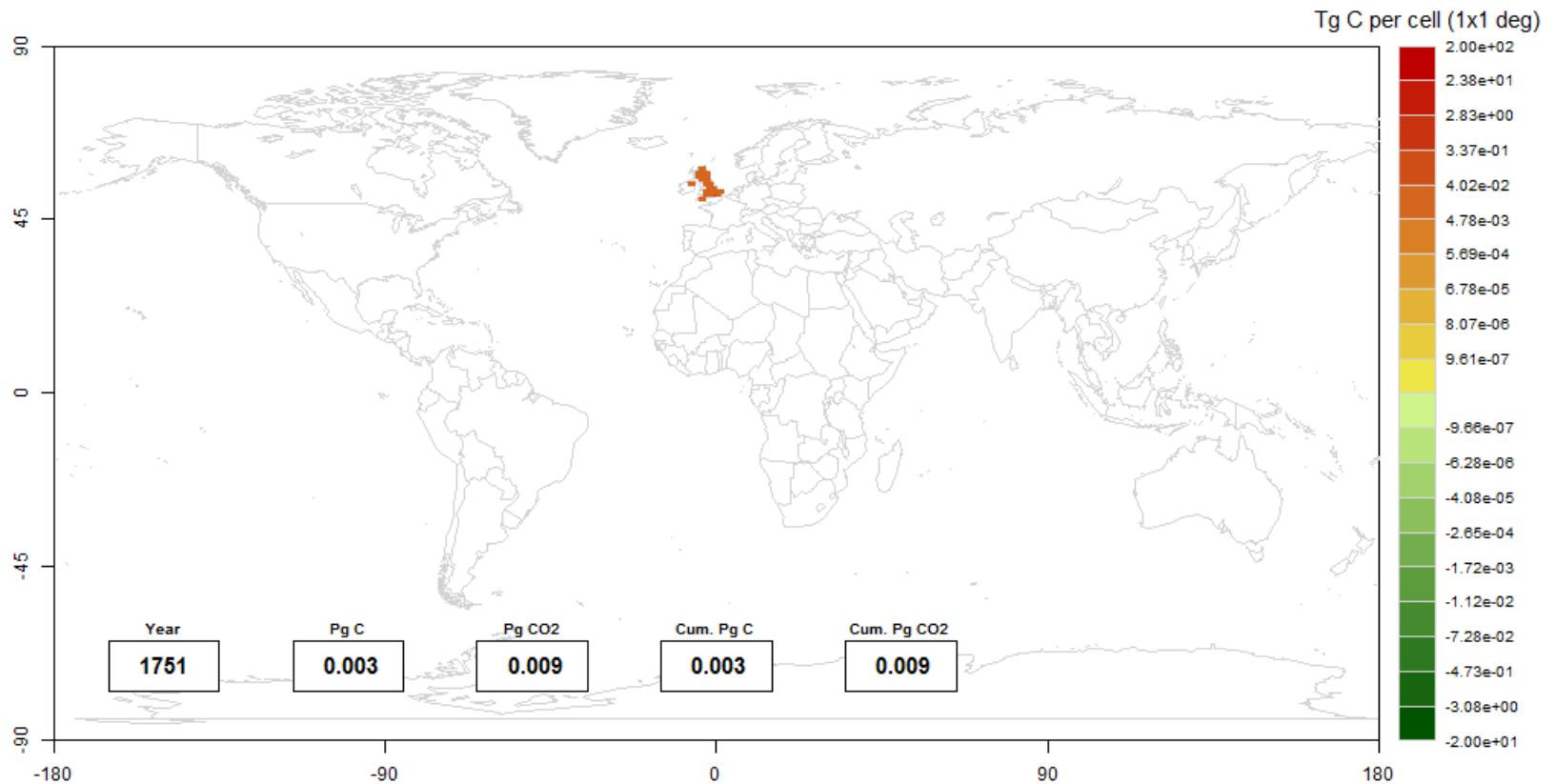
The INDCs present a real increase in the ambition level compared to a projection of current policies.

The emissions gap in both 2025 and 2030 will be very significant and ambitions will need to be enhanced urgently.

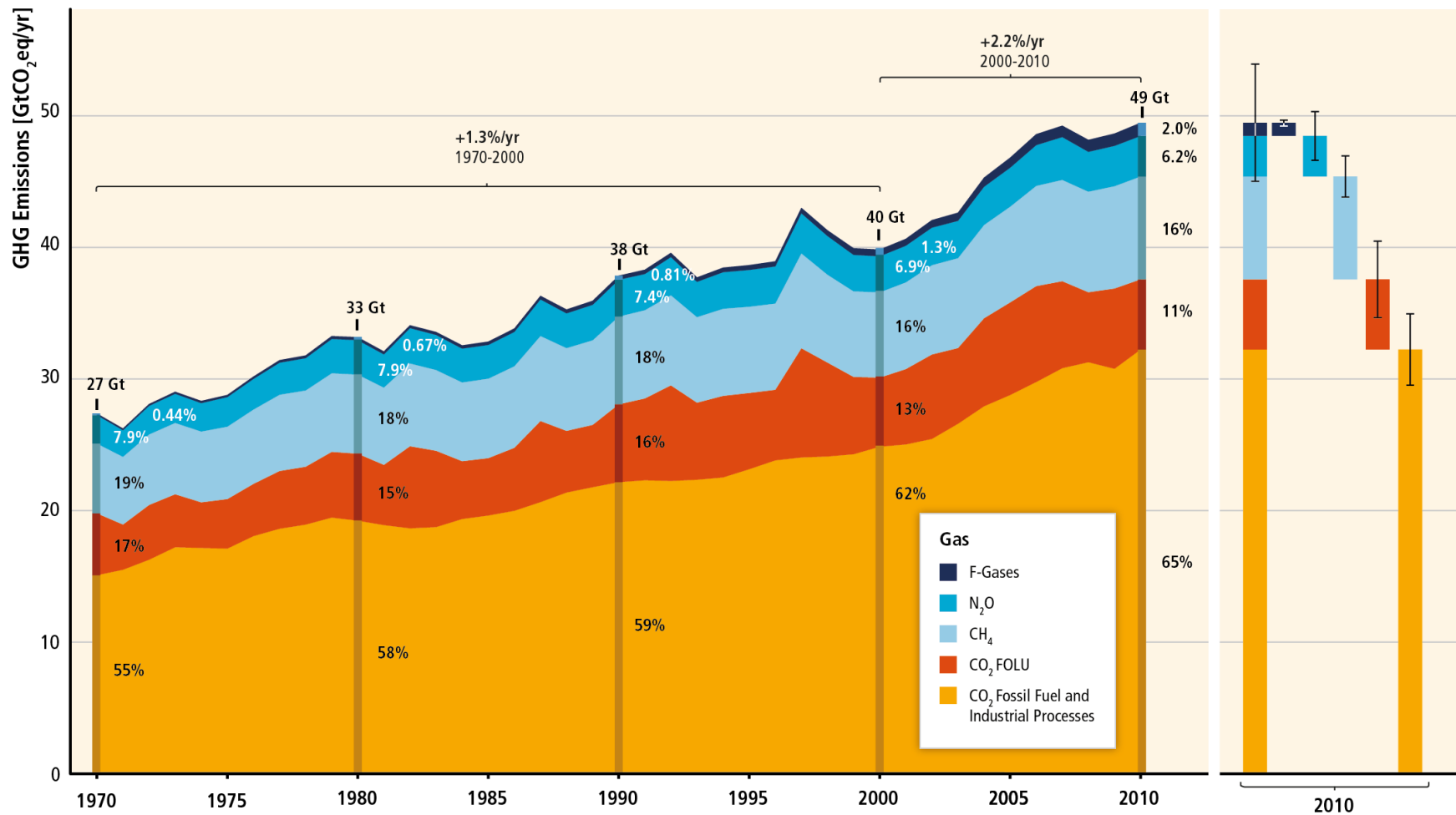
Annual CO₂ per Capita Emissions



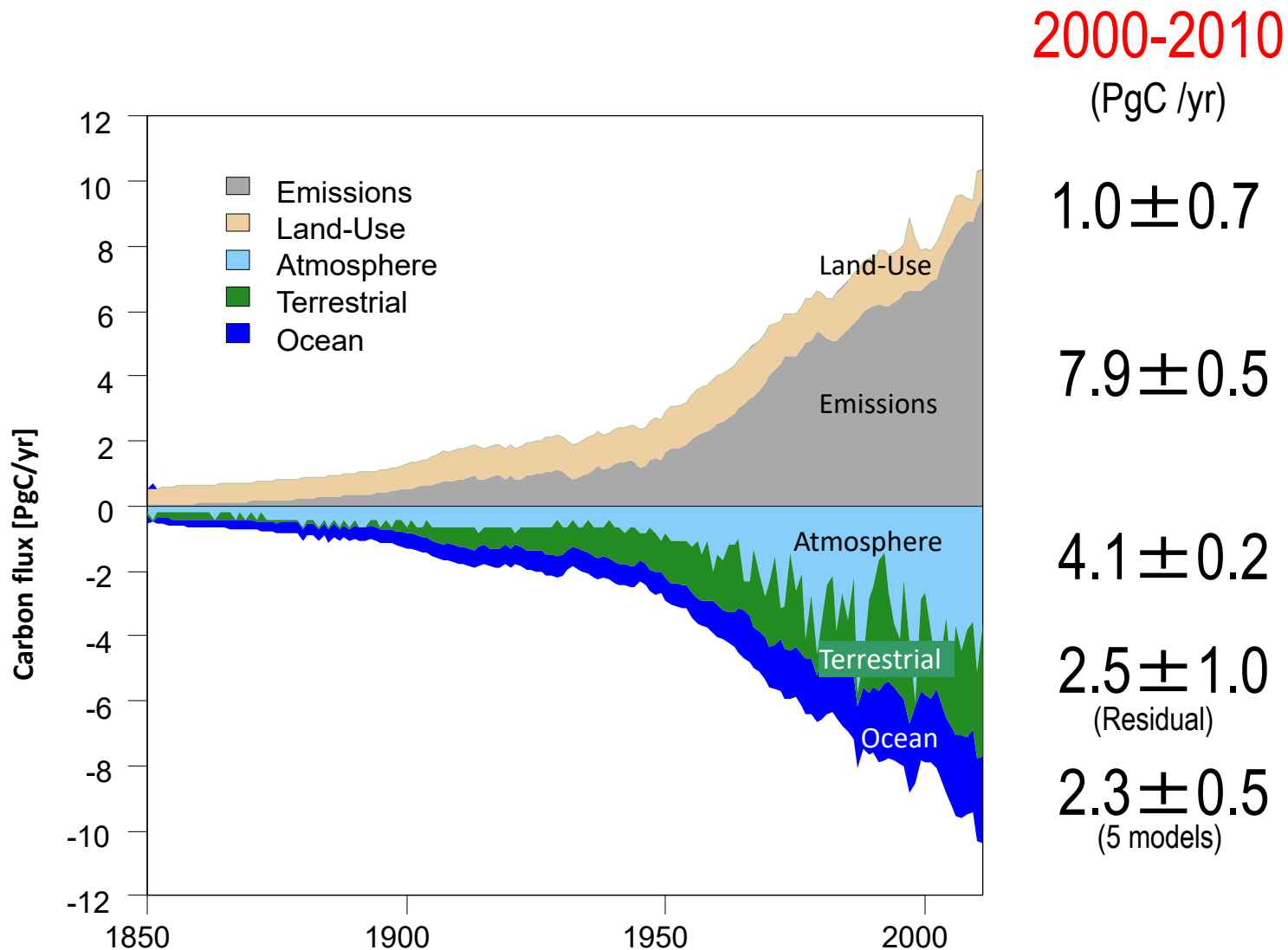
Global CO₂ Emissions



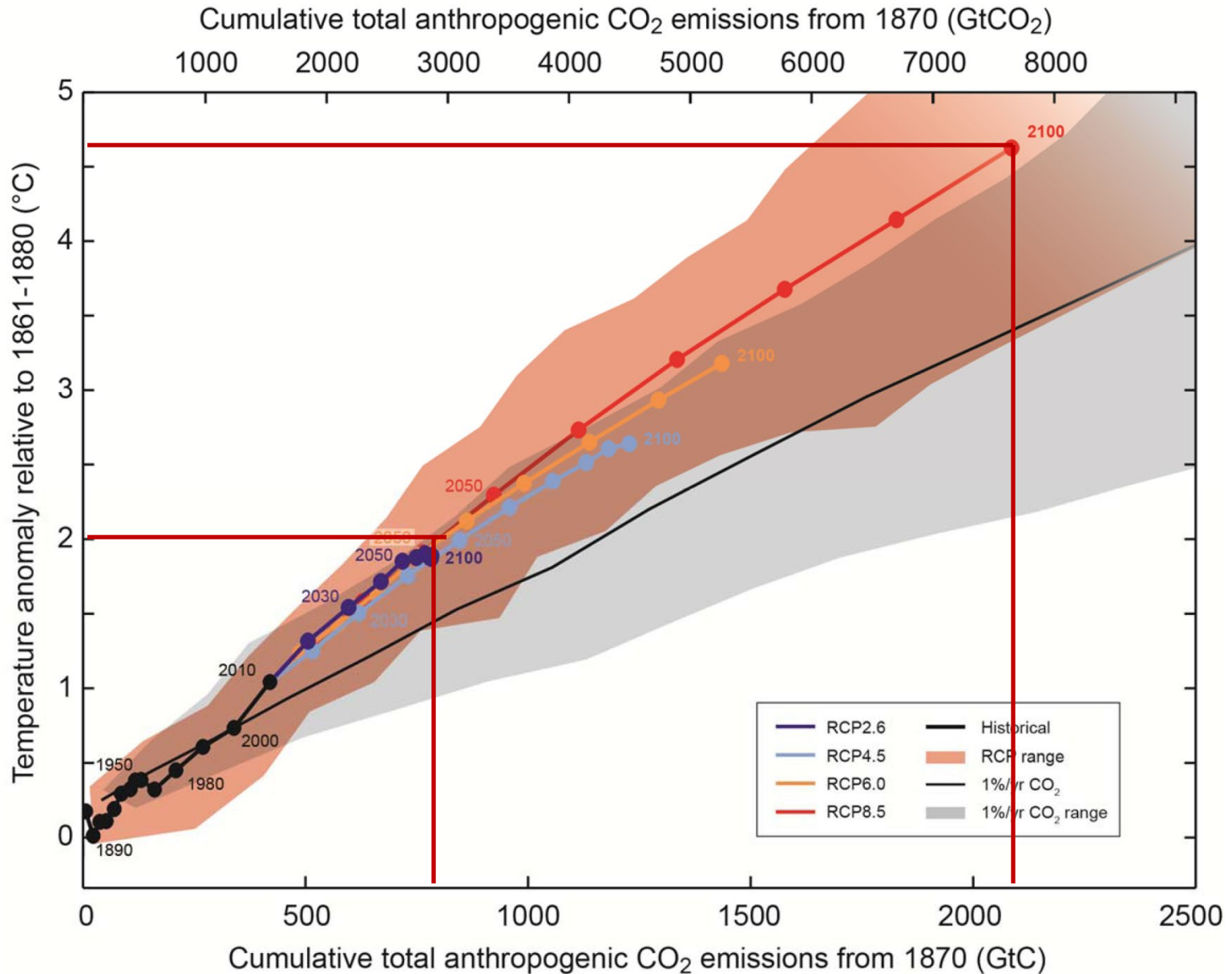
Total Annual Anthropogenic GHG Emissions by Groups of Gases 1970-2010



Human Perturbation of the Global Carbon Budget



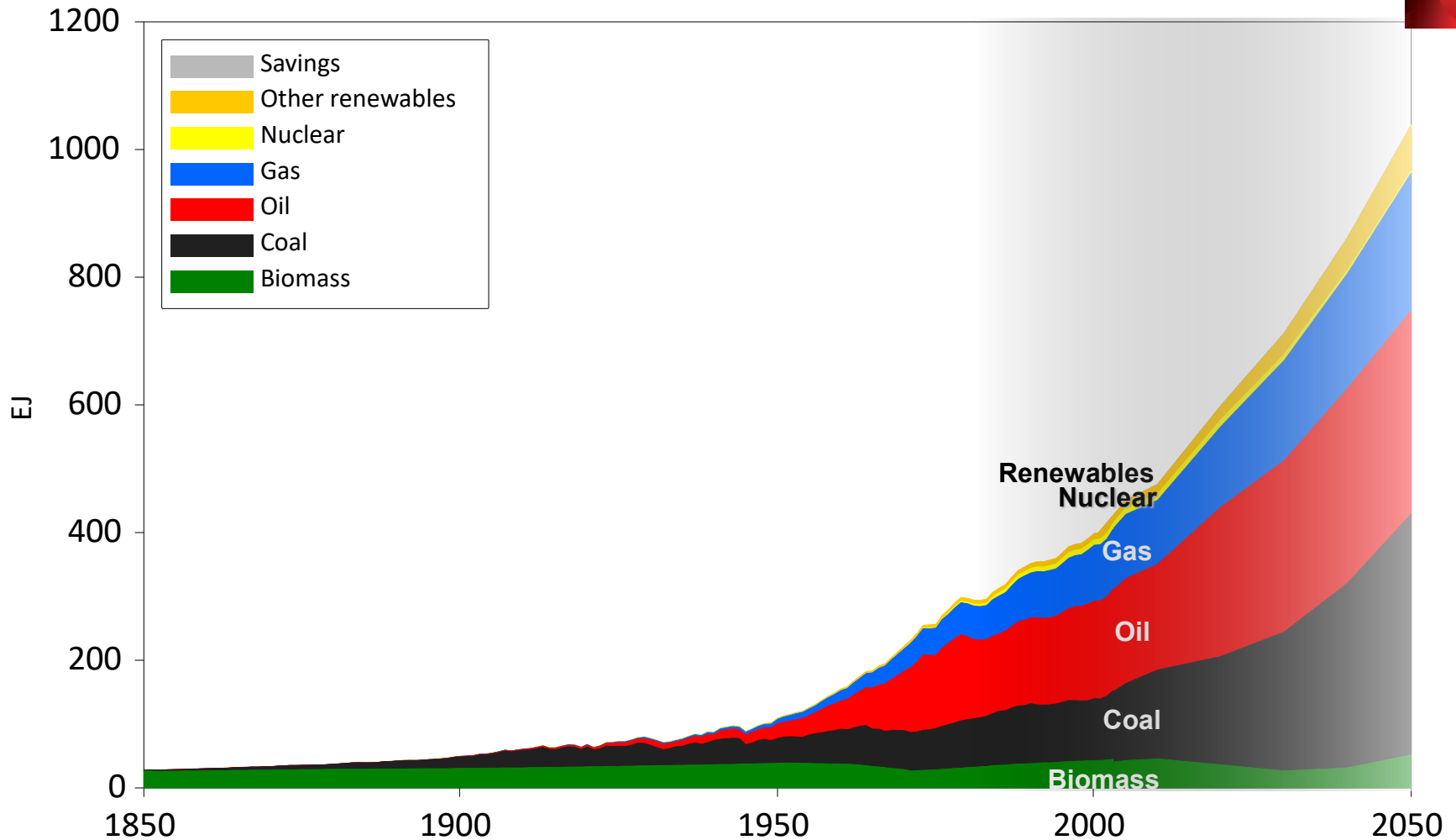
Cumulative Emissions & Temperature



Source: IPCC WGI, 2013

Global Primary Energy

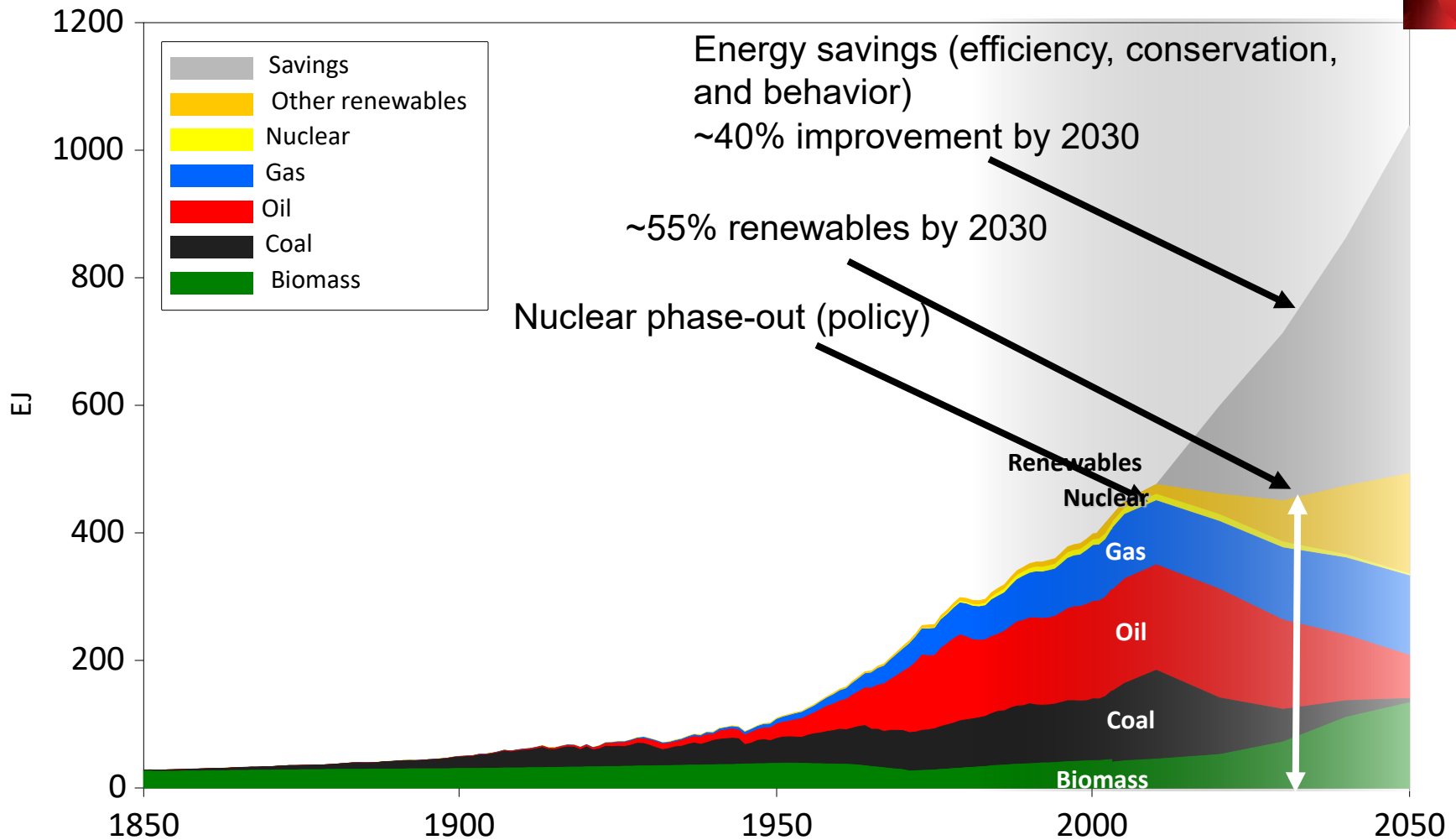
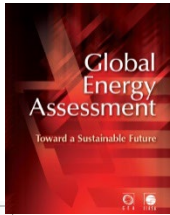
RCP 8.5 Pathway



Source: Riahi et al, 2012

Global Primary Energy

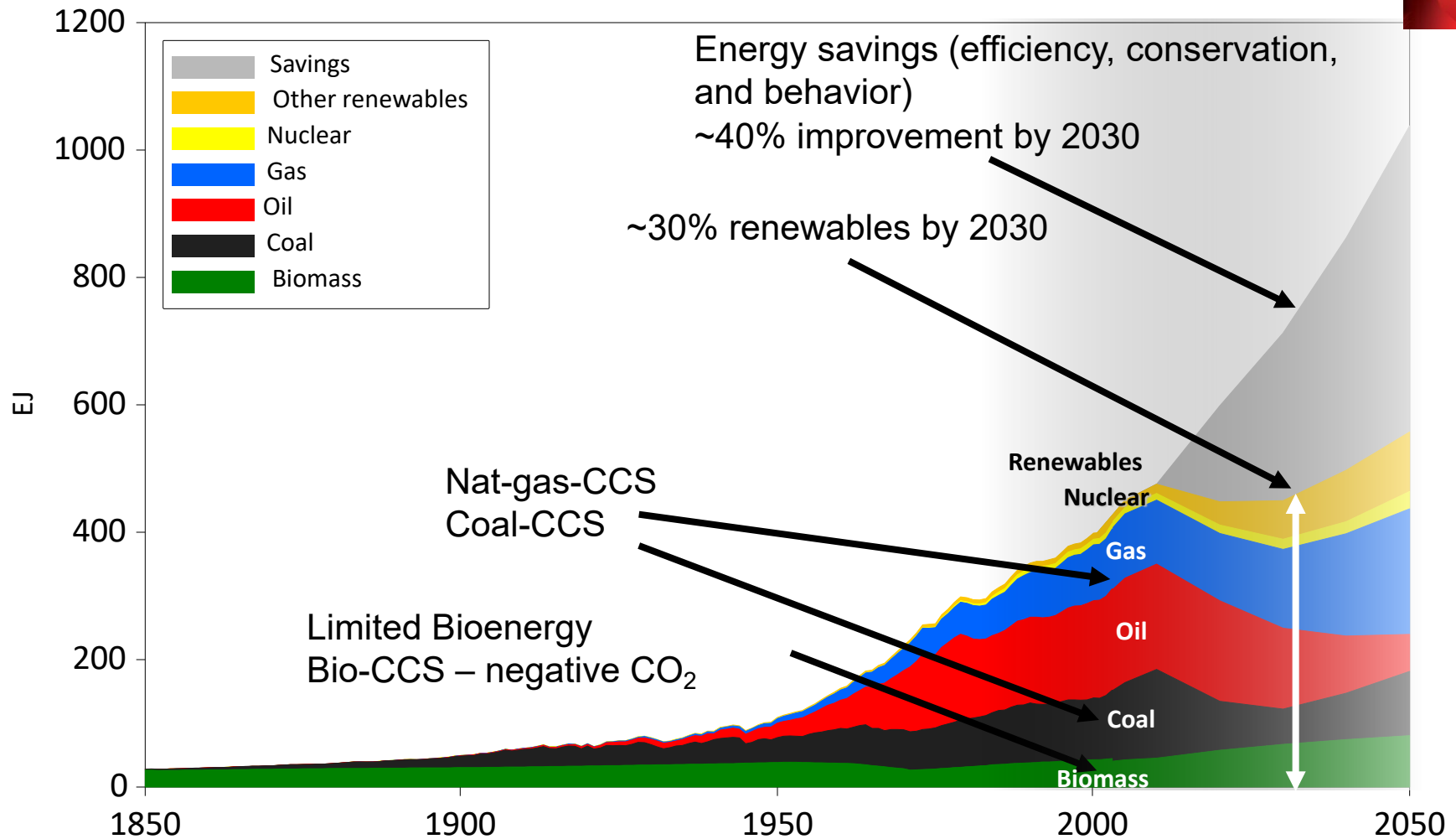
RCP 2.6 variant: no CCS



Source: Riahi et al, 2012

Global Primary Energy

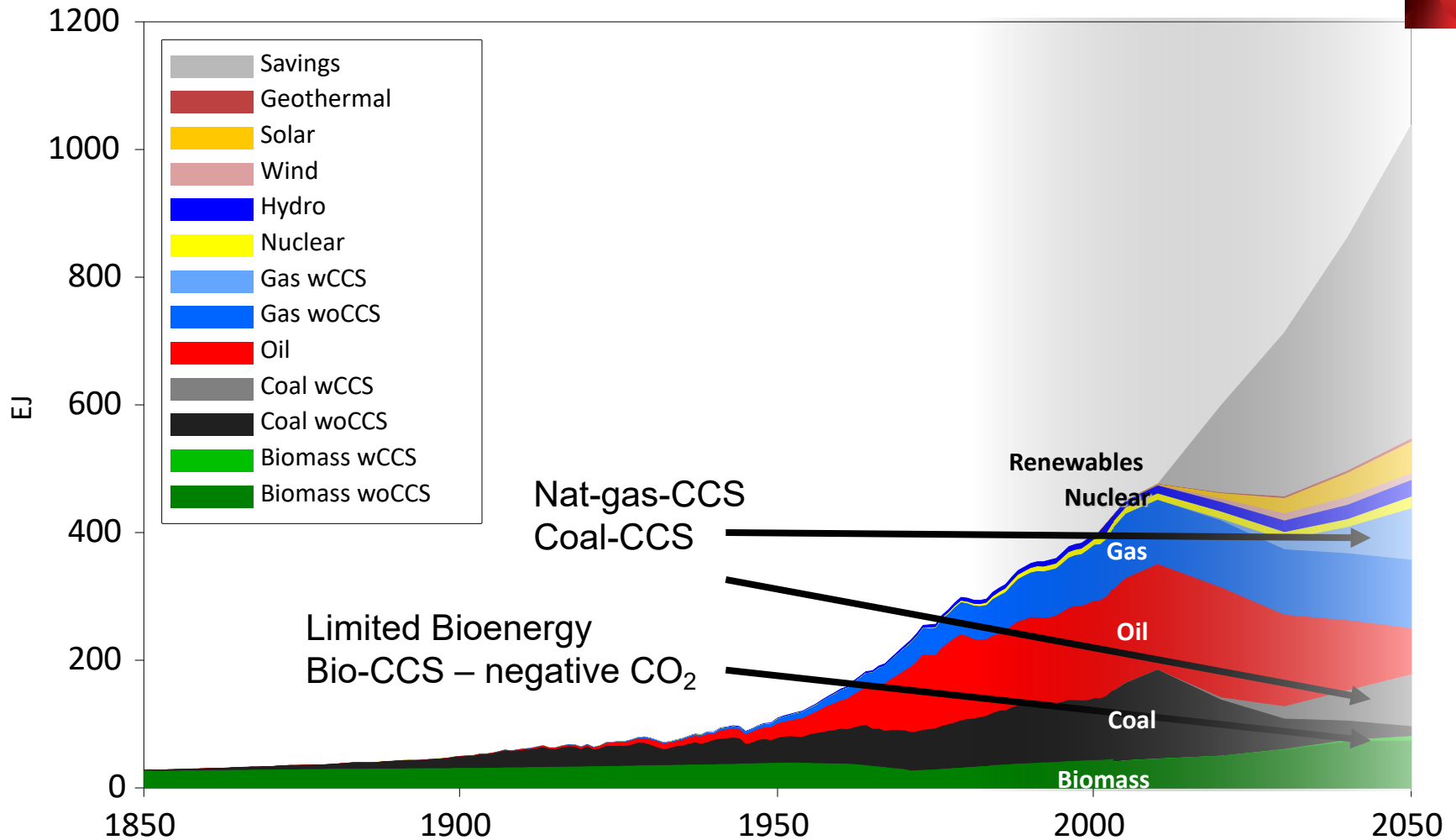
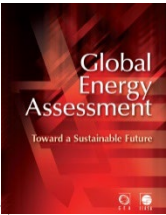
RCP 2.6 variant: limited REN



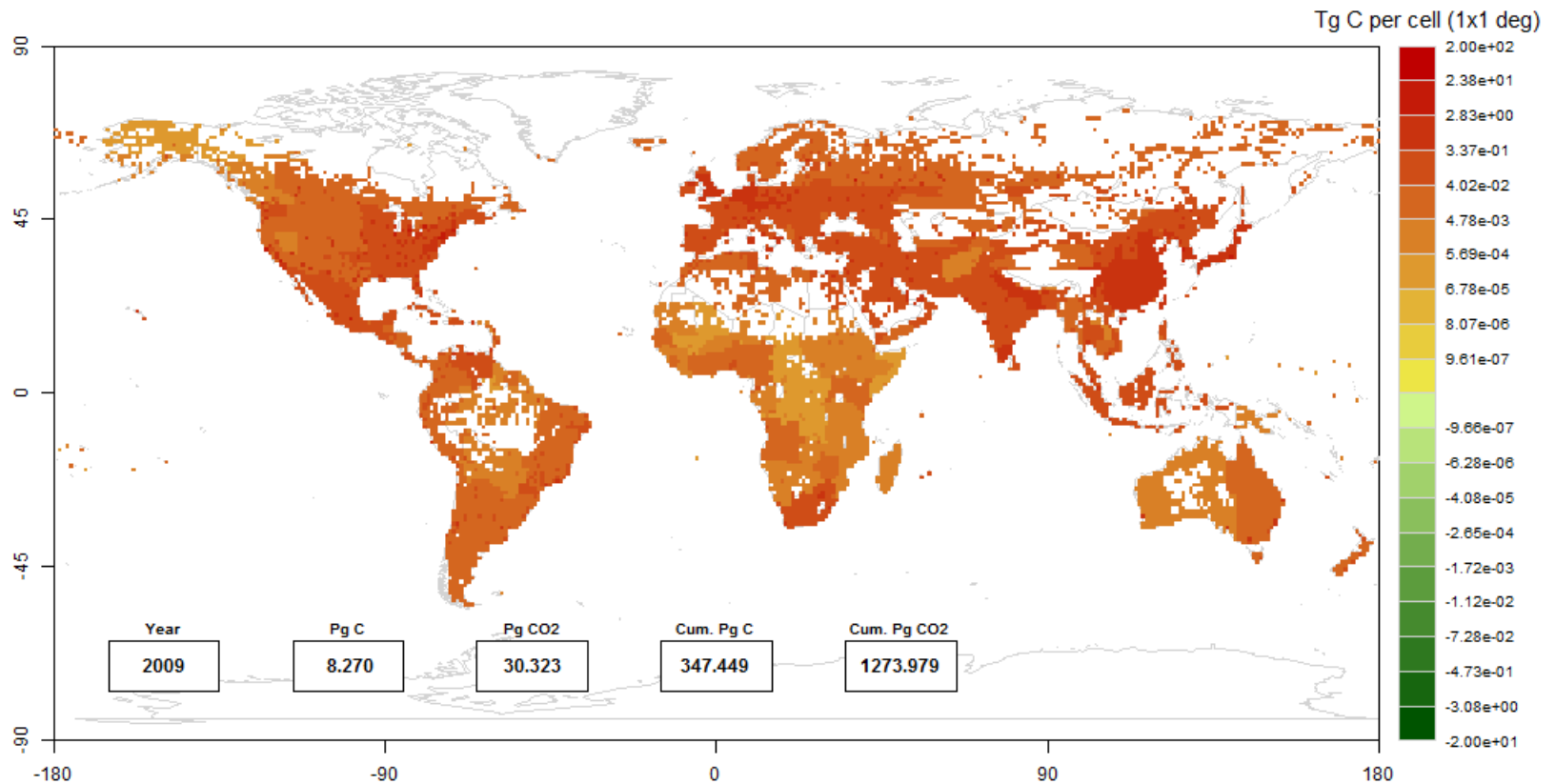
Source: Riahi et al, 2012

Global Primary Energy

RCP 2.6 variant: limited REN

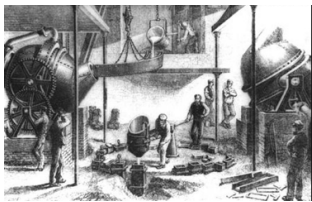
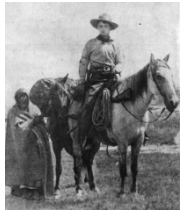
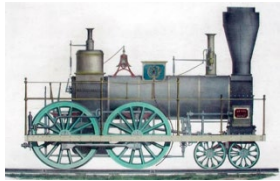


Global CO₂ Emissions

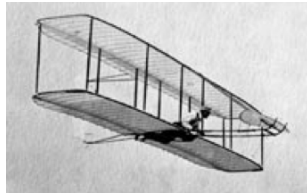


But first, a reminder... about technology

1850



1900



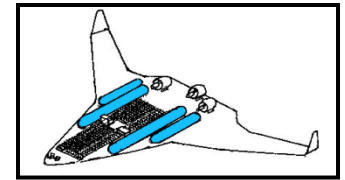
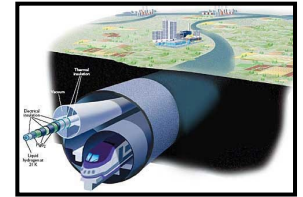
1950



2000



2050



Sources: www.the-ashpit.com; www.railroad.net; wikipedia commons; www.virtualtourist.com; airandspace.si.edu; www.rwf2000.com; www.islandregister.com; www.islandregister.com

Source: After Granger Morgan, 2012

An Example of a possible transformational technology

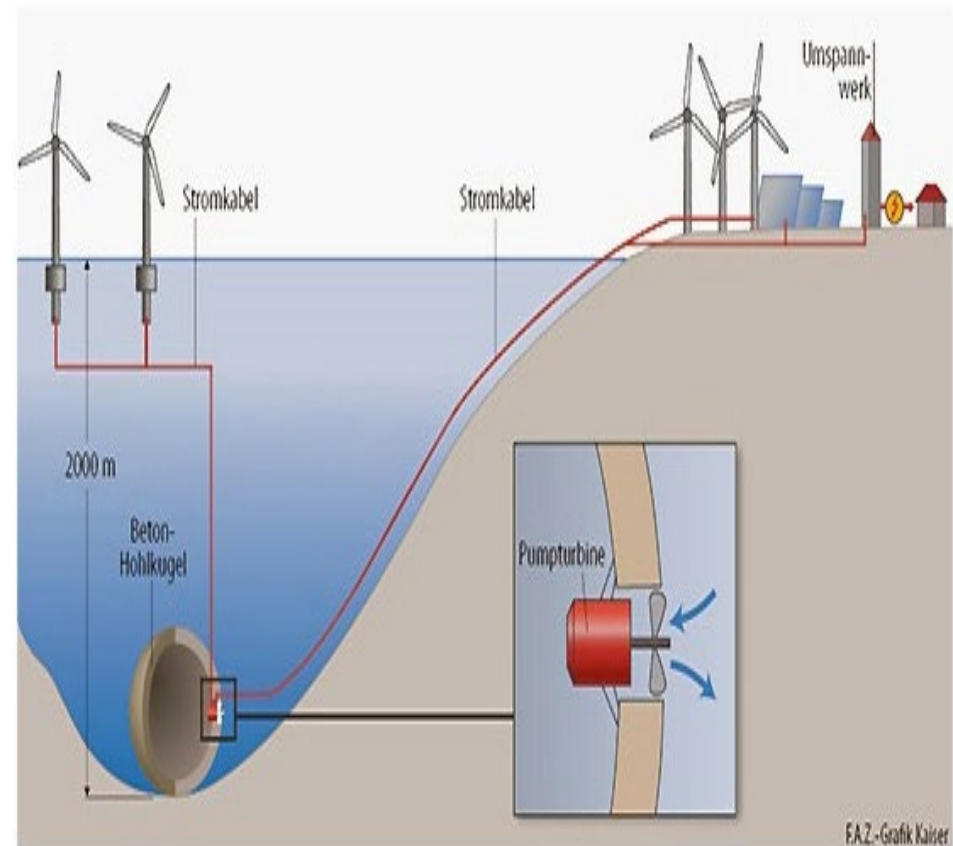
Conventional Turbine Offshore Wind Farm;

- No risk of it being hugely profitable.
- Typical IRR 5-7%

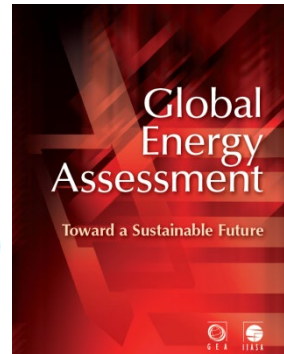
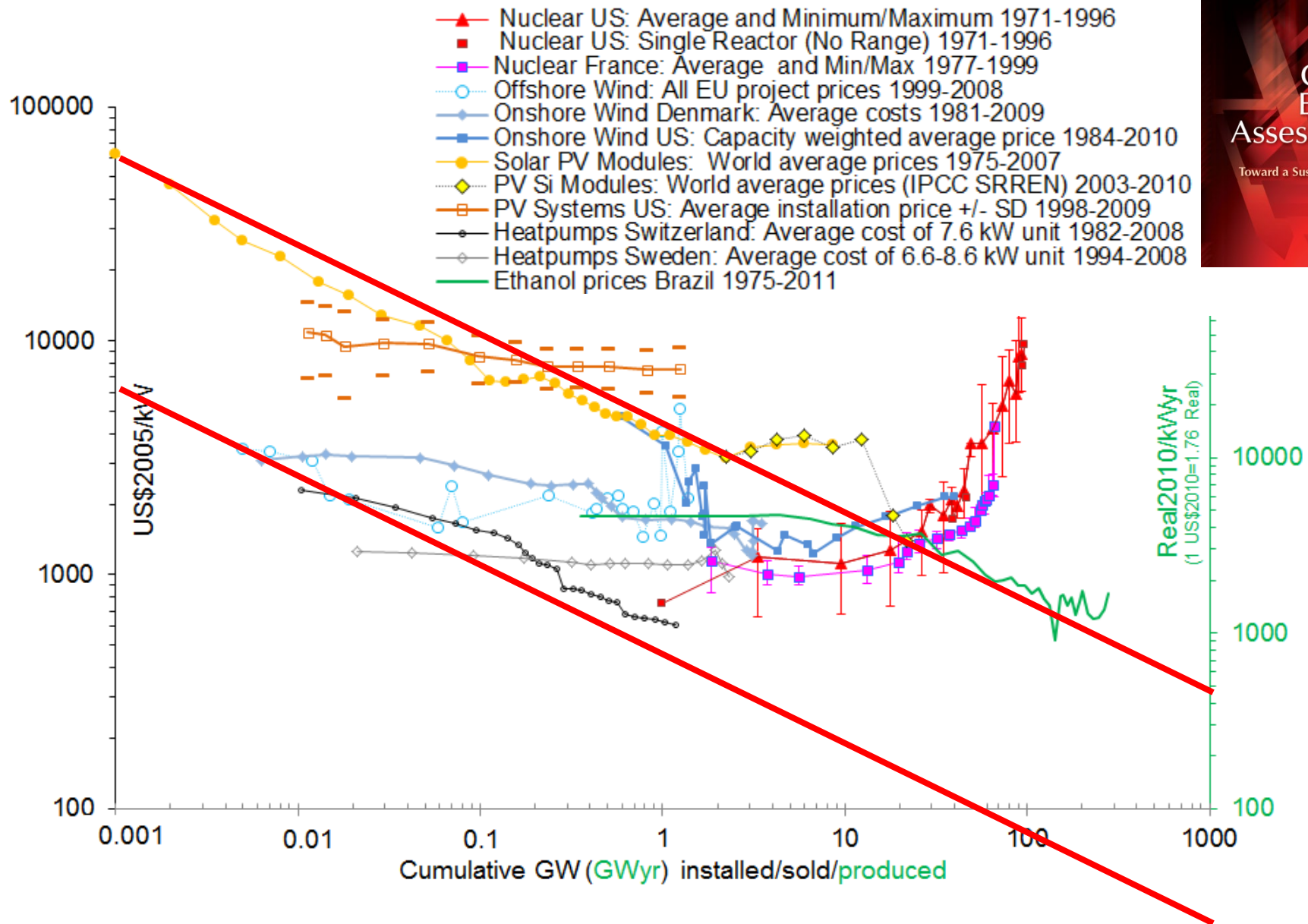
Accelerator Turbine Offshore Wind Farm;

- Excellent chance of being hugely profitable.
- Typical IRR 20-30%

STERLING
WIND POWER

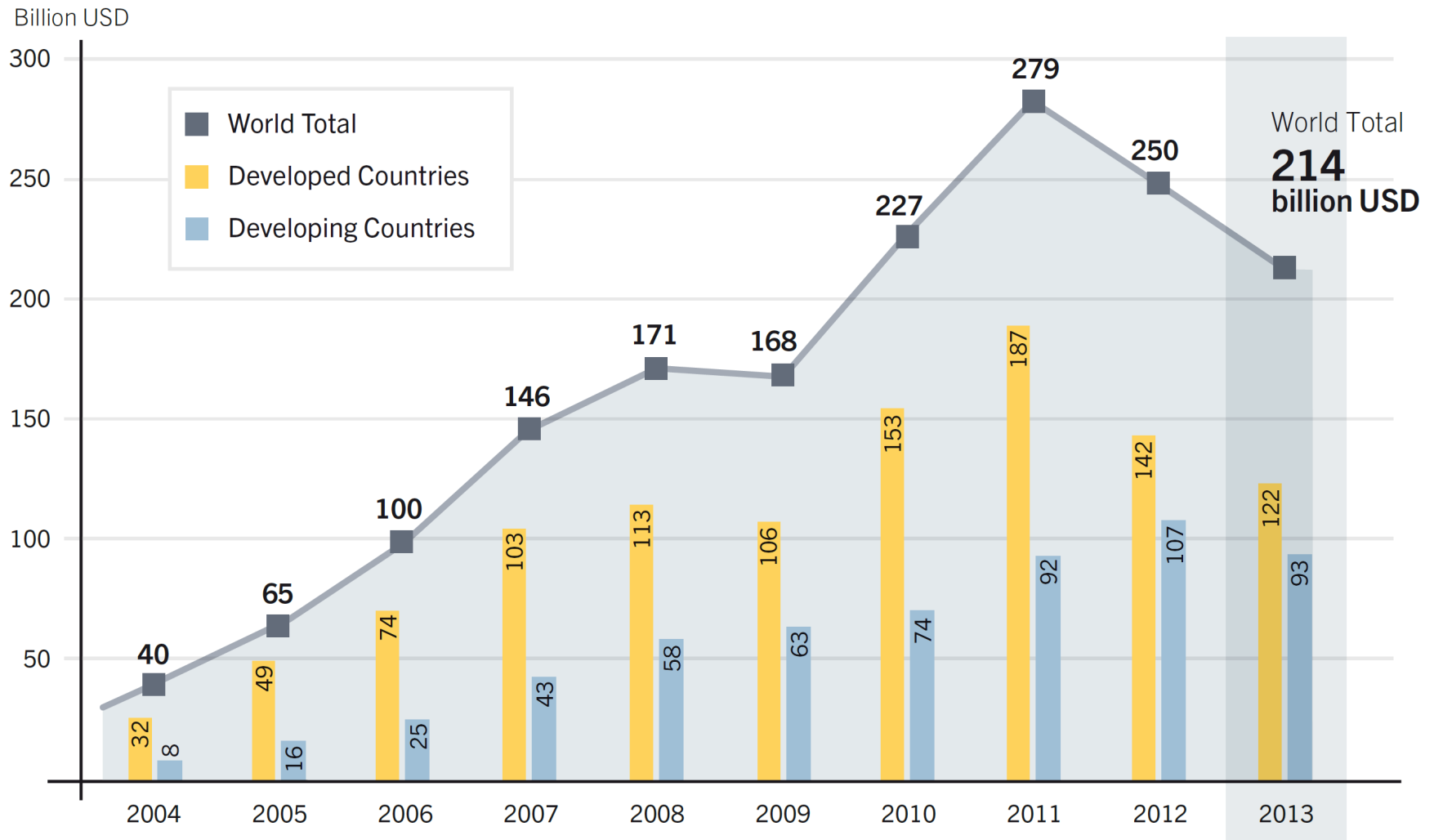


Supply Technologies Cost Trends



Source: Grubler et al, 2012

Annual Investments in Renewables



Source: REN 21, 2014

Estimates for mitigation costs vary widely

- Reaching 450ppm CO₂eq entails consumption losses of 1.7% (1%-4%) by 2030, 3.4% (2% to 6%) by 2050 and 4.8% (3%-11%) by 2100 relative to baseline (which grows between 300% to 900% over the course of the century).
- This is equivalent to a reduction in consumption growth over the 21st century by about 0.06 (0.04-0.14) percentage points a year (relative to annualized consumption growth that is between 1.6% and 3% per year).
- Cost estimates exclude benefits of mitigation (reduced impacts from climate change). They also exclude other benefits (e.g. improvements for local air quality).
- Cost estimates are based on a series of assumptions.

Limiting Temperature Increase to 2°C



Measures exist to achieve the substantial emission reductions required to limit likely warming to 2°C (40-70% reduction in GHGs globally by 2050 and near zero or below emissions levels in 2100)



A combination of adaptation and substantial, sustained reductions in greenhouse gas emissions can limit climate change risks



Implementing reductions in greenhouse gas emissions poses substantial technological, economic, social, and institutional challenges



Ambitious mitigation is affordable and translates into delayed but not foregone growth (economic growth reduced by ~ 0.06% / BAU growth 1.6-3%). Estimated costs do not account for the benefits of reduced climate change



But delaying mitigation will substantially increase the challenges associated with limiting warming to 2°C

Climate Change and Equity

- Issues of equity, justice, and fairness arise with respect to mitigation and adaptation:
- Different past and future contributions to the accumulation of GHGs in the atmosphere
- Varying challenges and circumstances
- Different capacities to address mitigation and adaptation.
- Options for equitable burden-sharing can reduce the potential for the costs of climate action to constrain development.

Conclusions

- **We can and must act boldly to reduce GHG emissions to keep the agreed 1.5 – 2 degree C goal within reach**
- **The scale of the challenge is beyond anything we have yet considered**
- **Success is only achievable if we tackle the technological, institutional, financial and political inertia now. Our current pathway will not achieve the deep decarbonization we need**
- **There is major cost-effective potential to rapidly increase efficiency in all sectors with existing commercially available technologies and use of best practices, given appropriate policy support**
- **There is significant scope for early deployment at scale of renewable energy technologies, if supported with policies (affordable capital, feed-in tariffs, elimination of fossil fuel subsidies) and increased financing**
- **An effective price on carbon (to reflect the costs of emissions) would send the right price signal to drive investments in clean technologies**
- **A systems-wide transformation towards a low-carbon economy requires policies to catalyze societal behavioural changes**
- **No more coal-fired power plants should be built without Carbon Capture and Storage**