

Achieving SDG including sustainable energy for all within planetary boundaries

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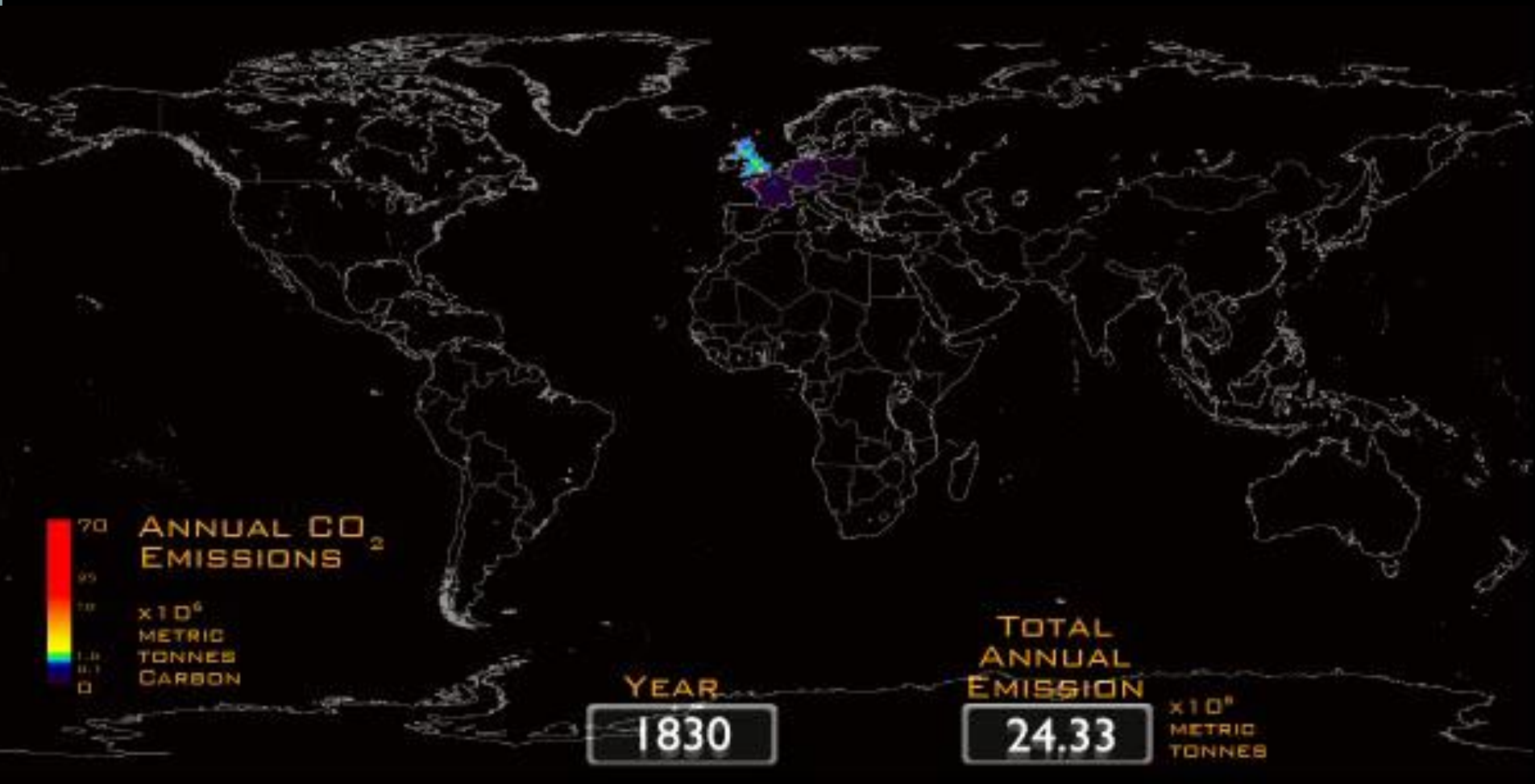
International Institute for Applied Systems Analysis

Univ. Prof. i.R. für Energiewirtschaft

Technische Universität Wien

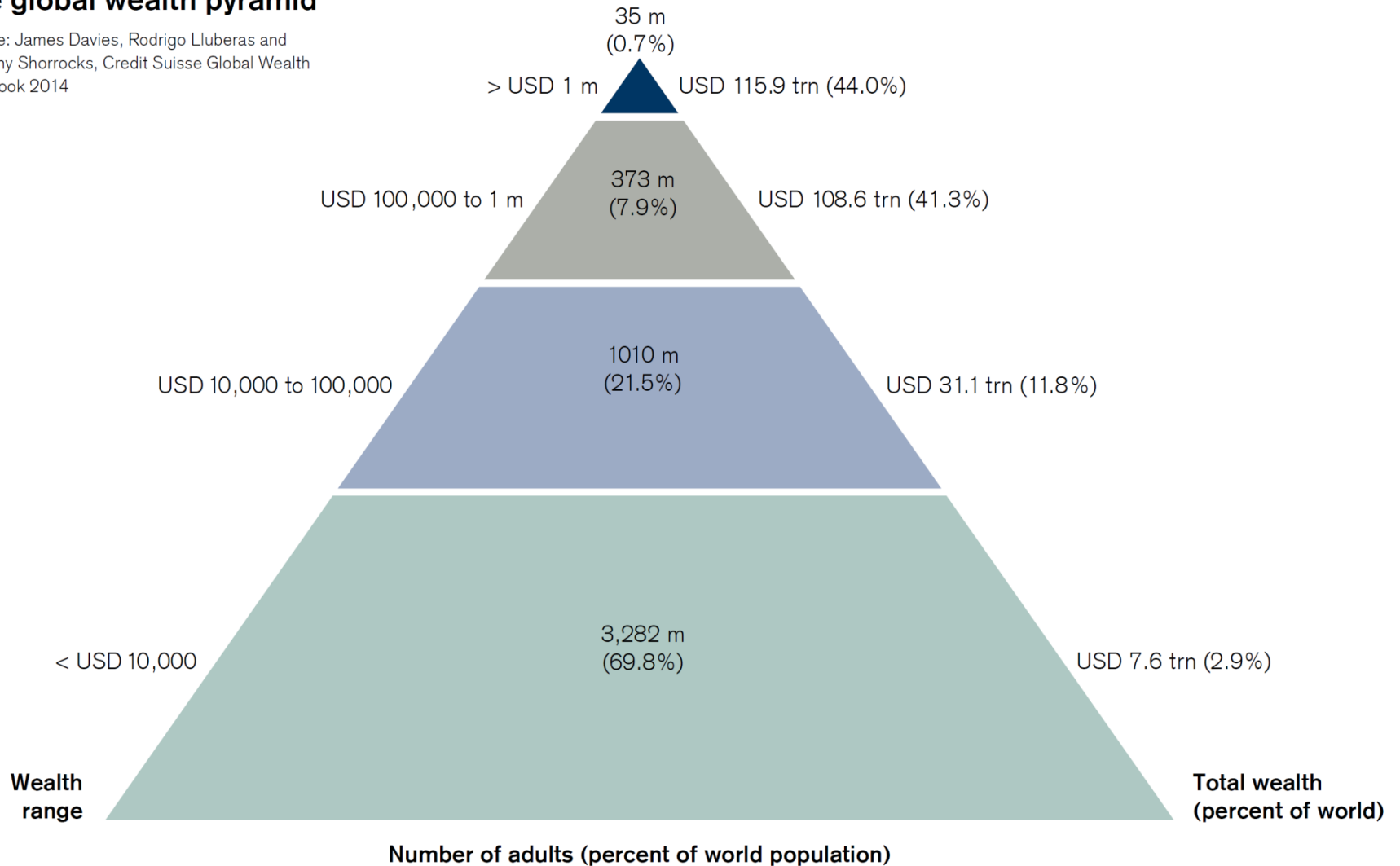
10th Conference on Sustainable Development of Energy, Water and
Environment Systems (SDEWES) , Dubrovnik – 29 September 2015

Global CO₂ Emissions



The global wealth pyramid

Source: James Davies, Rodrigo Lluberá and Anthony Shorrocks, Credit Suisse Global Wealth Databook 2014



Sustainable Development Goals (SDGs)

Goal #	Description	Goal #	Description
Goal 1	End poverty in all its forms everywhere	Goal 10	Reduce inequality within and among countries
Goal 2	End hunger, achieve food security and improved nutrition and promote sustainable agriculture	Goal 11	Make cities and human settlements inclusive, safe, resilient and sustainable
Goal 3	Ensure healthy lives and promote well-being for all at all ages	Goal 12	Ensure sustainable consumption and production patterns
Goal 4	Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all	Goal 13	Take urgent action to combat climate change and its impacts
Goal 5	Achieve gender equality and empower all women and girls	Goal 14	Conserve and sustainably use the oceans, seas and marine resources for sustainable development
Goal 6	Ensure availability and sustainable management of water and sanitation for all	Goal 15	Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss
Goal 7	Ensure access to affordable, reliable, sustainable and modern energy for all	Goal 16	Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels
Goal 8	Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	Goal 17	Strengthen the means of implementation and revitalize the global partnership for sustainable development
Goal 9	Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation		

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The Key Energy Challenges



Energy Access



Climate Change



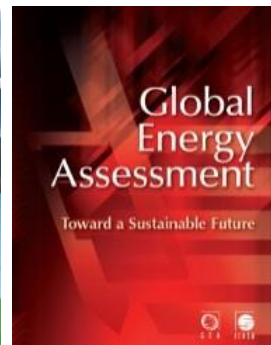
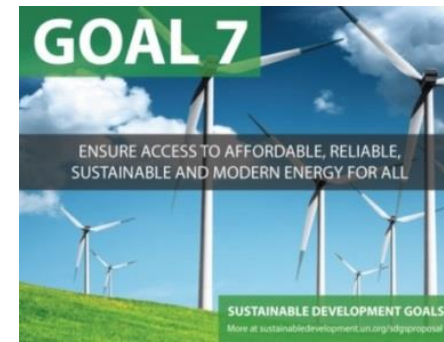
Energy Security



**Air Pollution
Health Impacts**



2012 INTERNATIONAL YEAR OF
SUSTAINABLE ENERGY
FOR ALL

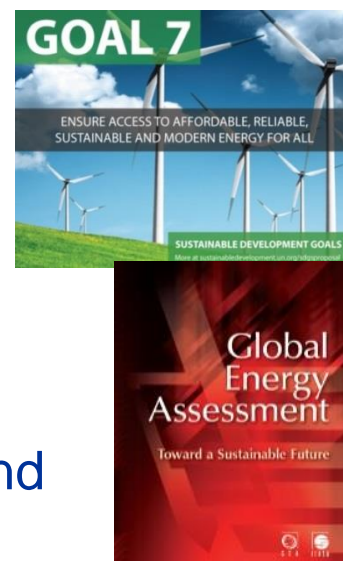


2030 Energy Goal

- Universal Access to Modern Energy
- Double Energy Efficiency Improvement
- Double Renewable Share in Final Energy

Aspirational & Ambitious but Achievable

SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all



- 7.1 by 2030 ensure universal access to affordable, reliable, and modern energy services
- 7.2 increase substantially the share of renewable energy in the global energy mix by 2030
- 7.3 double the global rate of improvement in energy efficiency by 2030
- 7.a by 2030 enhance international cooperation to facilitate access to clean energy **research and technologies**, including renewable energy, energy efficiency, and advanced and cleaner fossil fuel technologies, and promote **investment** in energy infrastructure and clean energy technologies
- 7.b by 2030 expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in **developing countries**, particularly LDCs and SIDS



Stockholm Resilience Centre
Sustainability Science for Biosphere Stewardship

THE EARTH INSTITUTE
COLUMBIA UNIVERSITY

The World in 2050

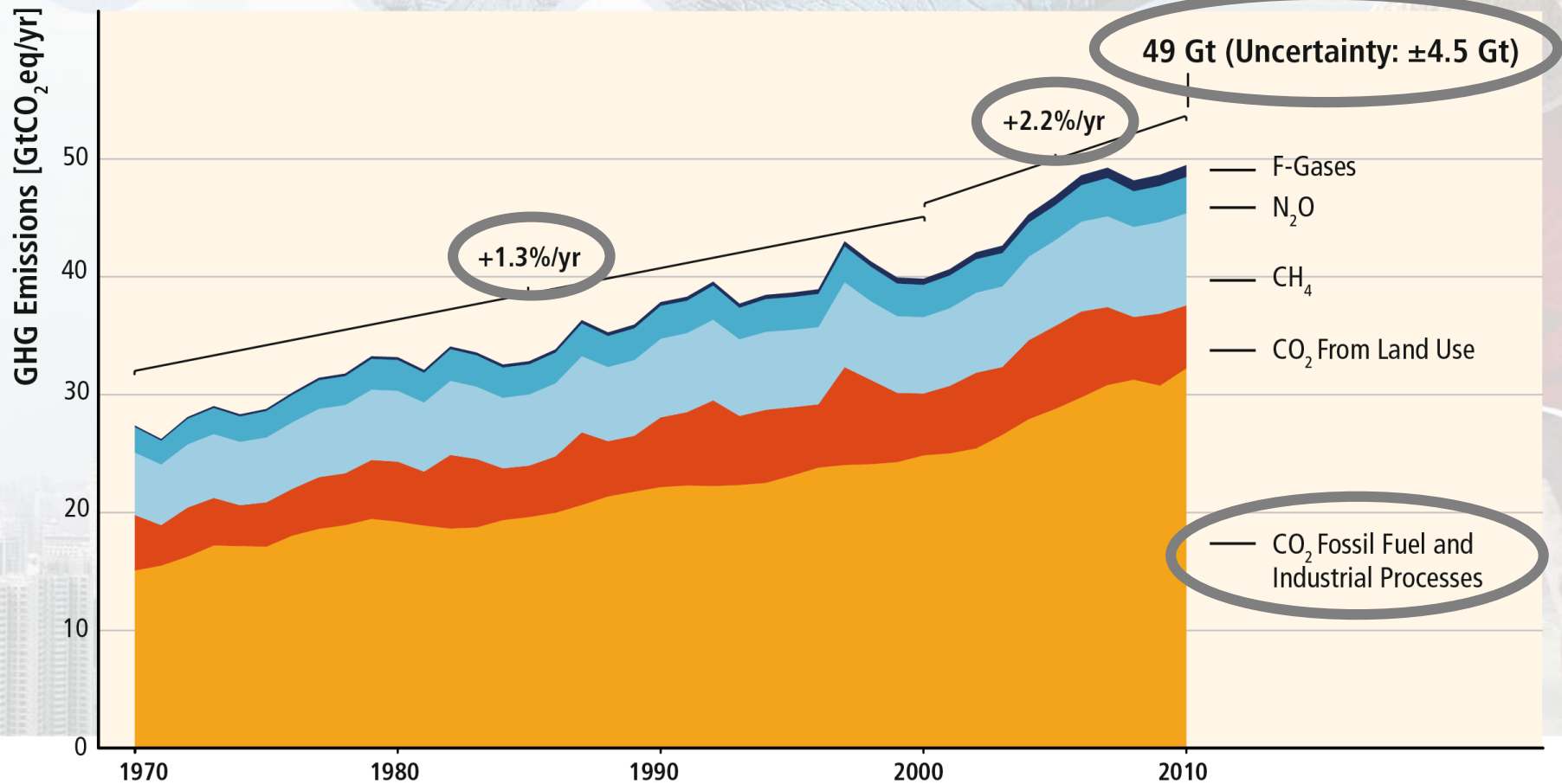
Integrating knowledge on SDSN pathways to global sustainable development

Inaugural Meeting – 10-12 March 2015

The World in 2050

- ➡ Global development within a safe and just operating space and planetary boundaries
- ➡ “Safe Space” of interaction among SDGs: integrated models to sustainability narratives
- ➡ Transformational pathways based on existing literature e.g. SSPs, GEA, SDSN’s DDPP
- ➡ Co-benefits of transformation toward the “safe space” and how to achieve sustainable futures

Growth of emissions between 2000 and 2010 has been larger than in the previous three decades



Window for action rapidly closing

65% of our carbon budget compatible with a 2°C goal already used

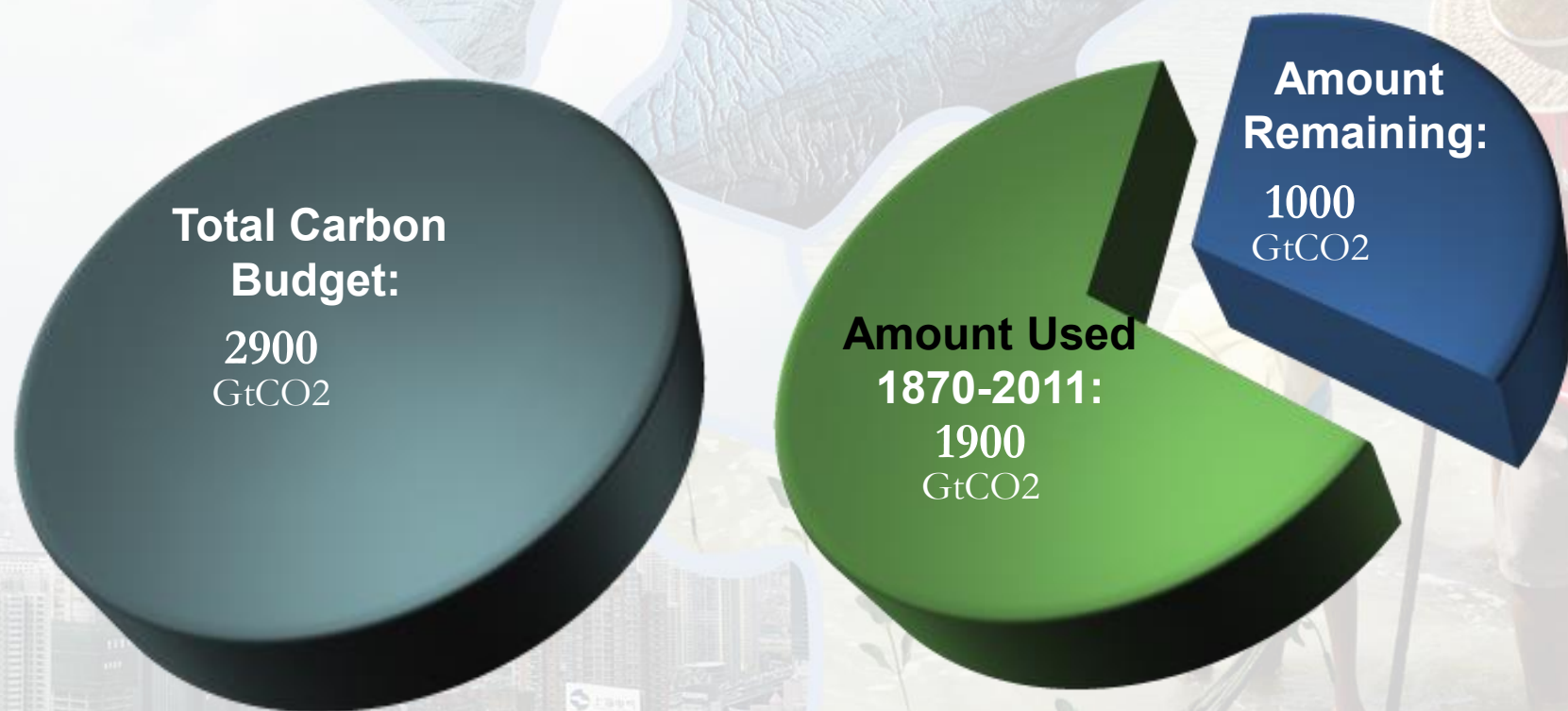
**Total Carbon
Budget:**

**2900
GtCO₂**

AR5 WGI SPM

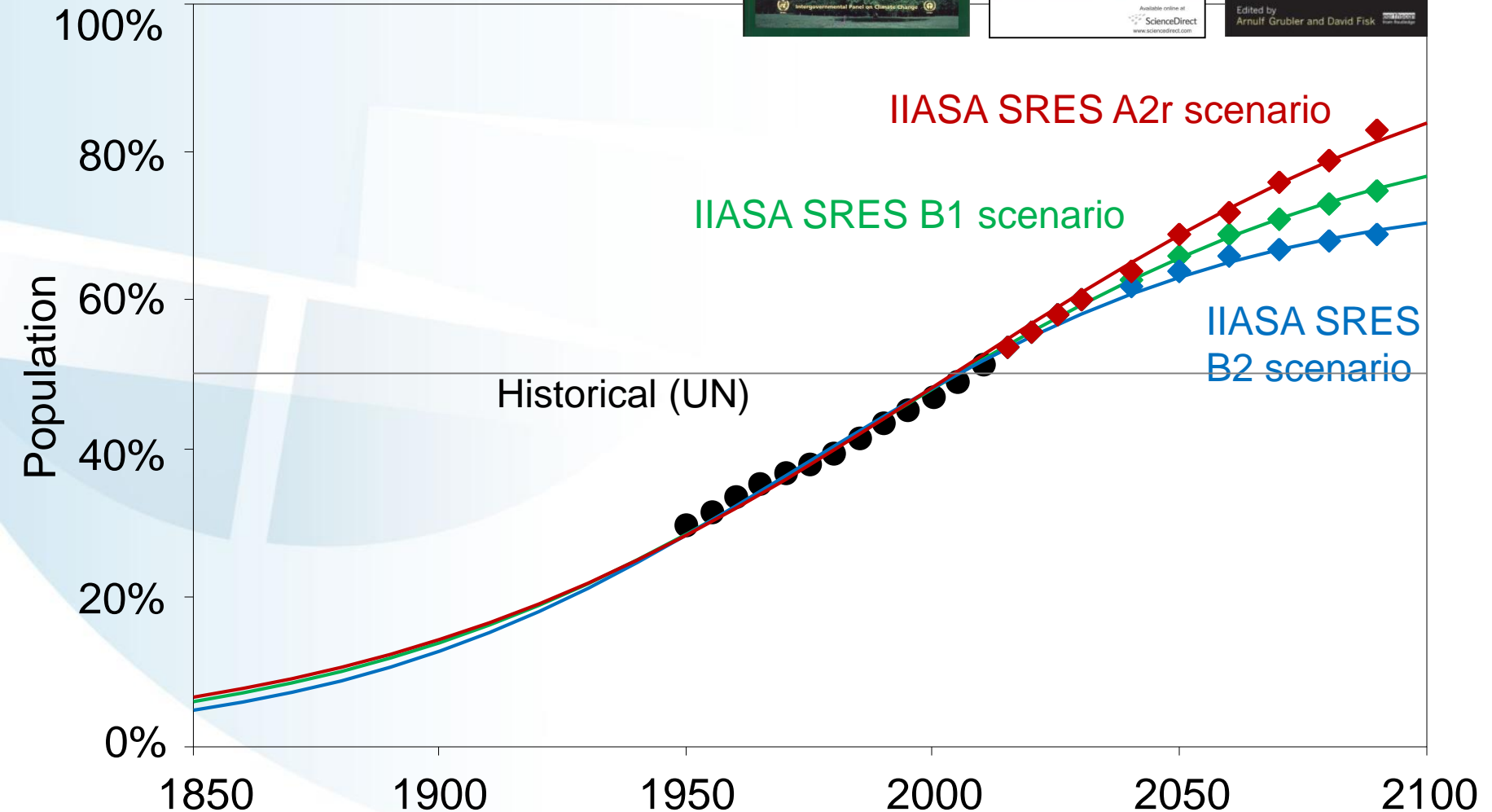
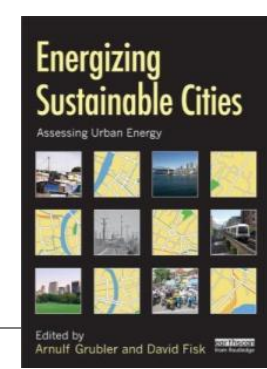
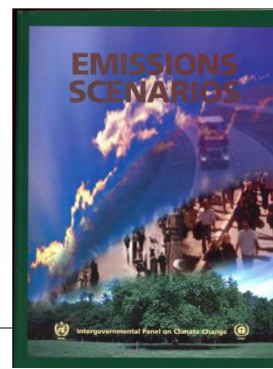
Window for action rapidly closing

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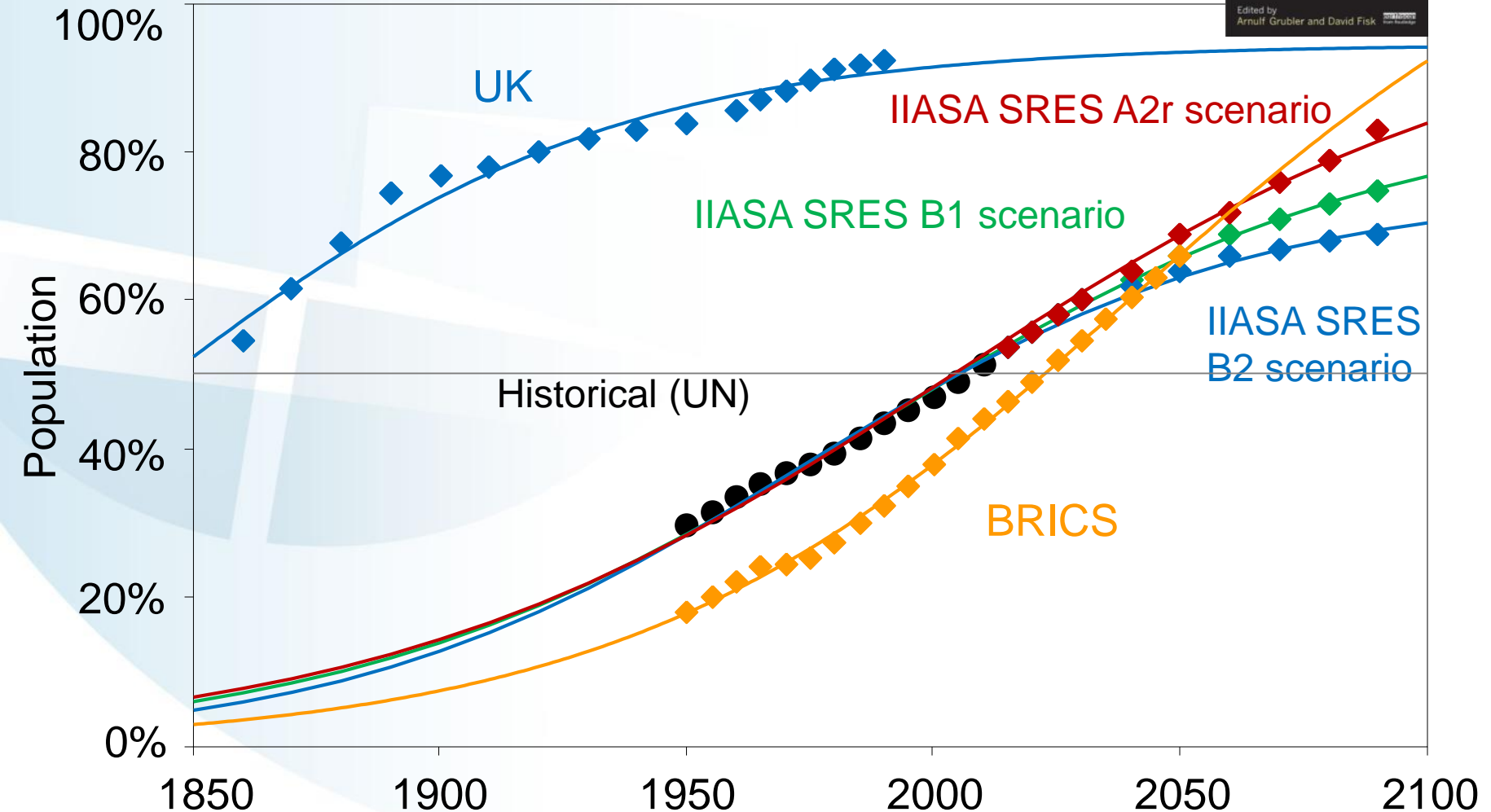
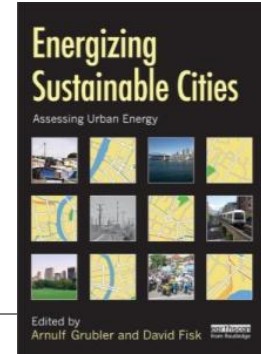


AR5 WGI SPM

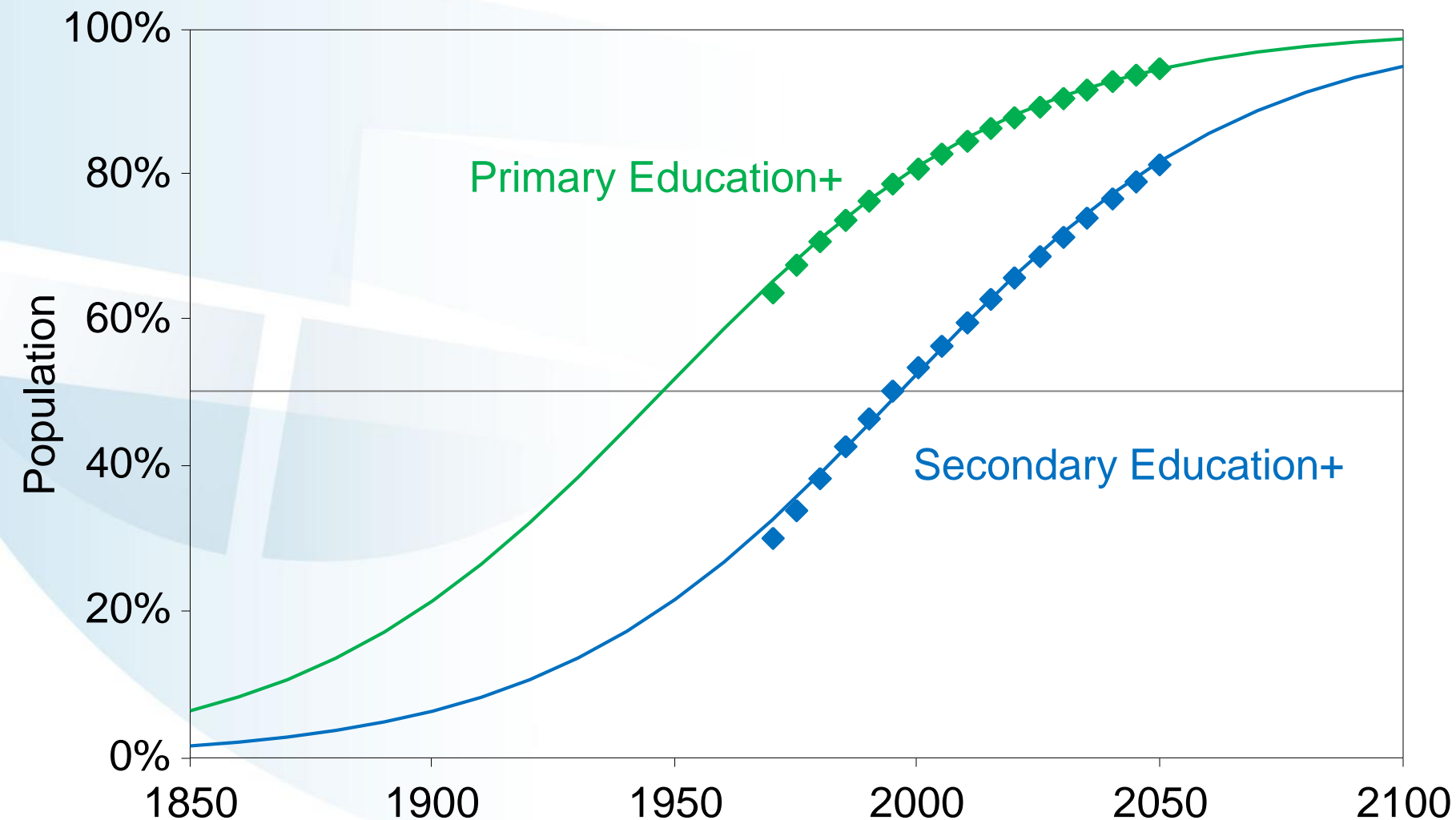
Urbanization World



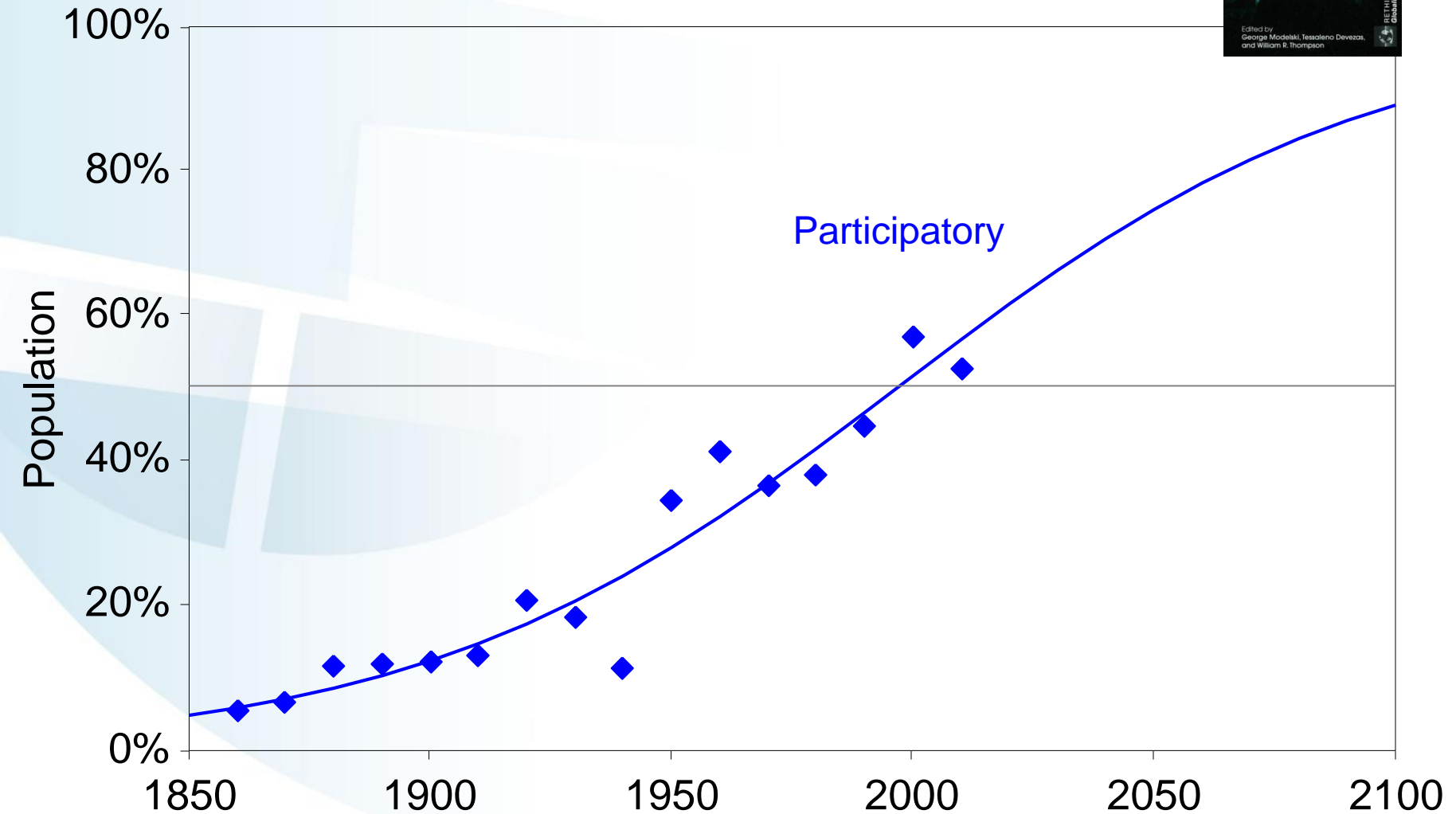
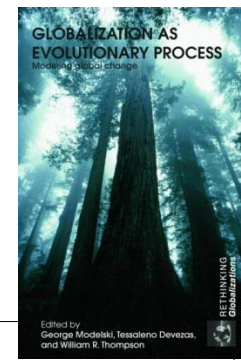
Urbanization World, UK, BRICs



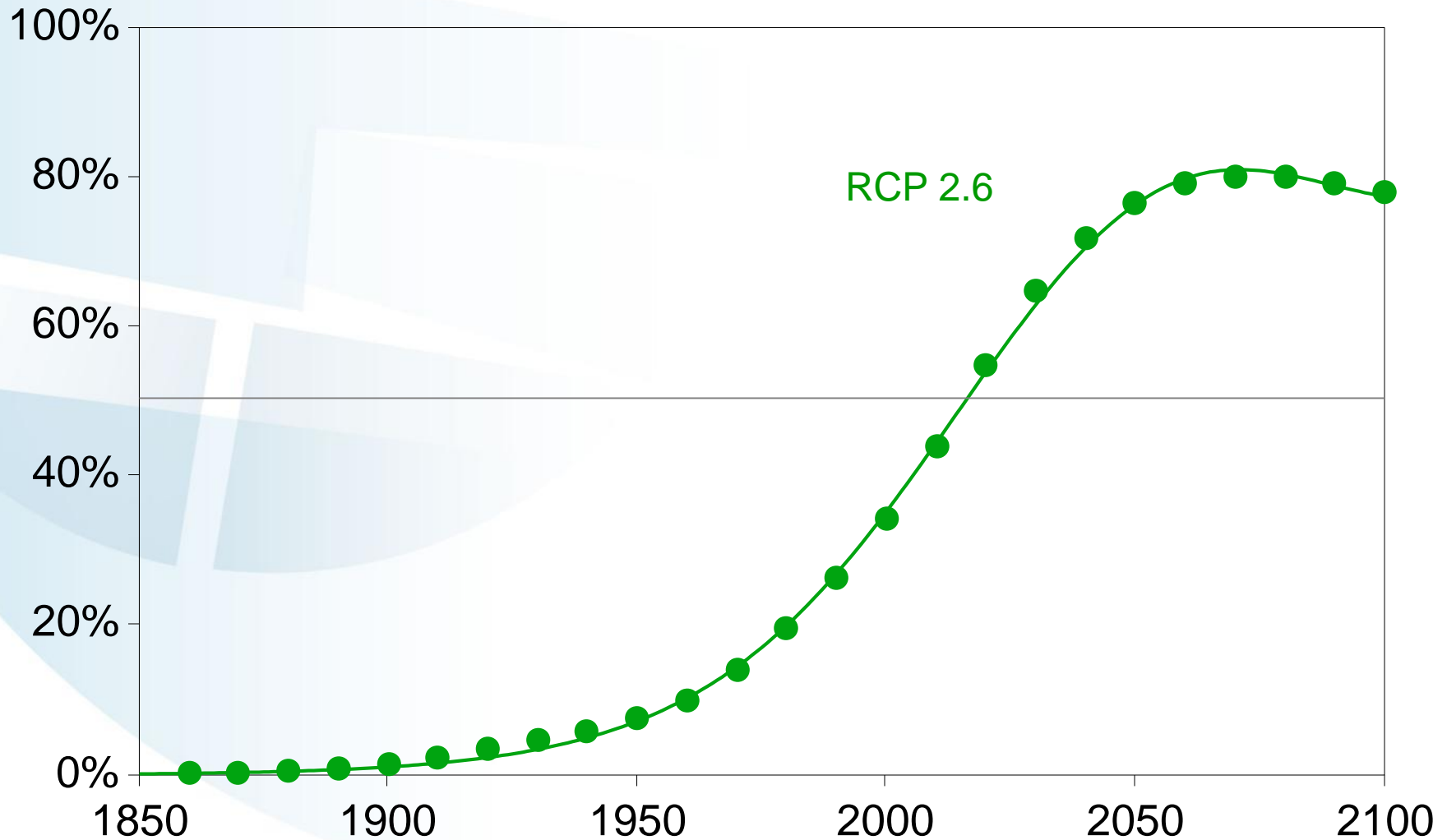
Global Educational Attainment



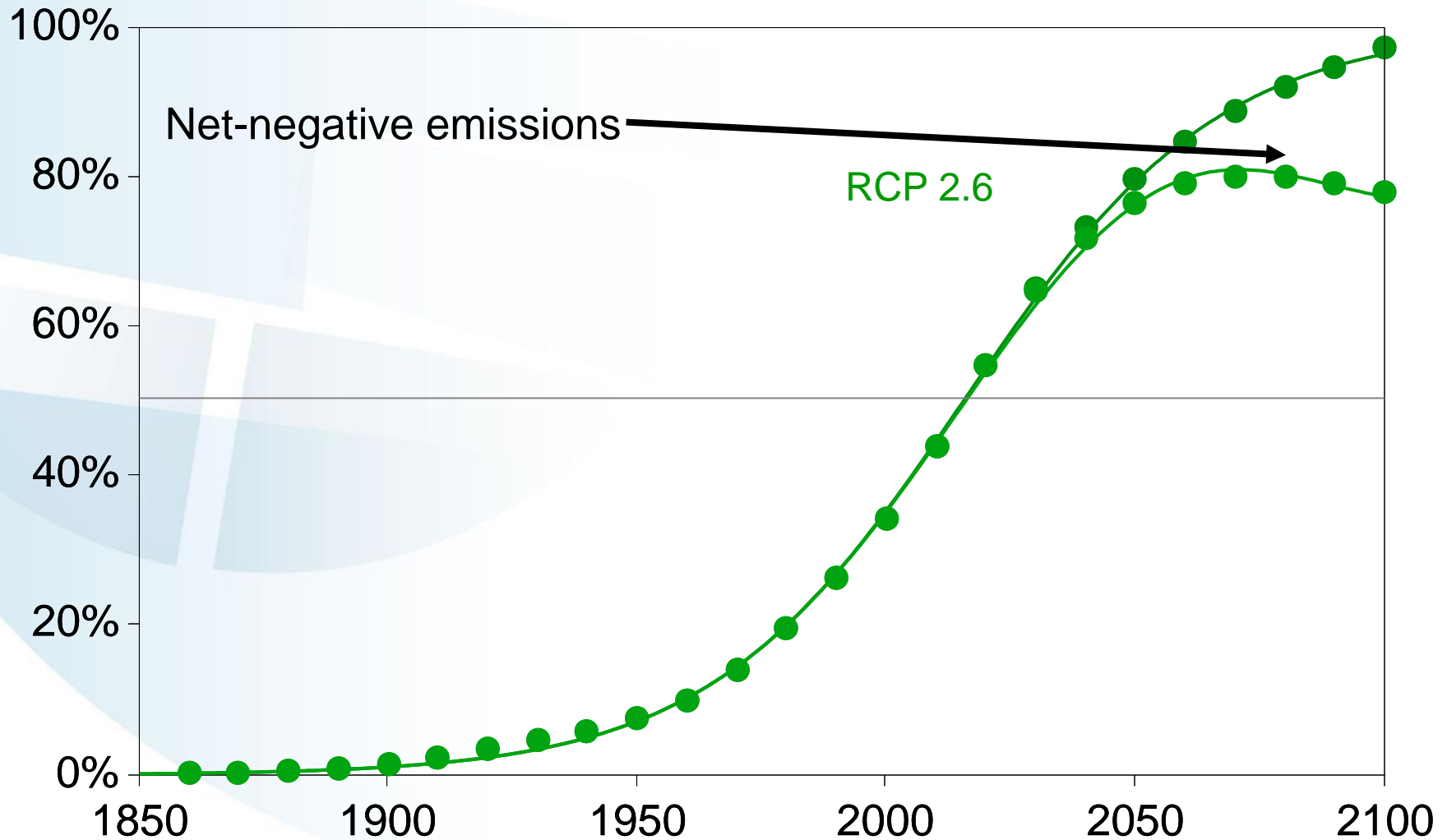
Participatory Governance



Cumulative Carbon Emissions



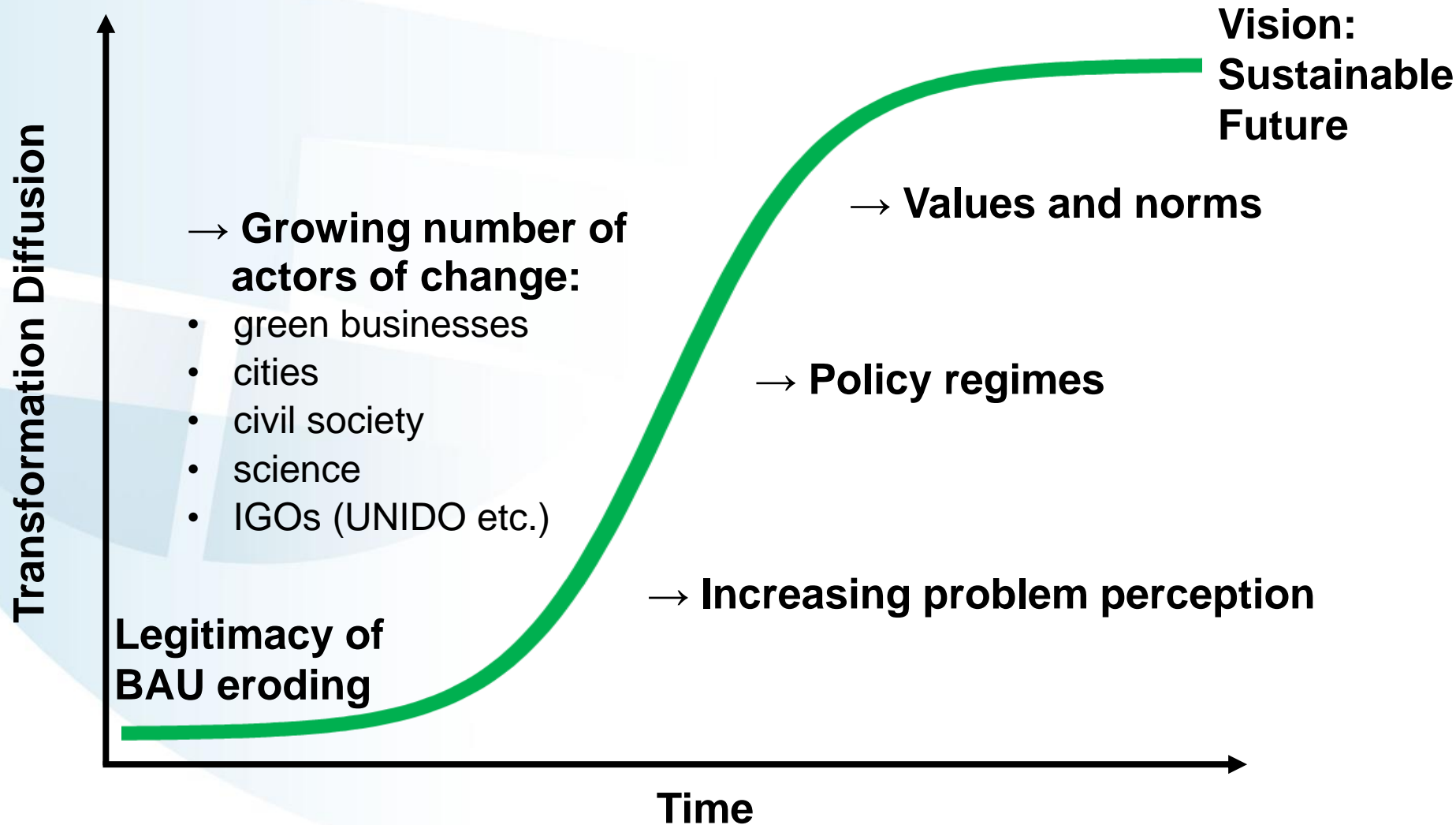
Cumulative Carbon Emissions



Sustainability Transformation



“Doing More with Less” within Planetary Boundaries





Laudato Si'

On Care for Our Common Home

POPE FRANCIS

POPE FRANCIS PRAISE BE TO YOU

Laudato Si'

On Care for Our Common Home



IGNATIUS





Regina

Winnipeg



Bakken

Bismarck

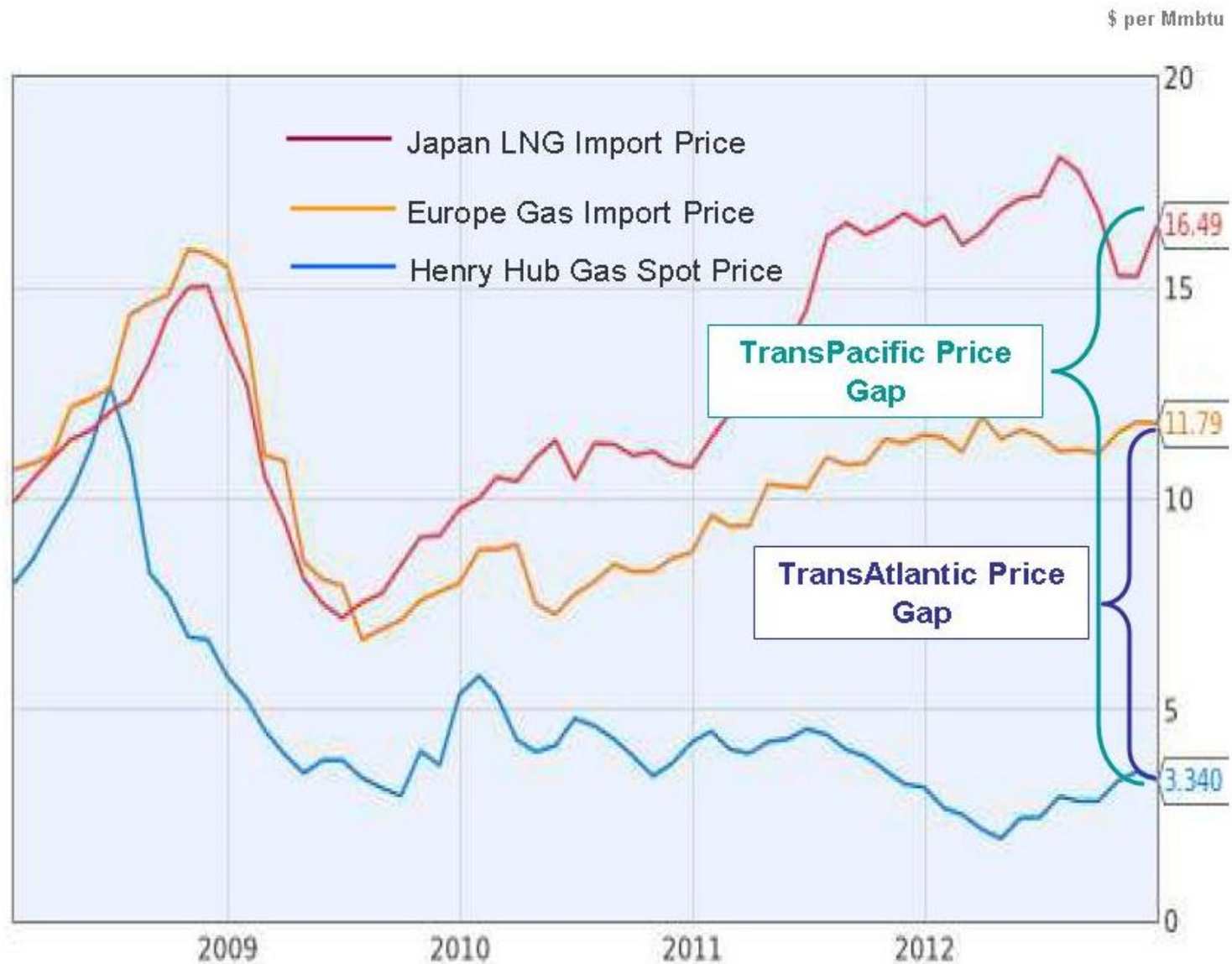
Fargo

Duluth

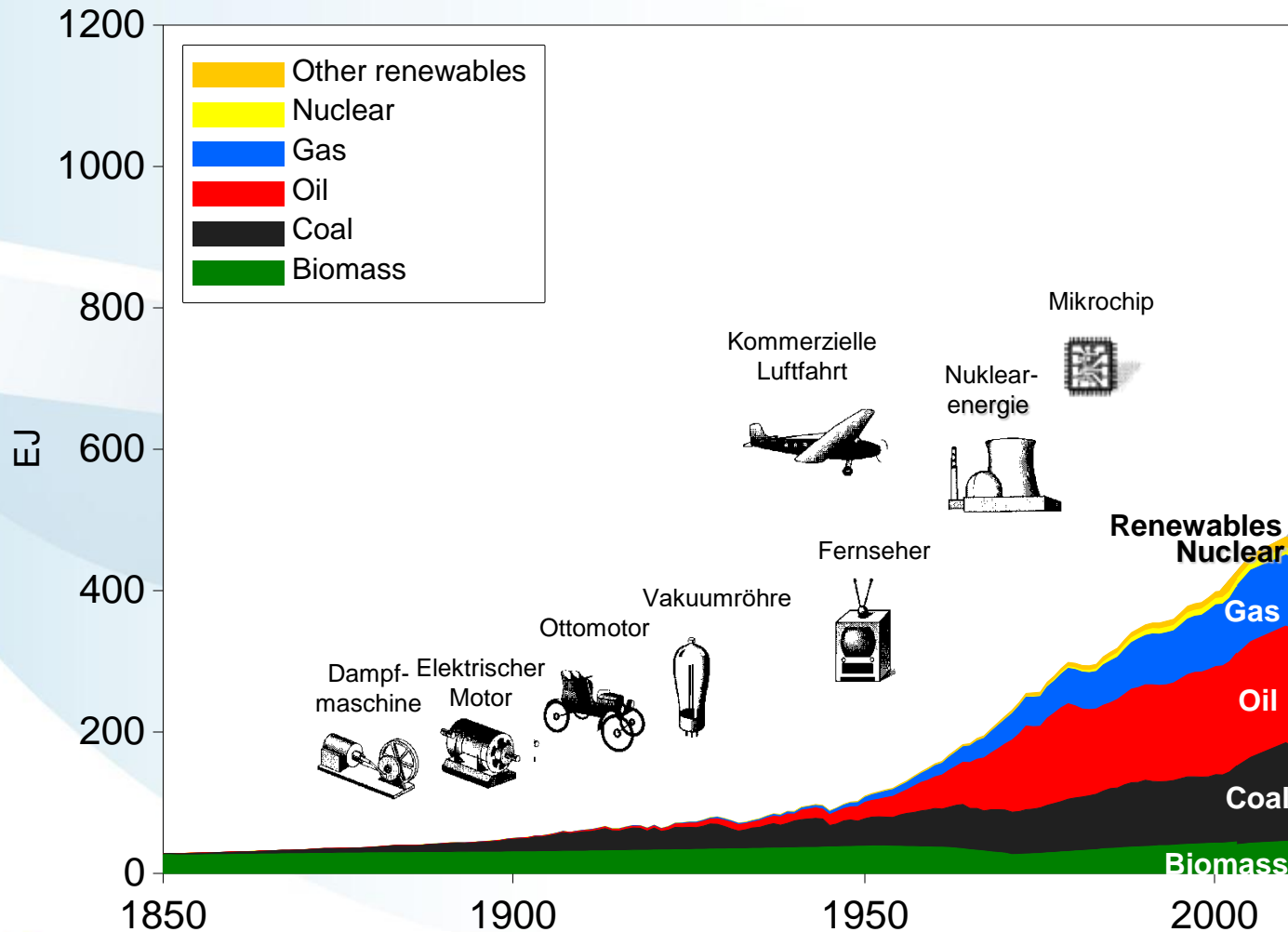
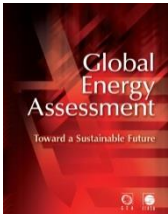
Rapid City

Minneapolis
St. Paul

Interregional gas price gaps

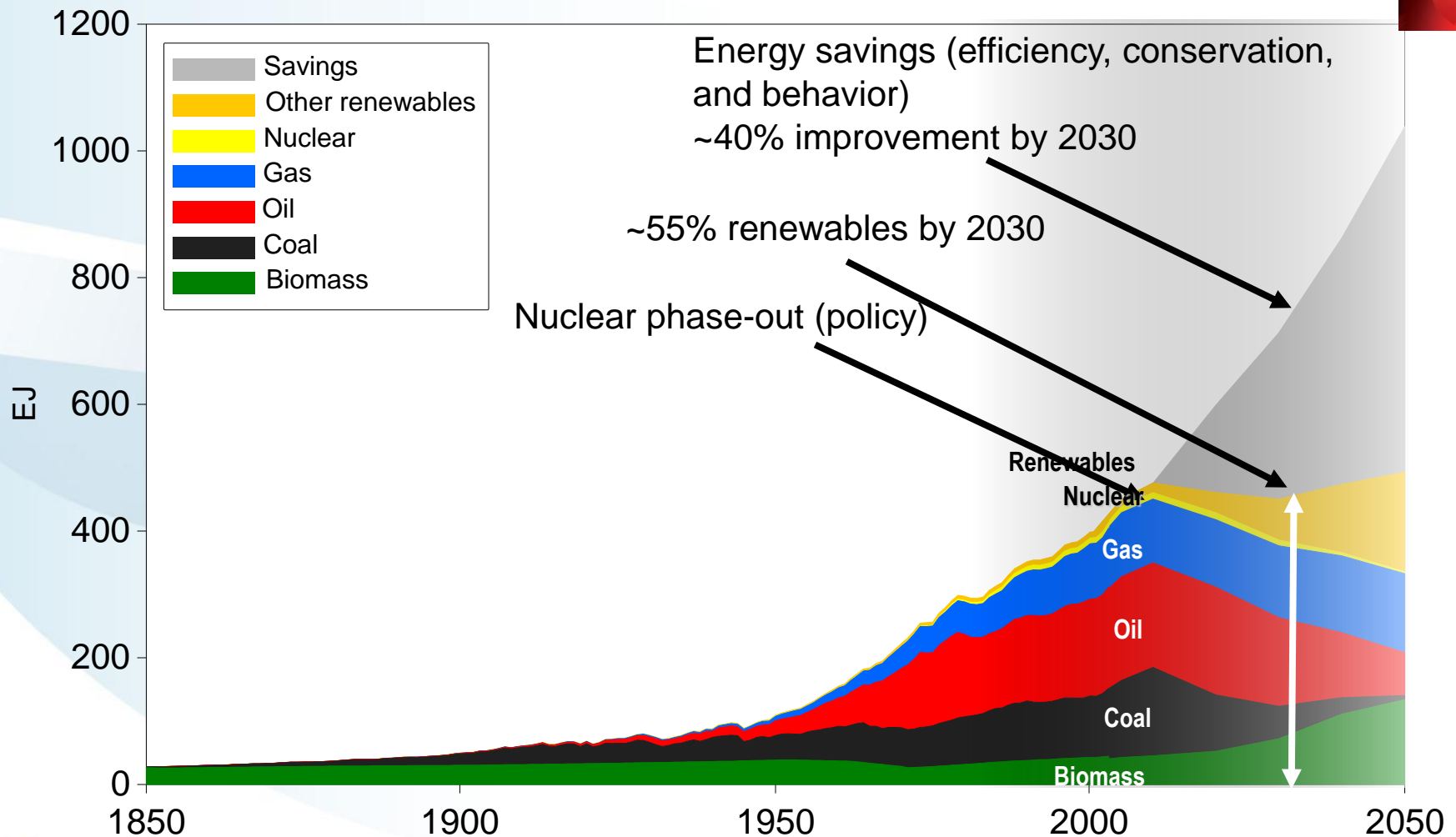
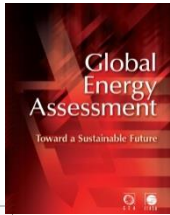


Global Primary Energy Historical Evolution



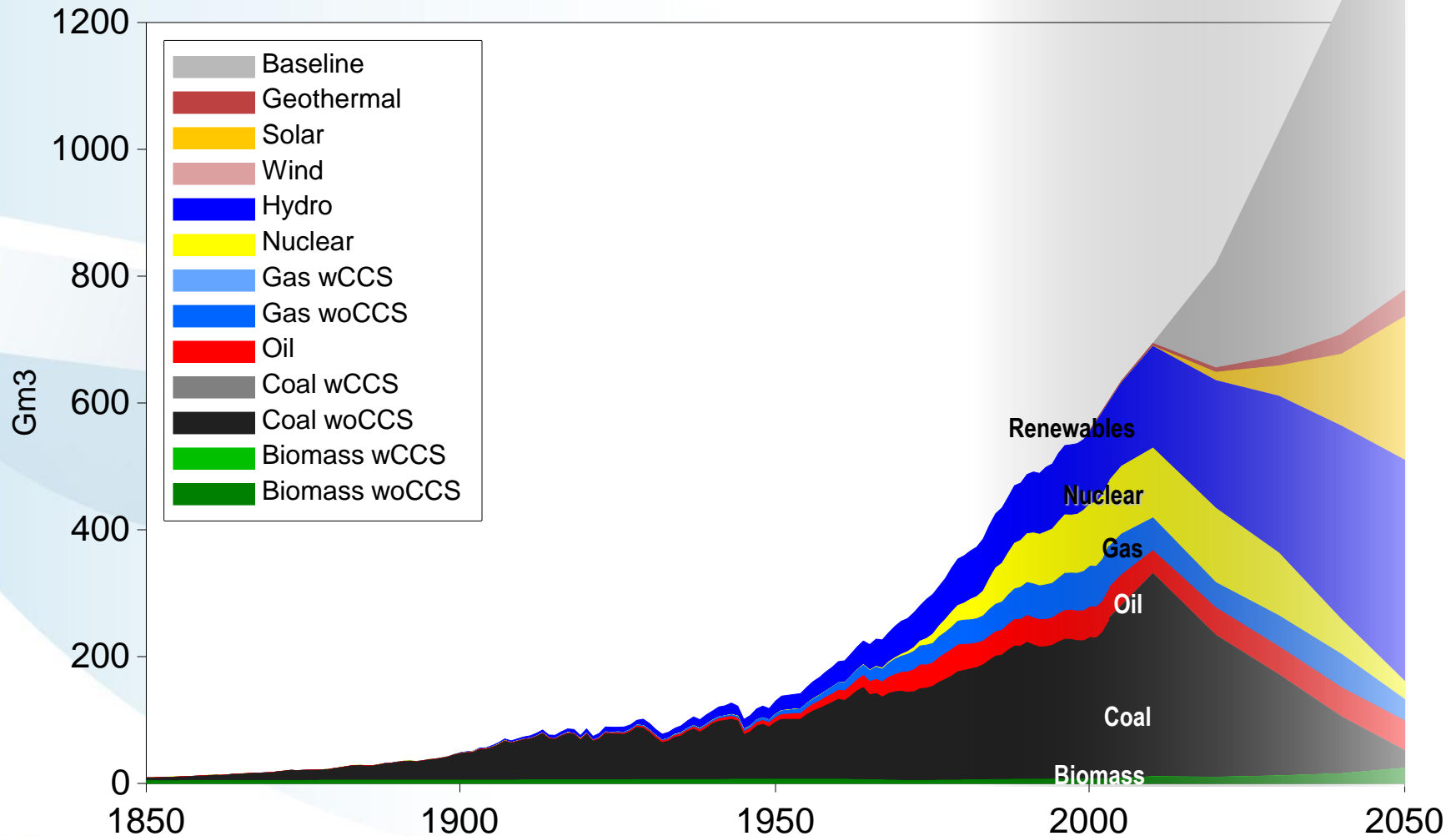
Global Primary Energy

A Transformational Pathway



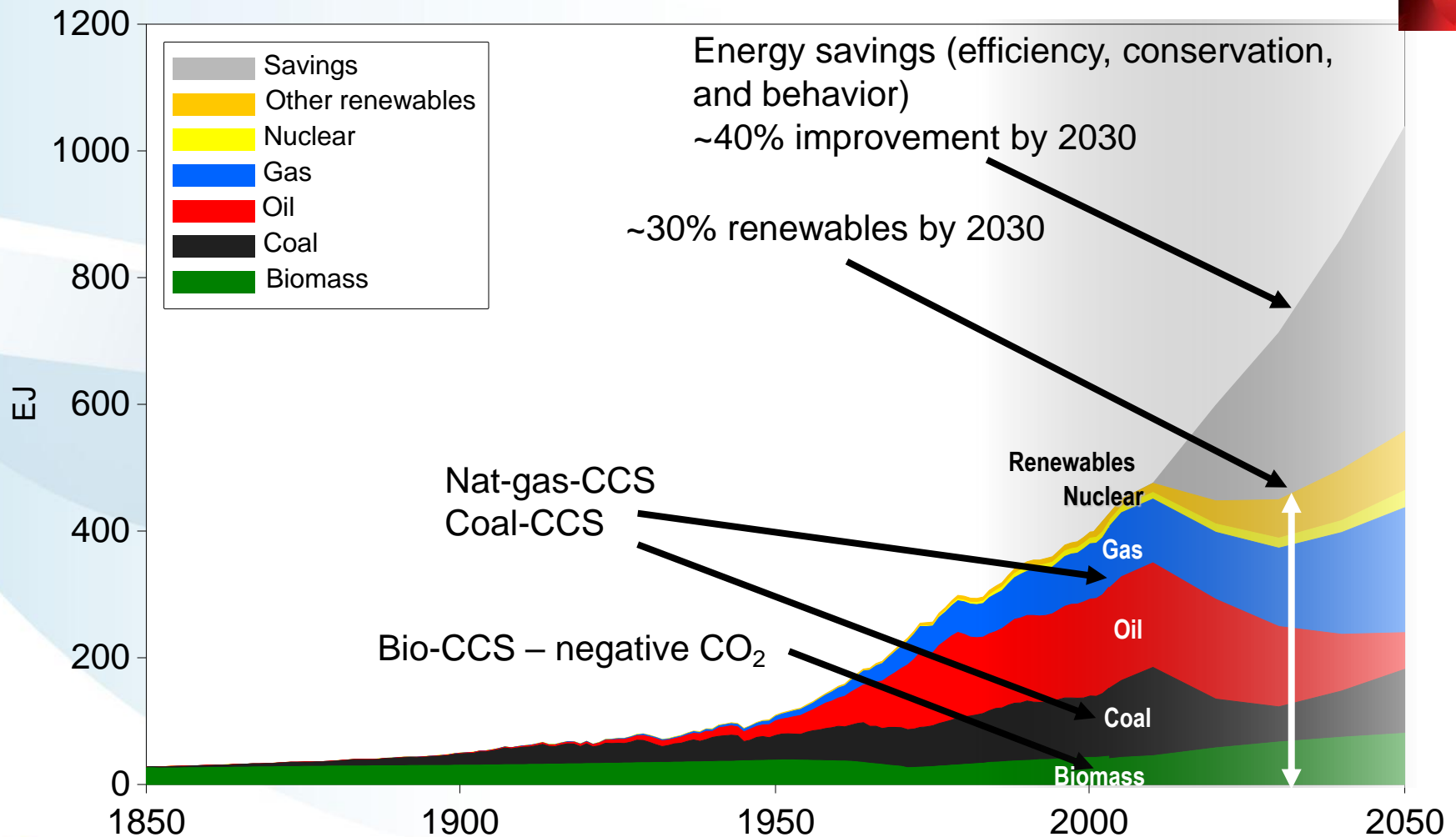
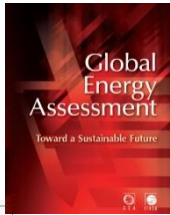
Global Water Withdrawals

A Transformational Pathway



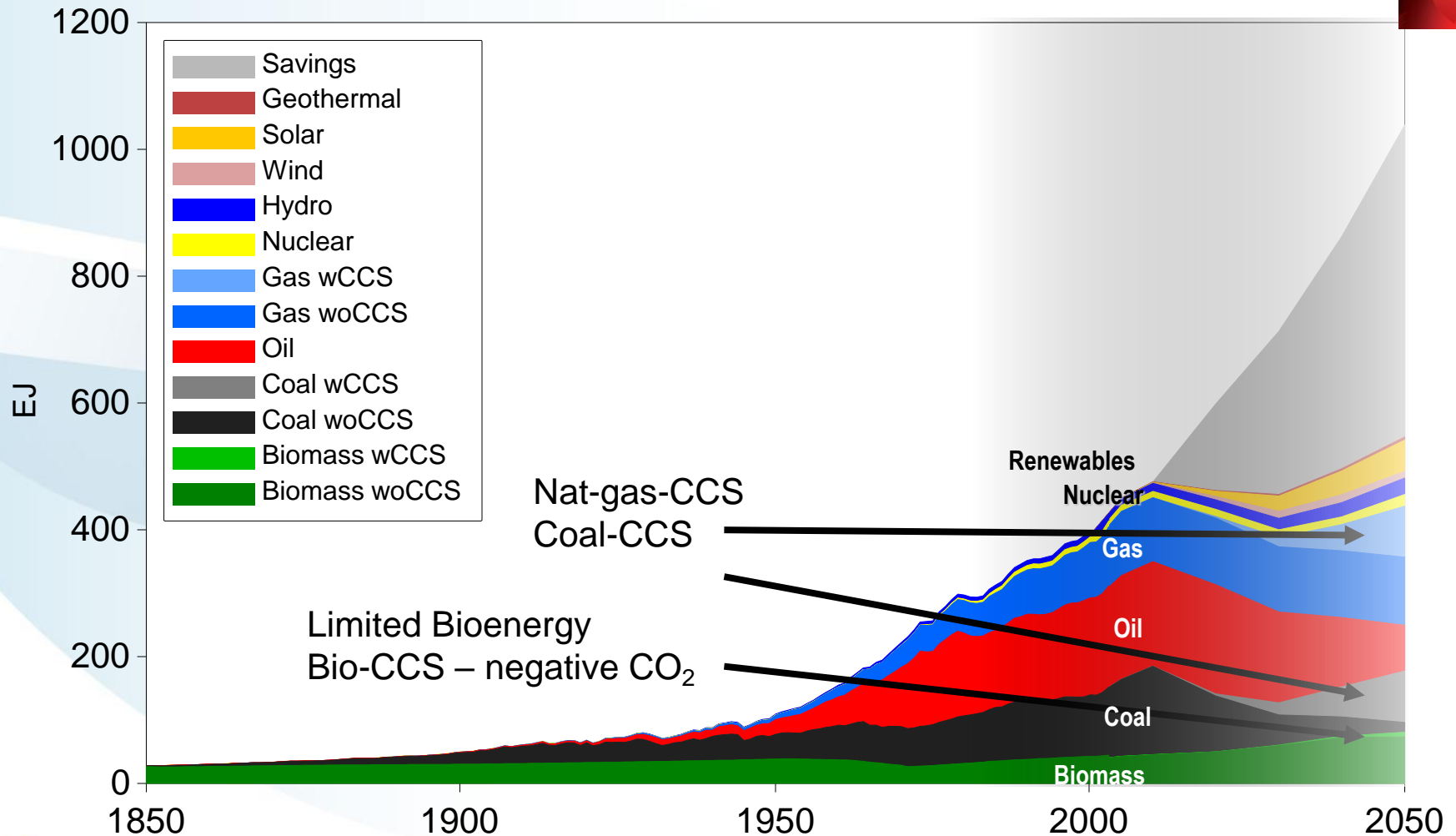
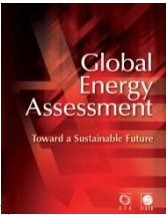
Global Primary Energy

A Pathway with a Full Portfolio



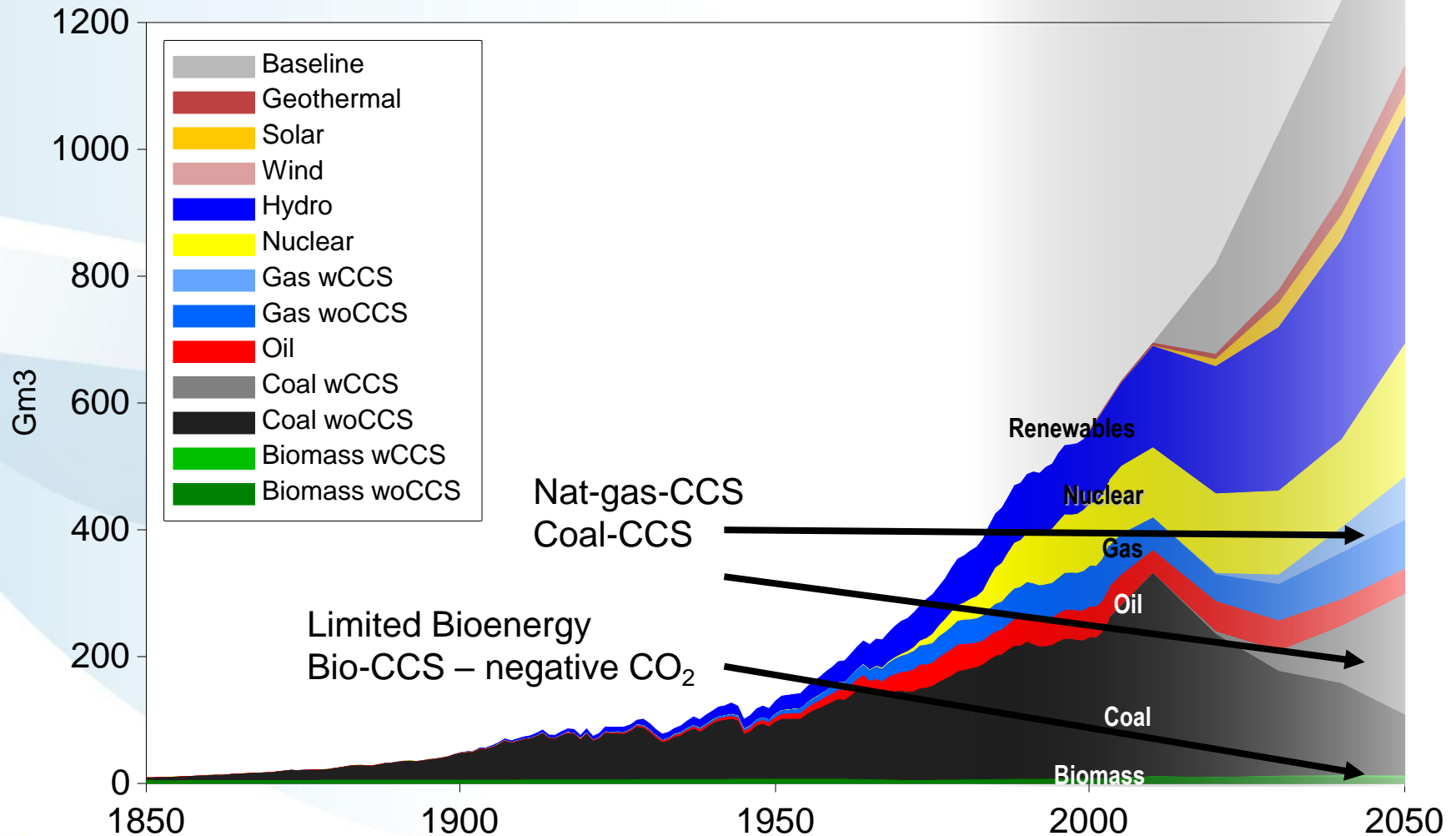
Global Primary Energy

A Pathway with a Full Portfolio



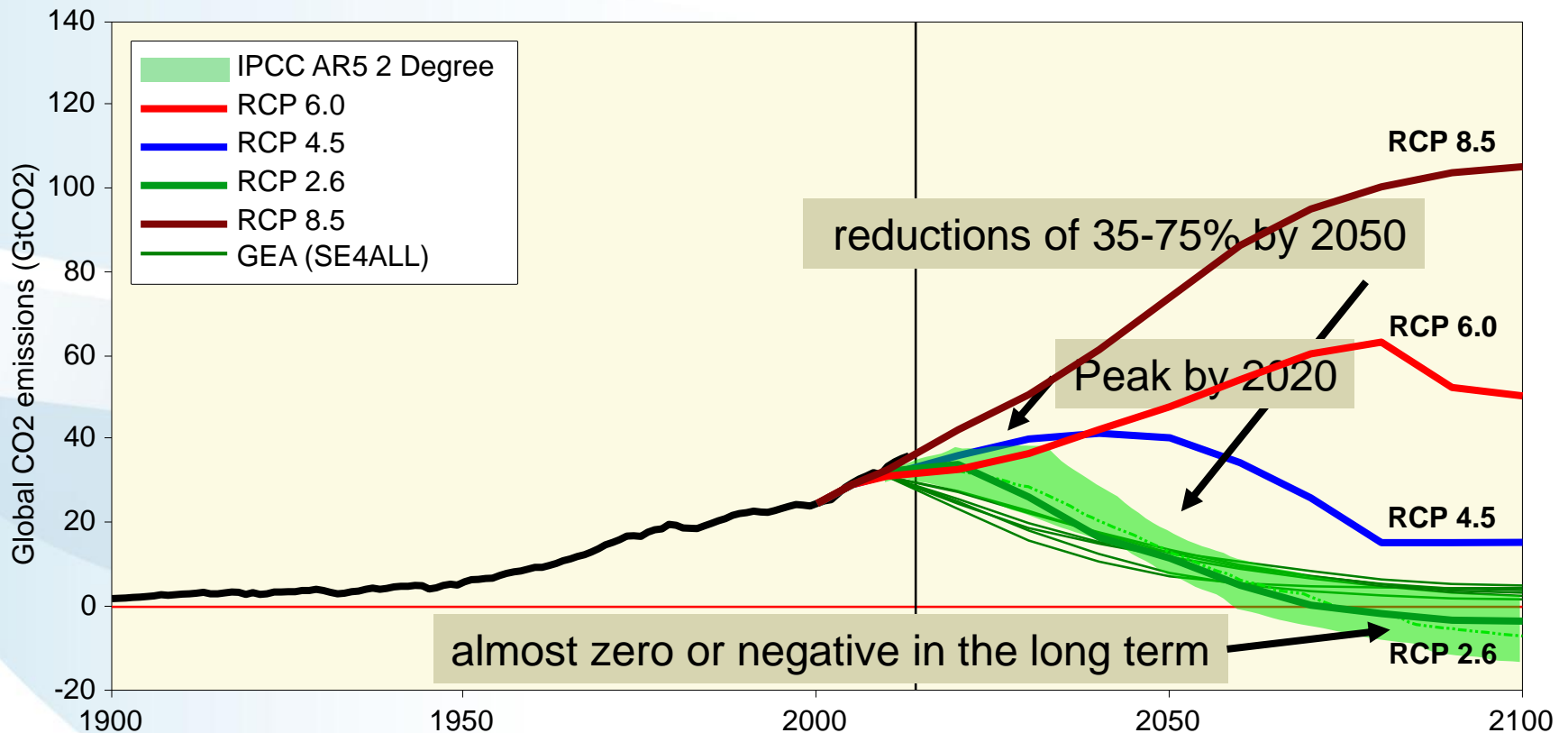
Global Water Withdrawals

A Pathway with Full Portfolio

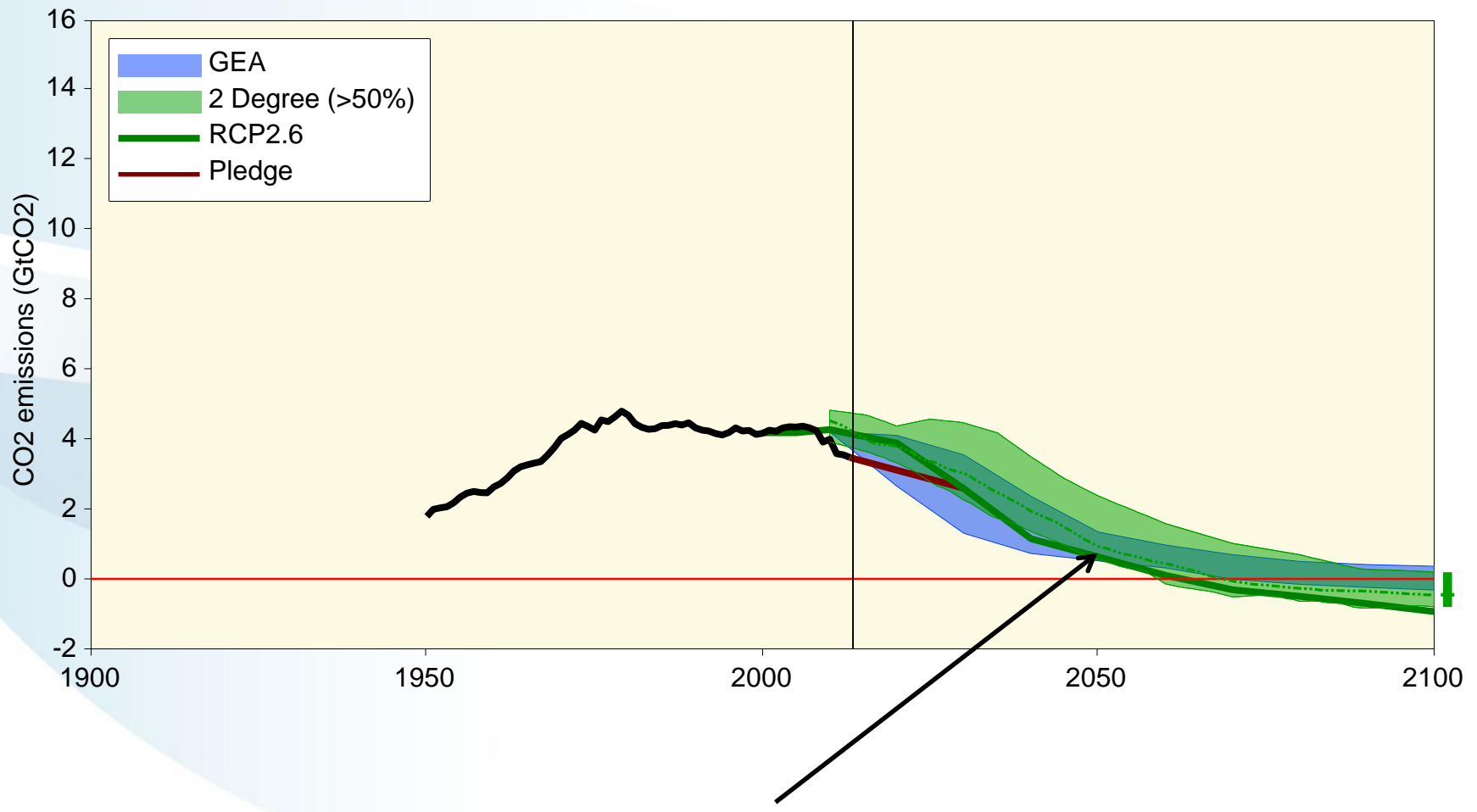


Global CO₂ Emissions

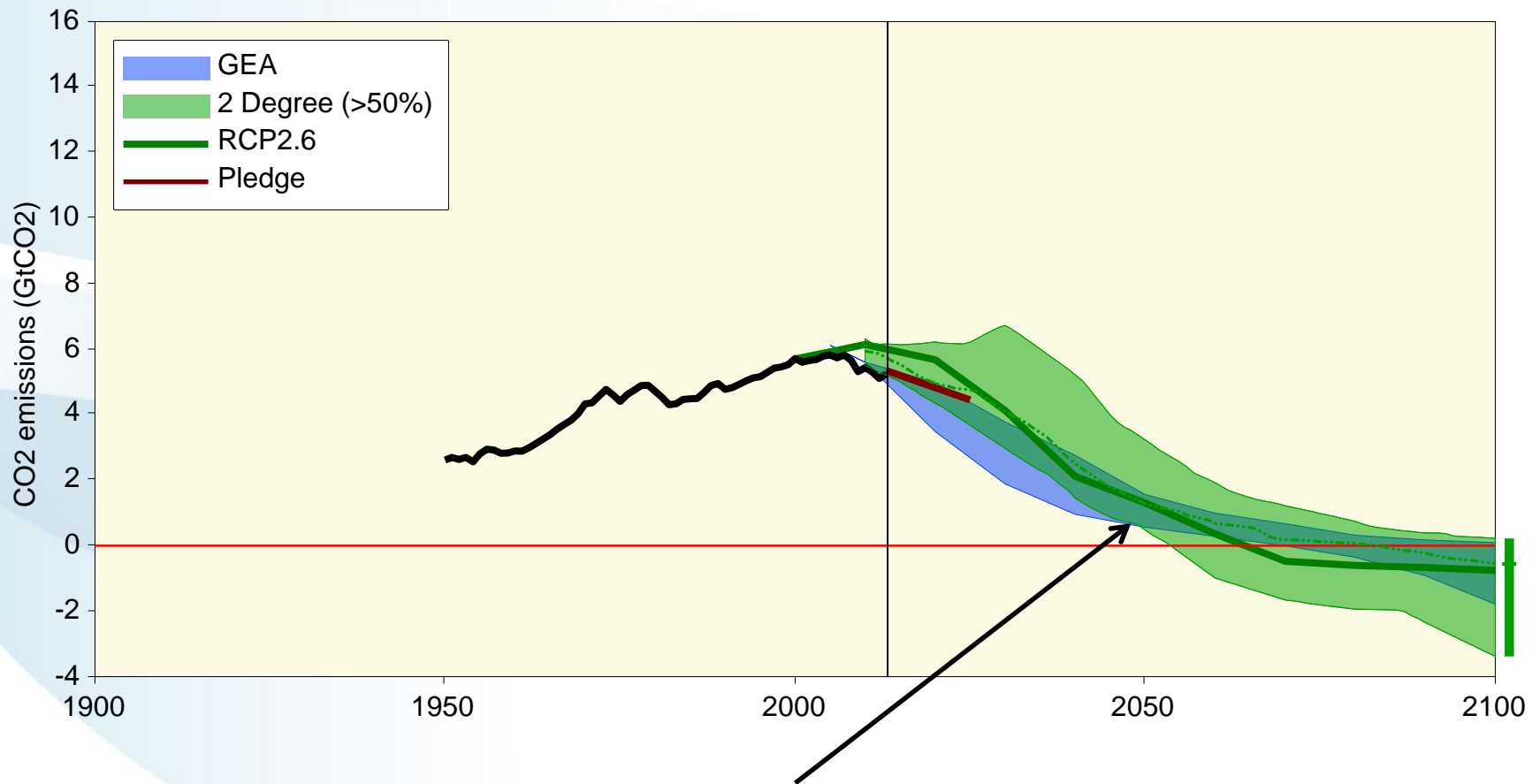
IPCC AR5+



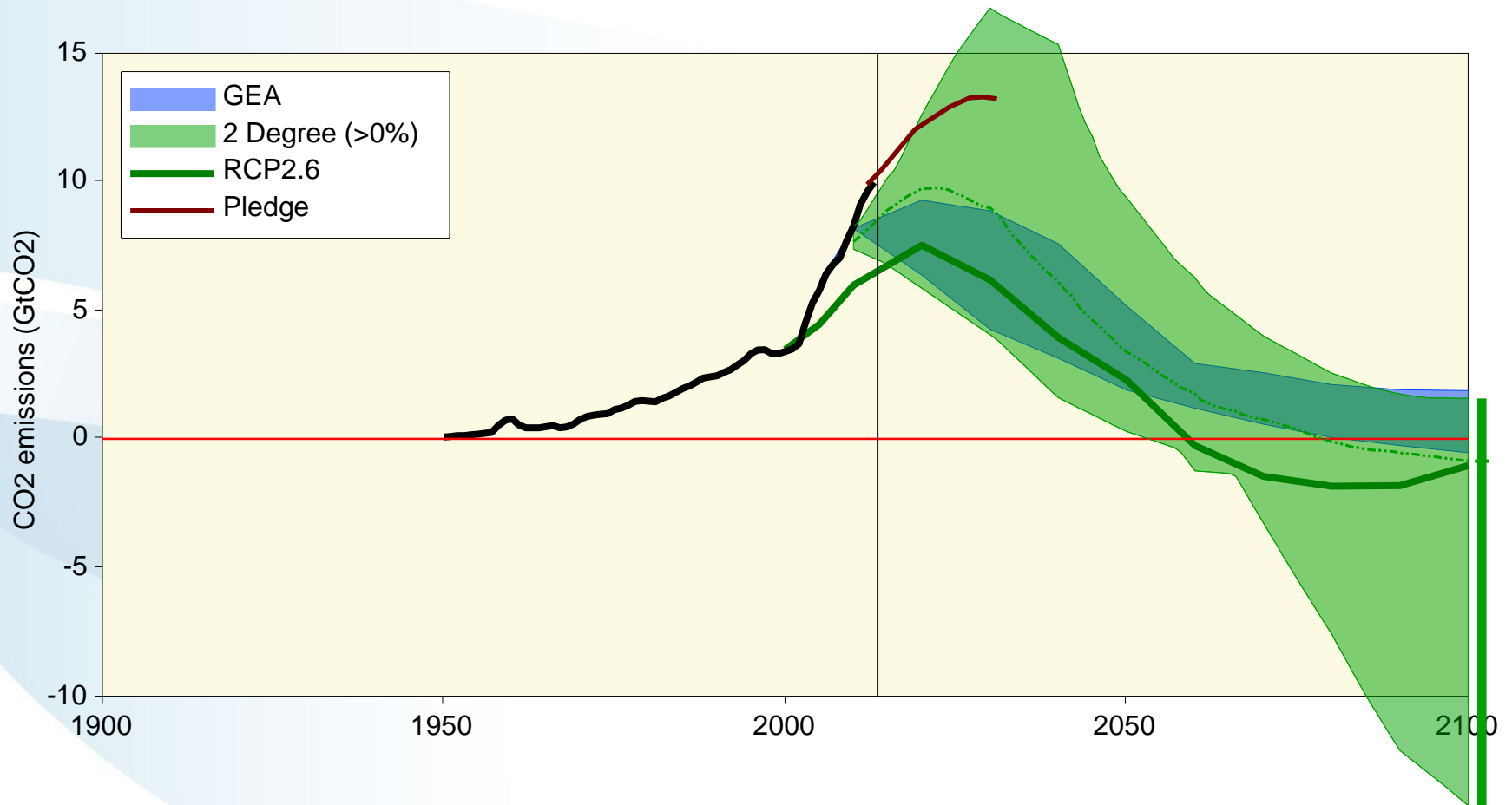
EU CO₂ Emissions



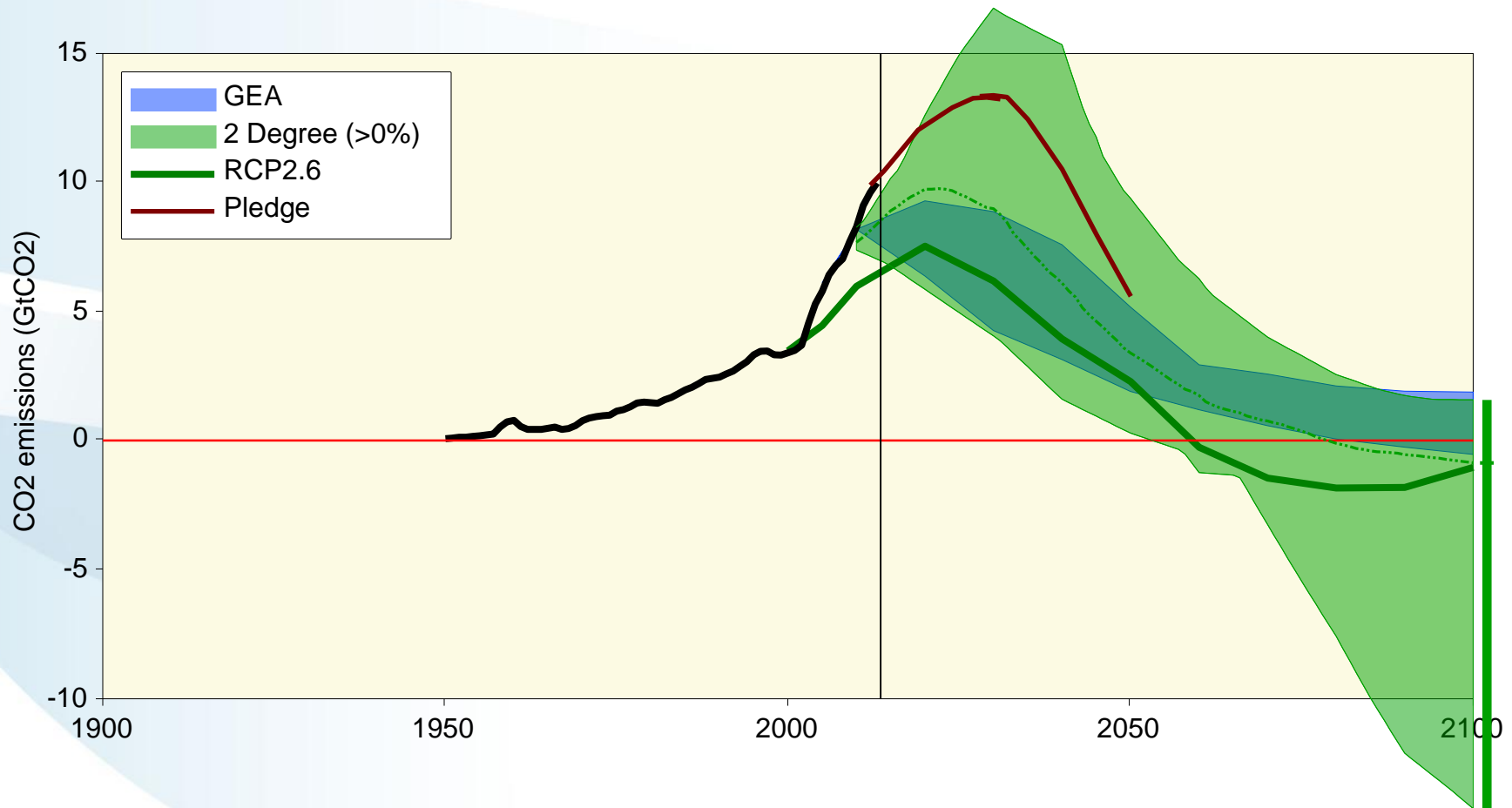
USA CO₂ Emissions



China CO₂ Emissions

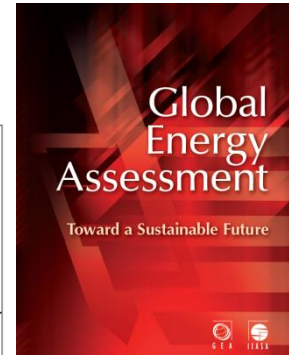
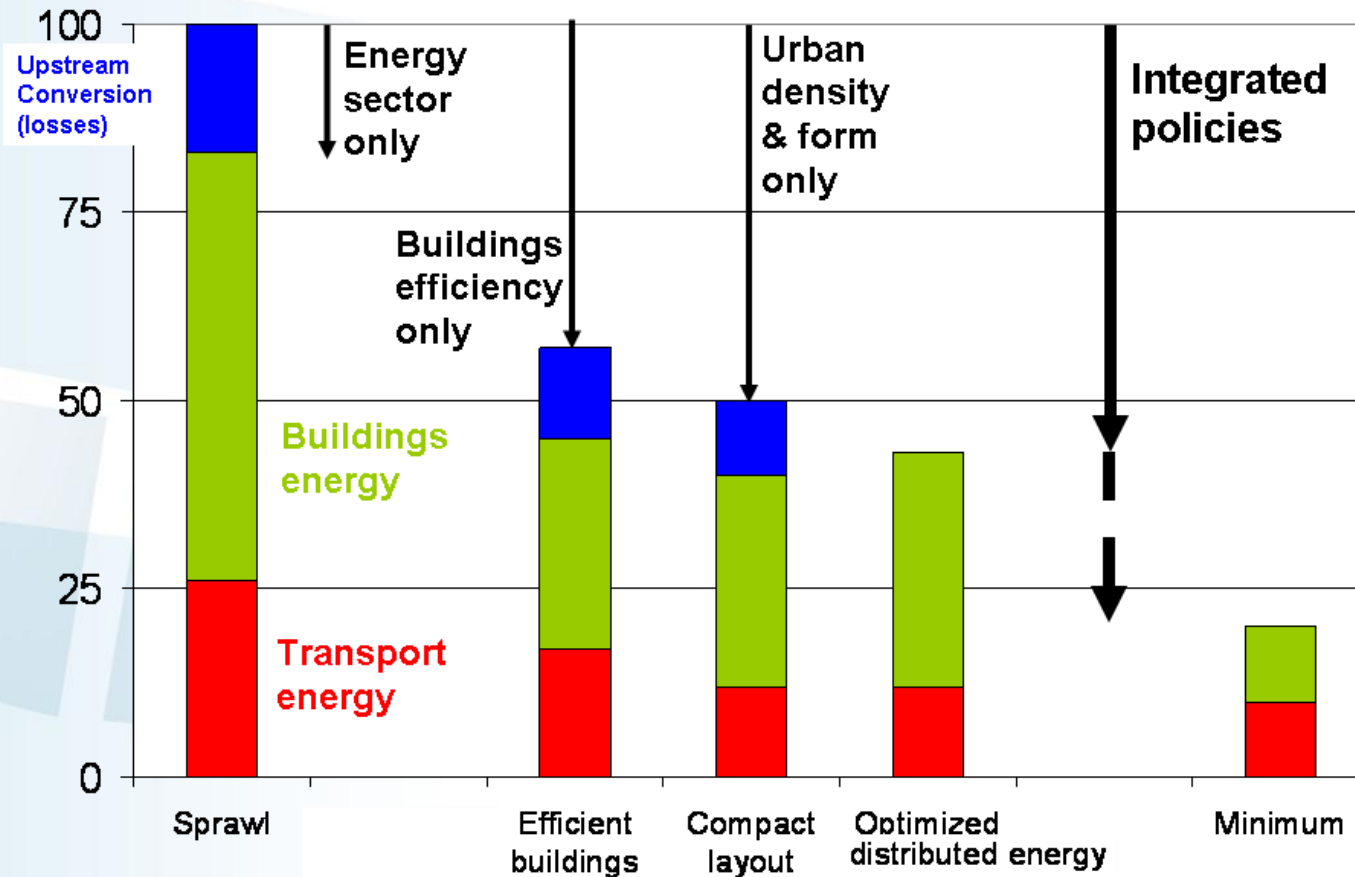


China CO₂ Emissions



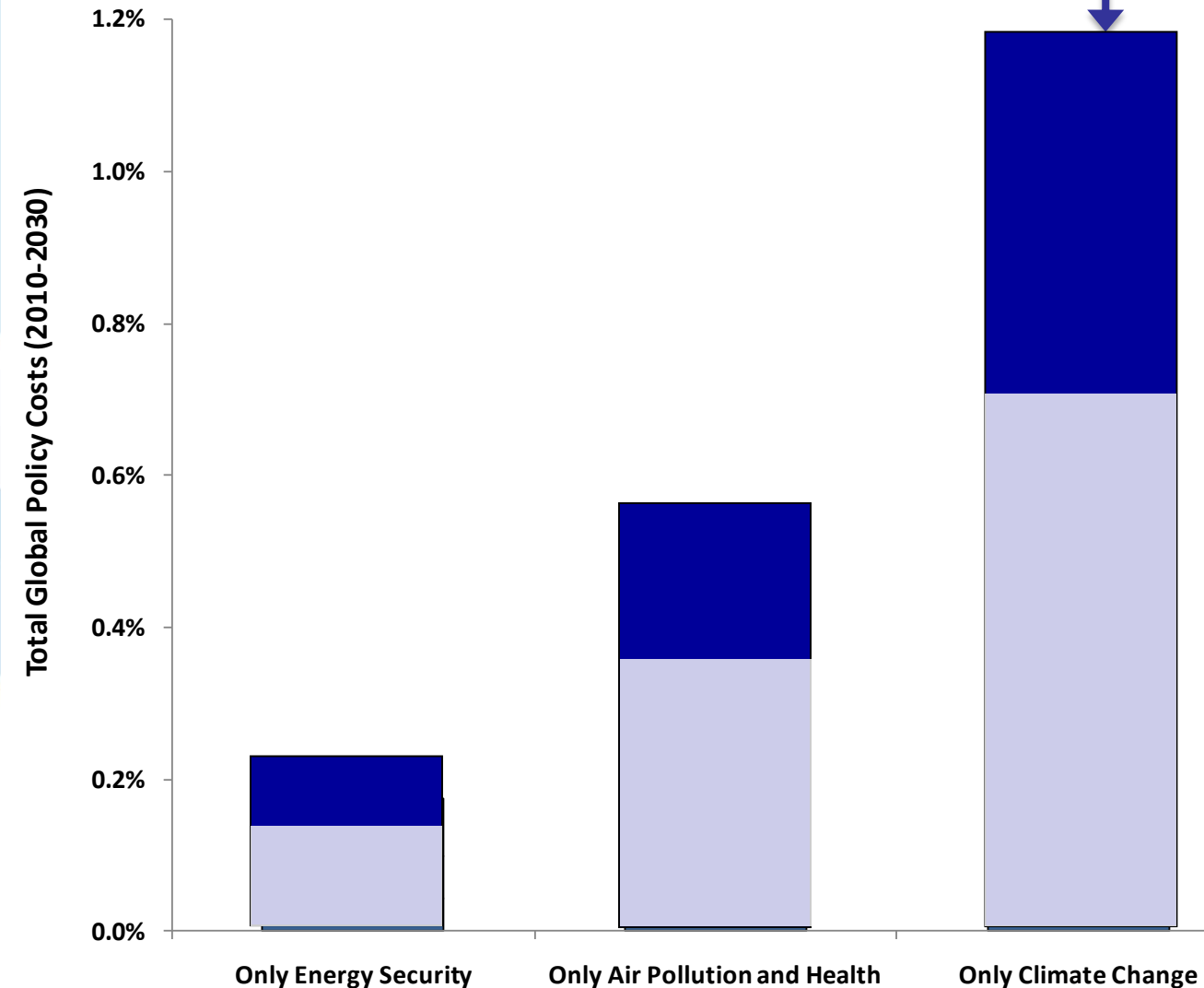
China National Center for Climate Change Strategy & International Cooperation

Policy Integration at the Urban Scale



Simulated energy use, urban settlement of 20,000, using the SimCity Model

Multiple Benefits of Integrated Policies



THANK YOU

science for global insight



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IPCC Fifth Assessment Report

**Nebojsa Nakicenovic
Nominated for the IPCC Chair
by Austria and Montenegro**

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