



International Institute for  
Applied Systems Analysis  
www.iiasa.ac.at

# The Road to Paris: From Global Commitments to National Pledges and Co-Benefits

Nebojsa Nakicenovic

Deputy Director General

International Institute for Applied Systems Analysis

Professor Emeritus of Energy Economics

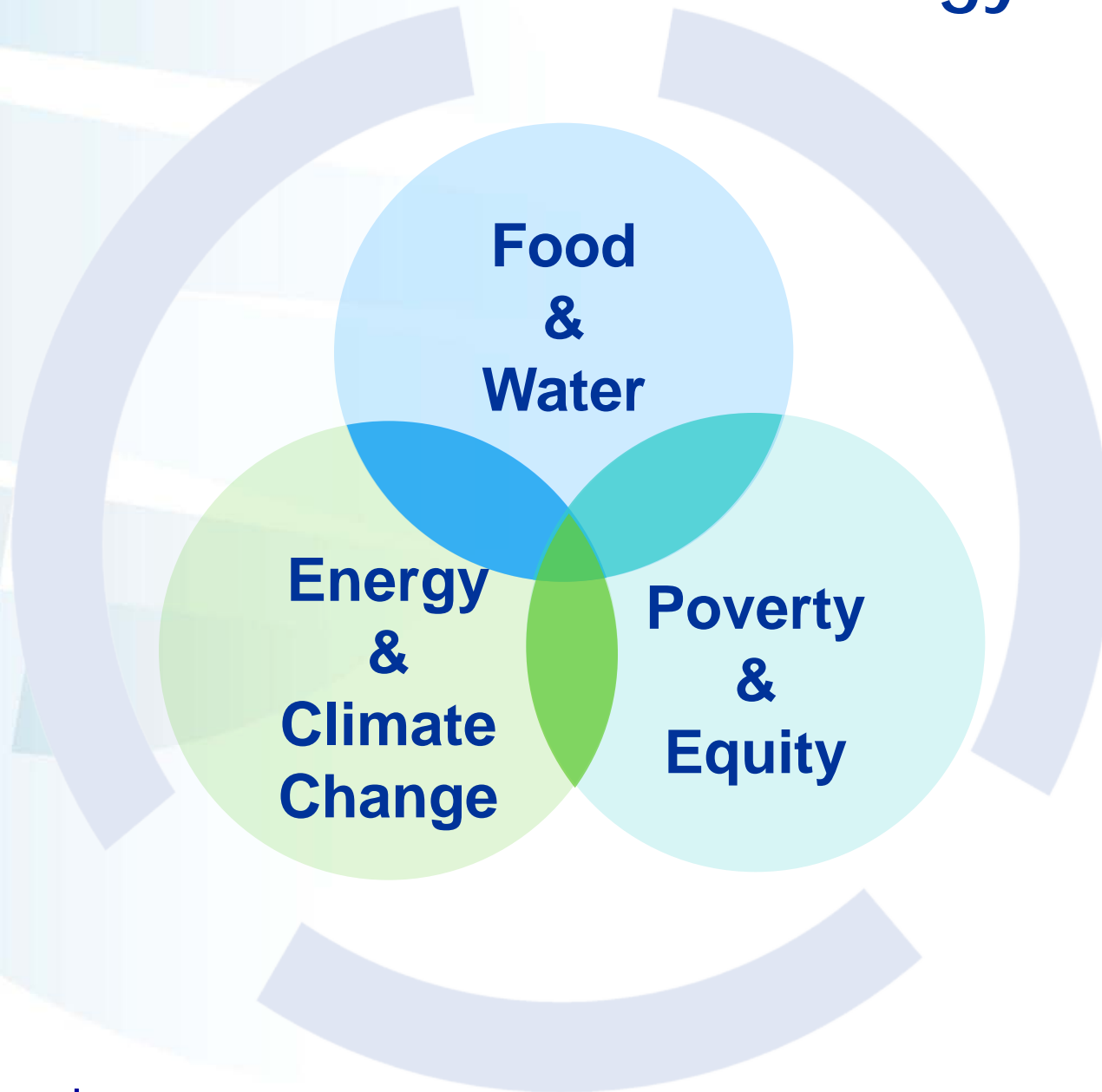
Vienna University of Technology

*ALPS International Symposium, Effective Frameworks and Measures for Climate Change to COP21, hosted by Research Institute of Innovative Technology for the Earth (RITE) at the Technology International Forum, Tokyo – 27 February 2015*

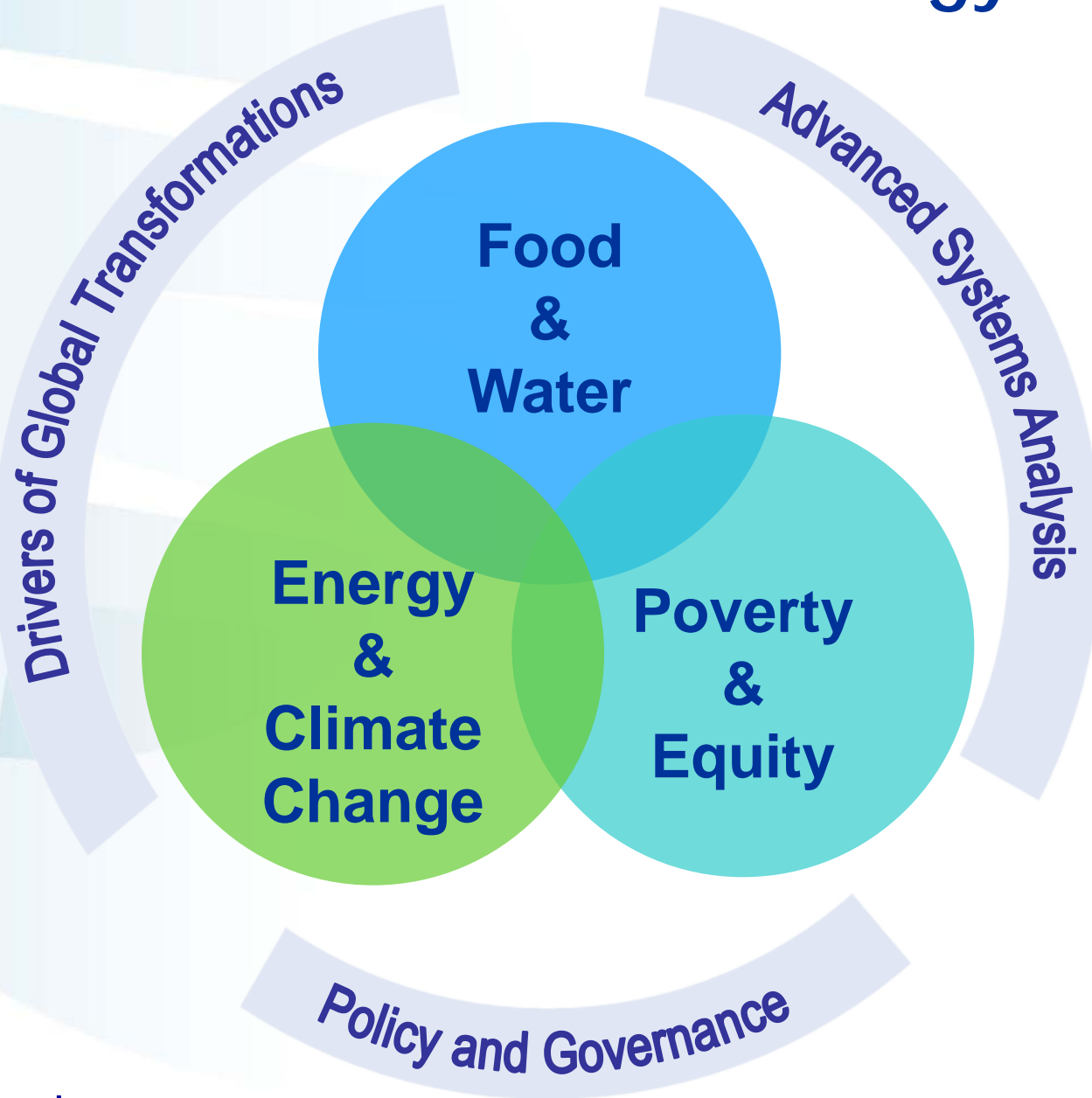


IIASA, International Institute for Applied Systems Analysis

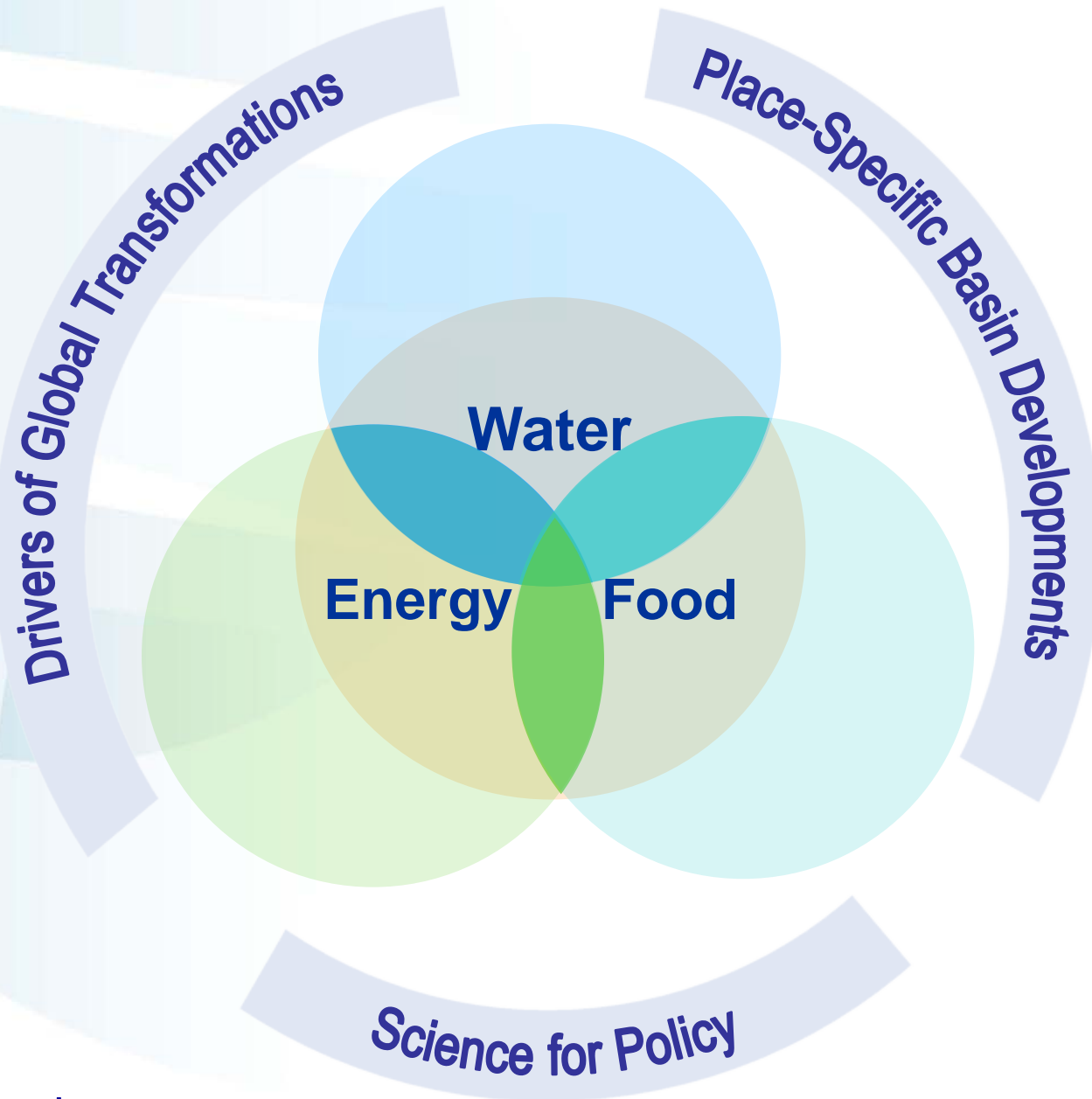
# IIASA Research Strategy



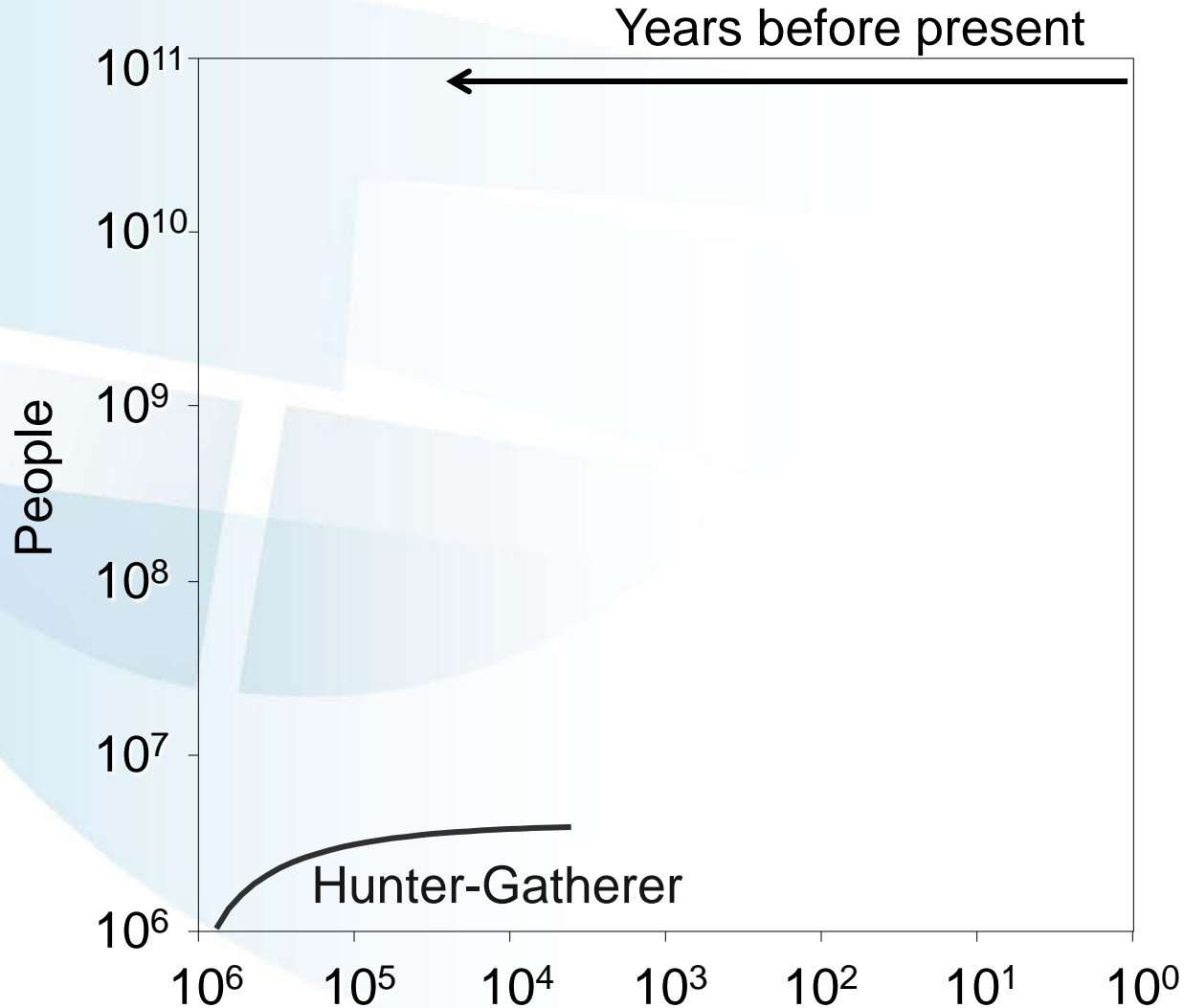
# IIASA Research Strategy



# IIASA Nexus Research

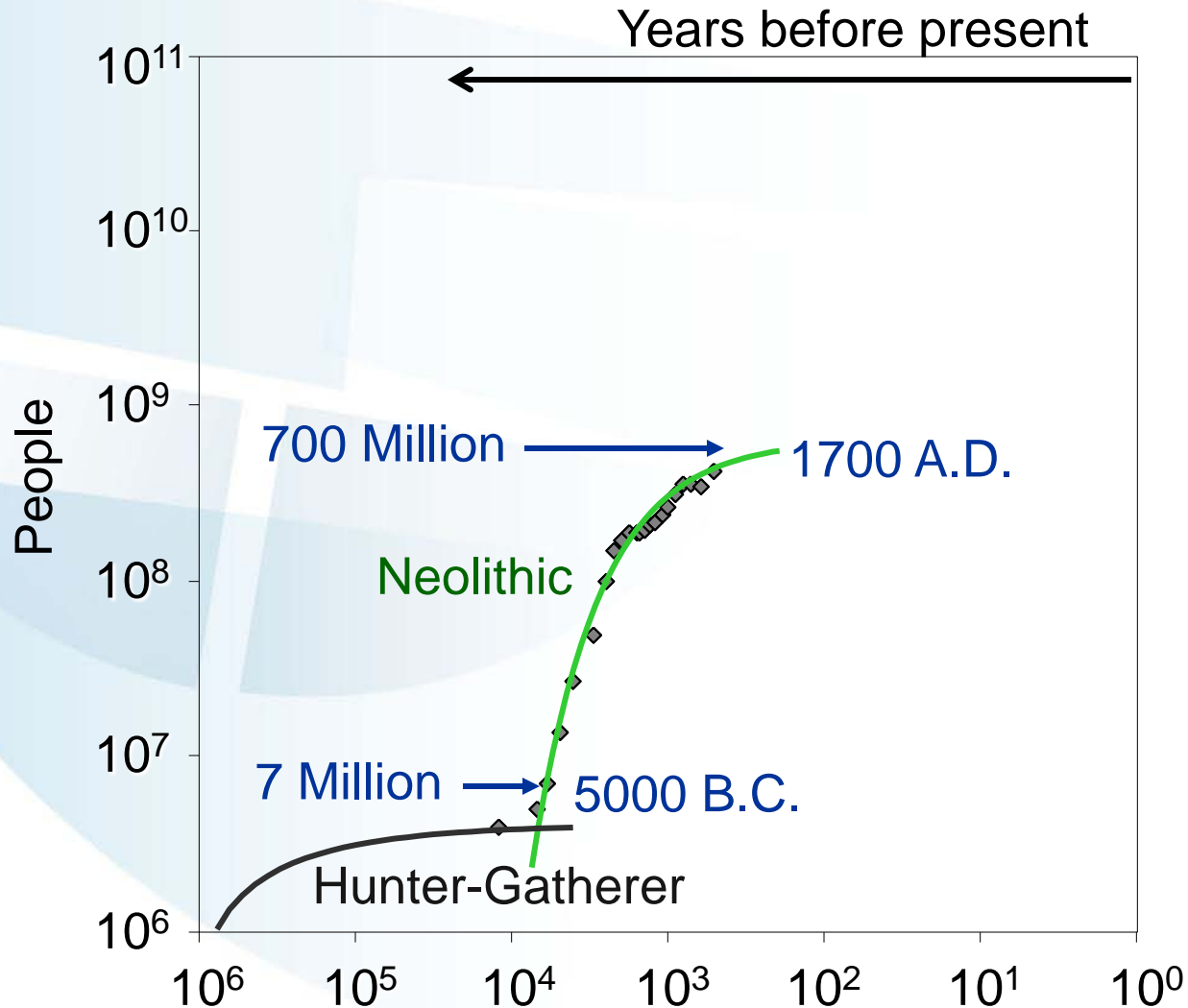


# Global Transformations



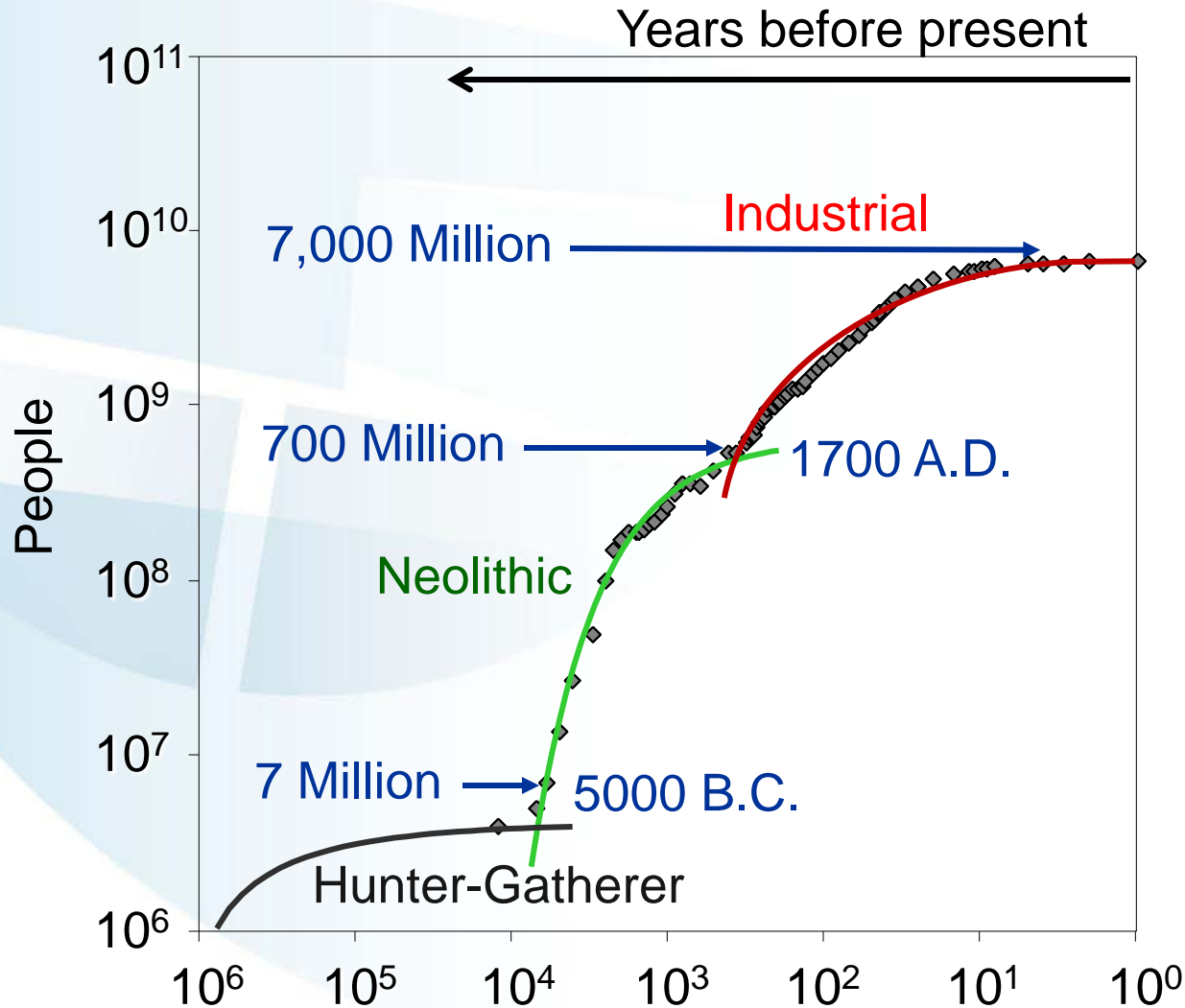
# Global Transformations

## Neolithic Revolution



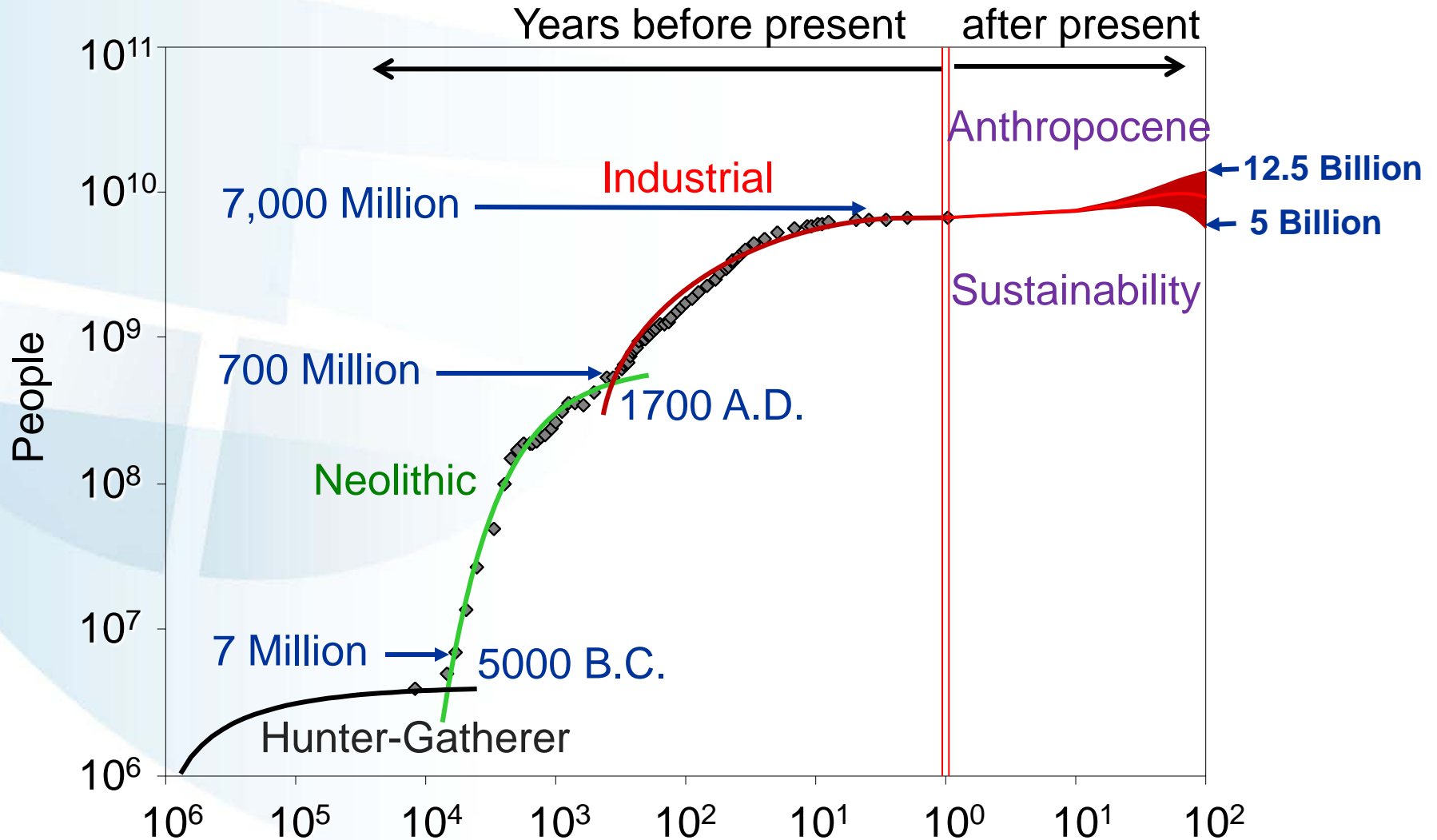
# Global Transformations

## Neolithic and Industrial Revolutions



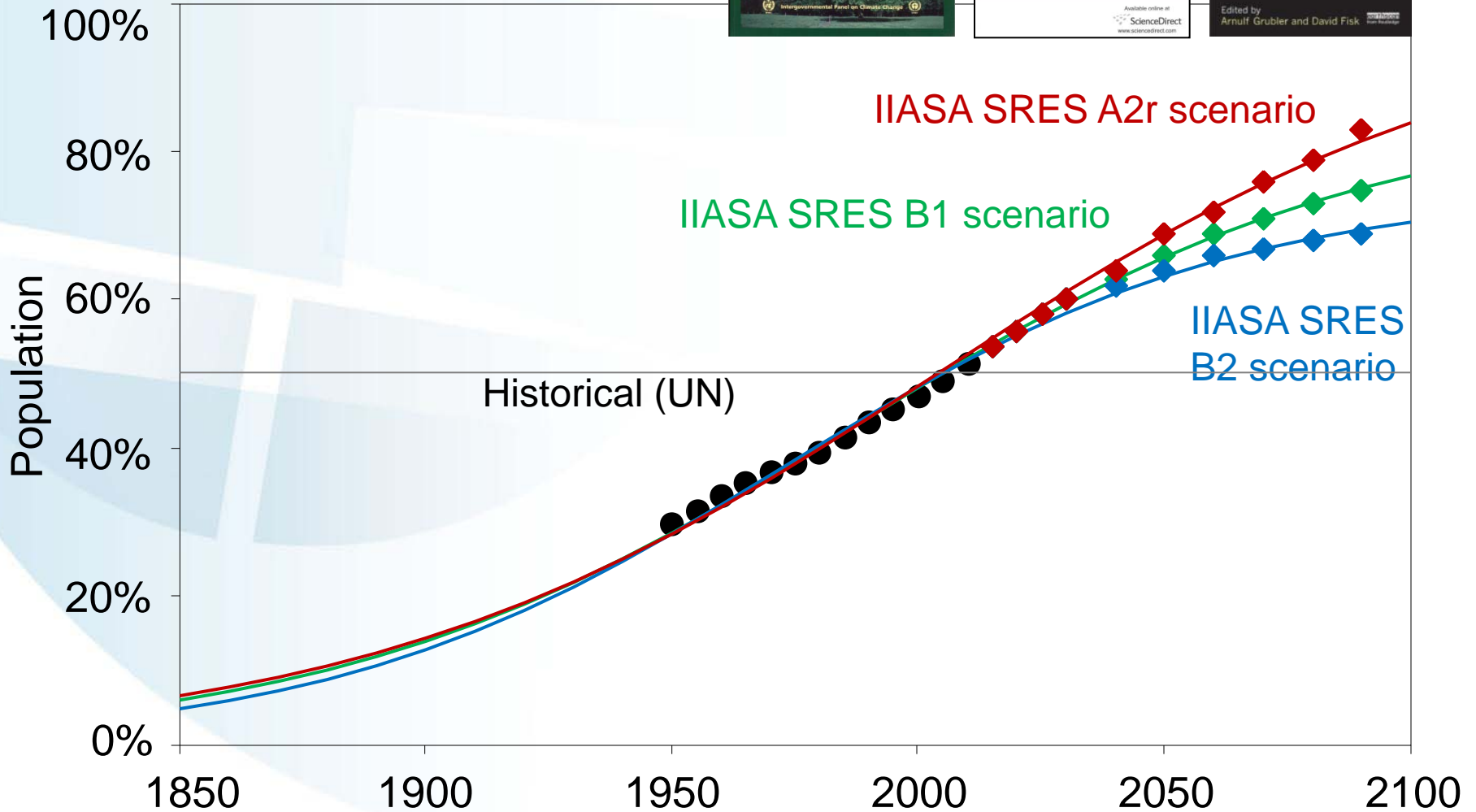
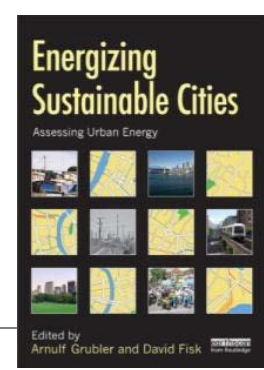
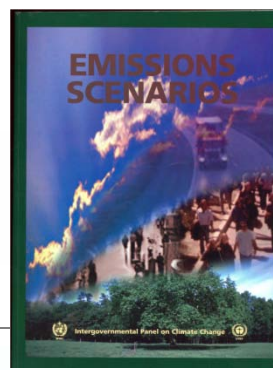
# Global Transformations

## Anthropocene - Toward Sustainability

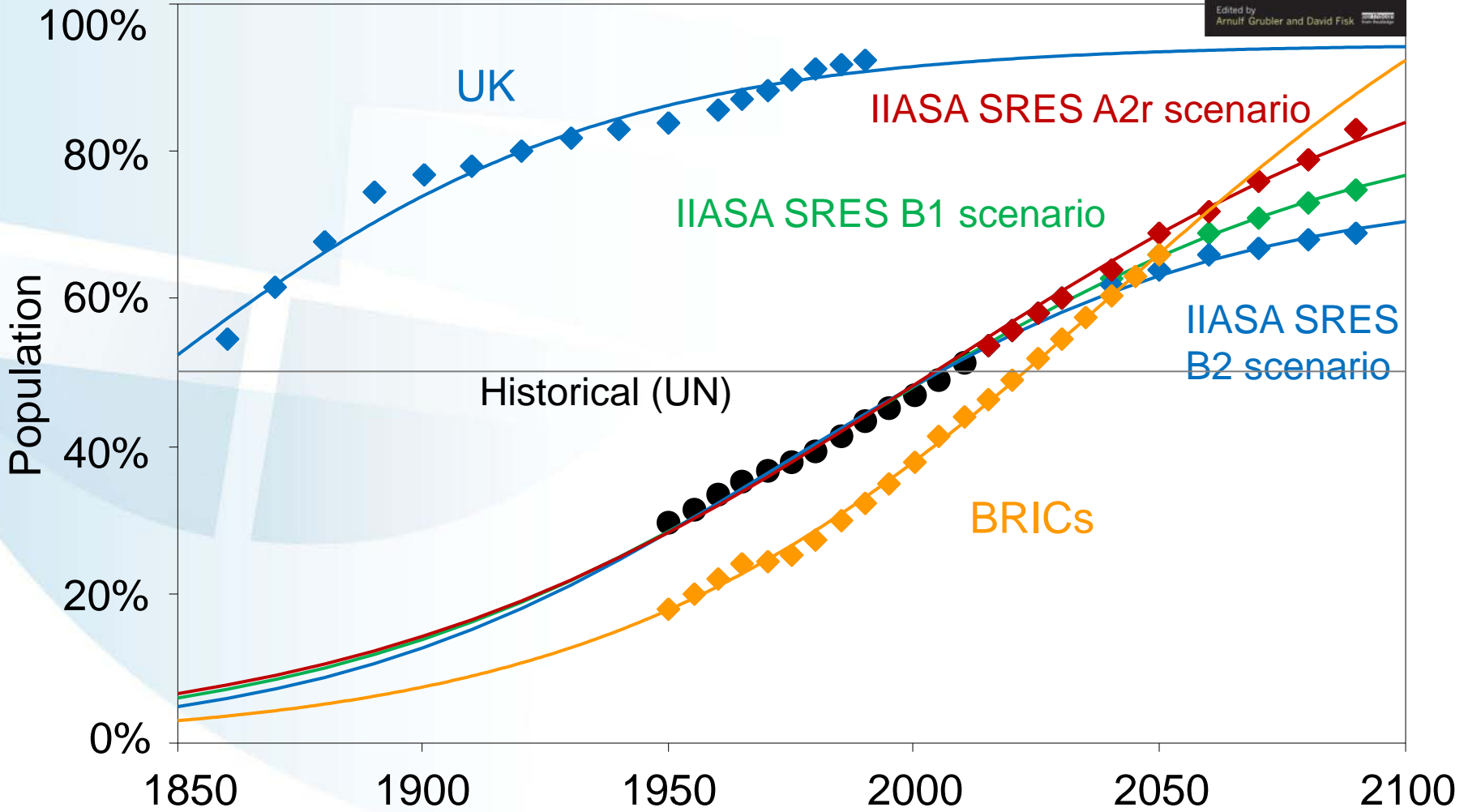
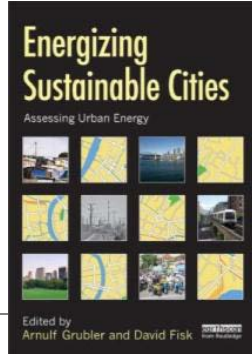




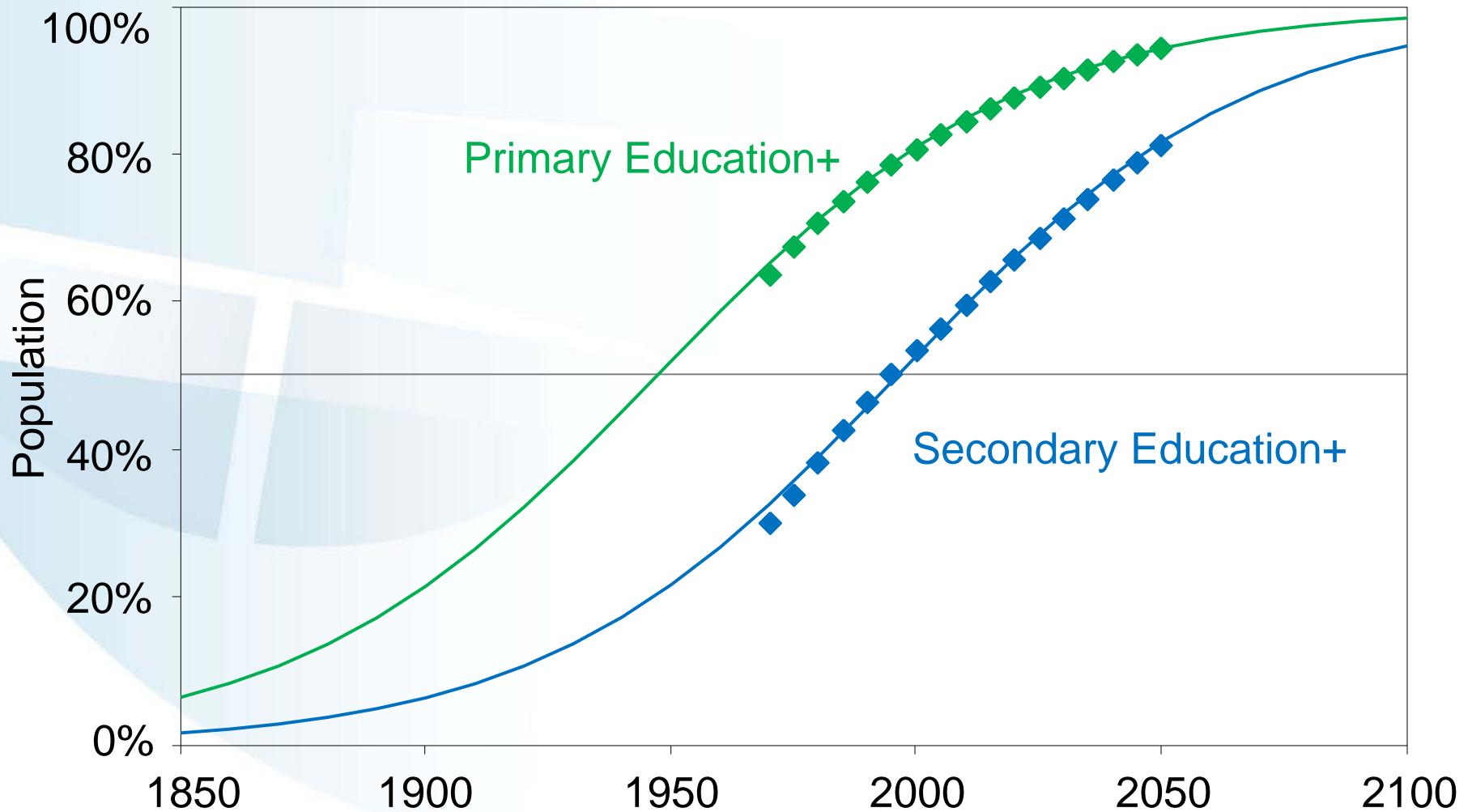
# Urbanization World



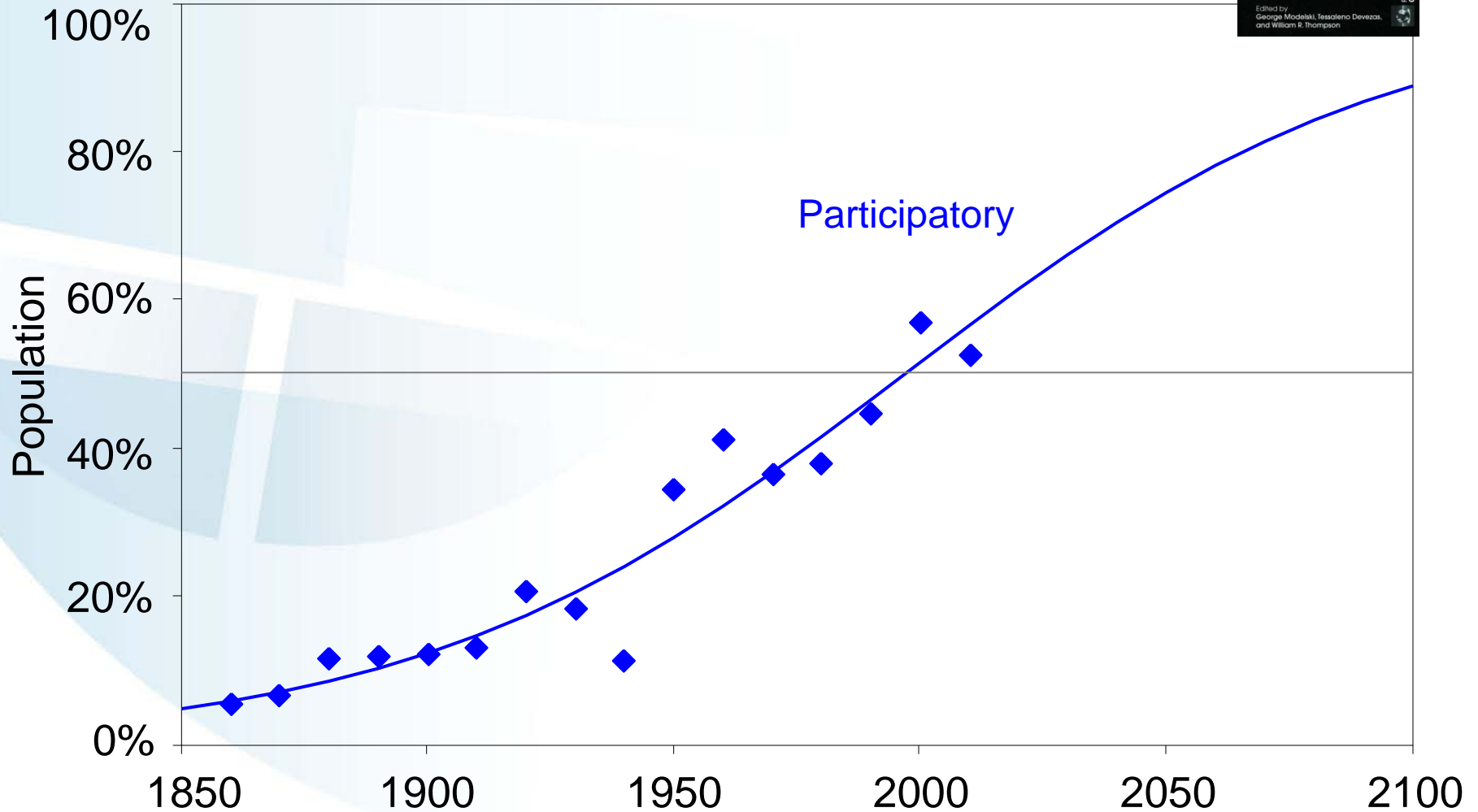
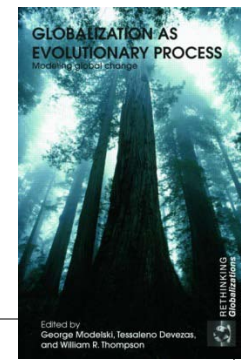
# Urbanization World, UK, BRICs



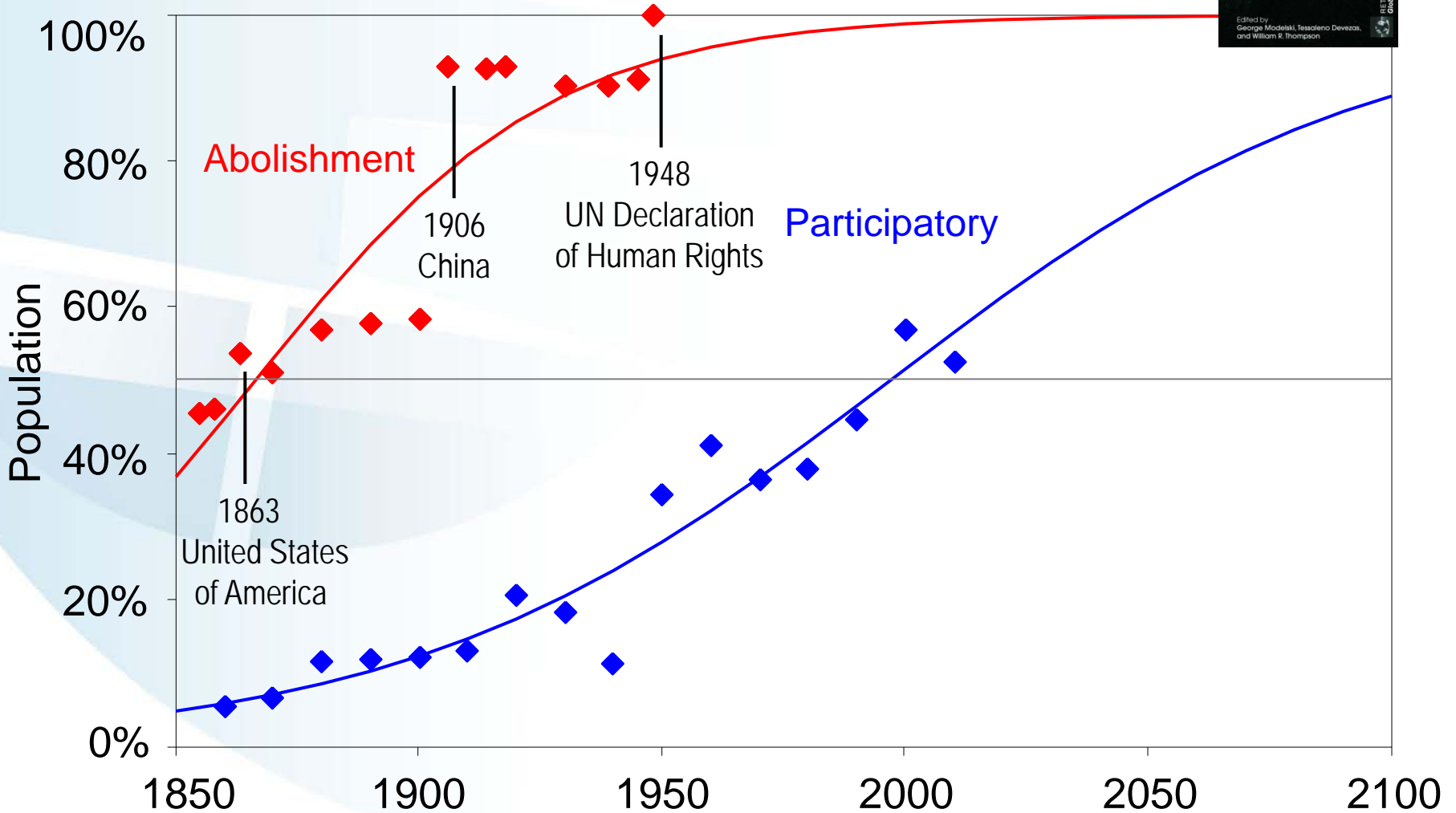
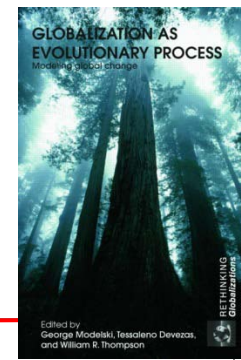
# Global Educational Attainment



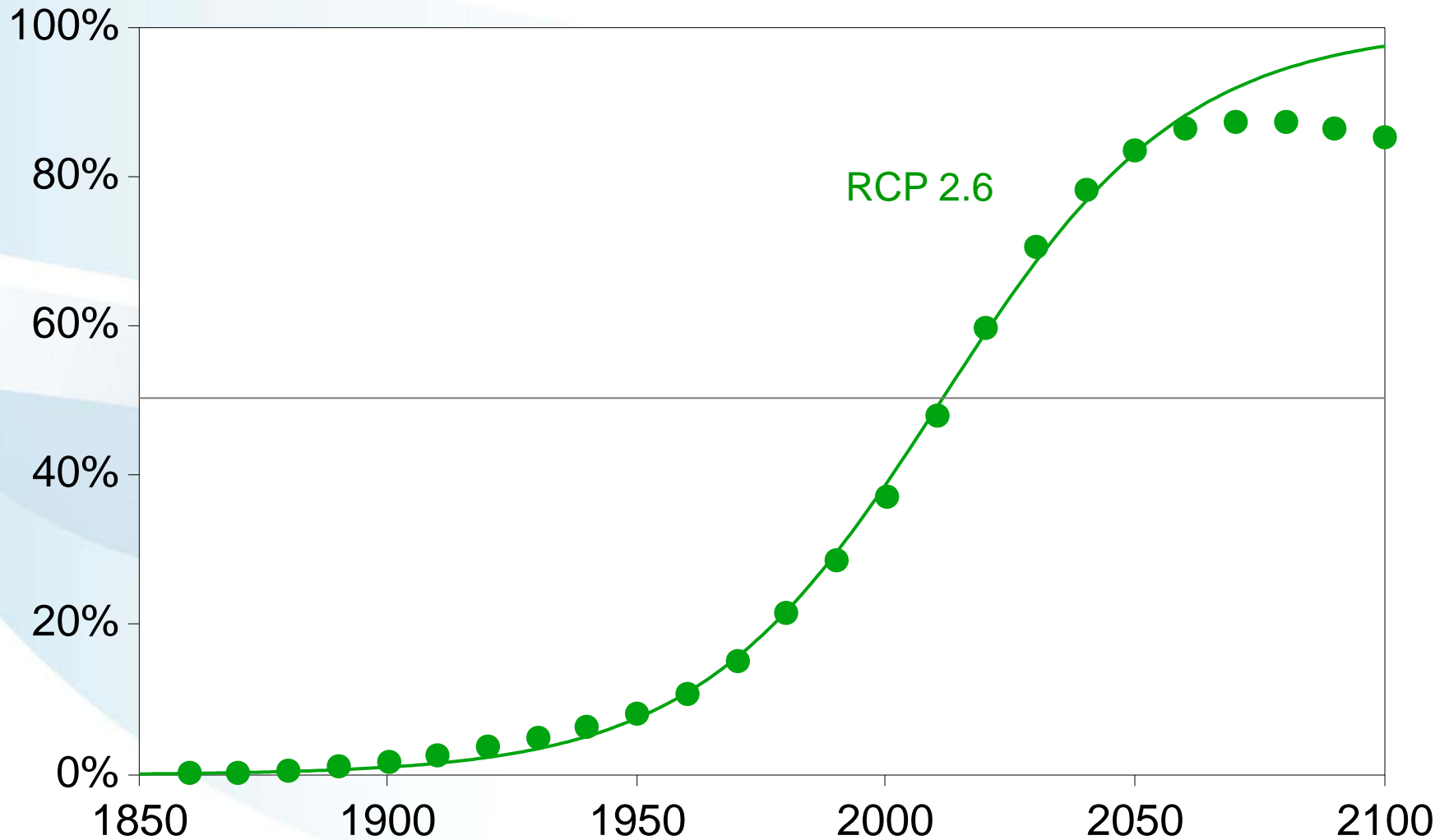
# Participatory Governance



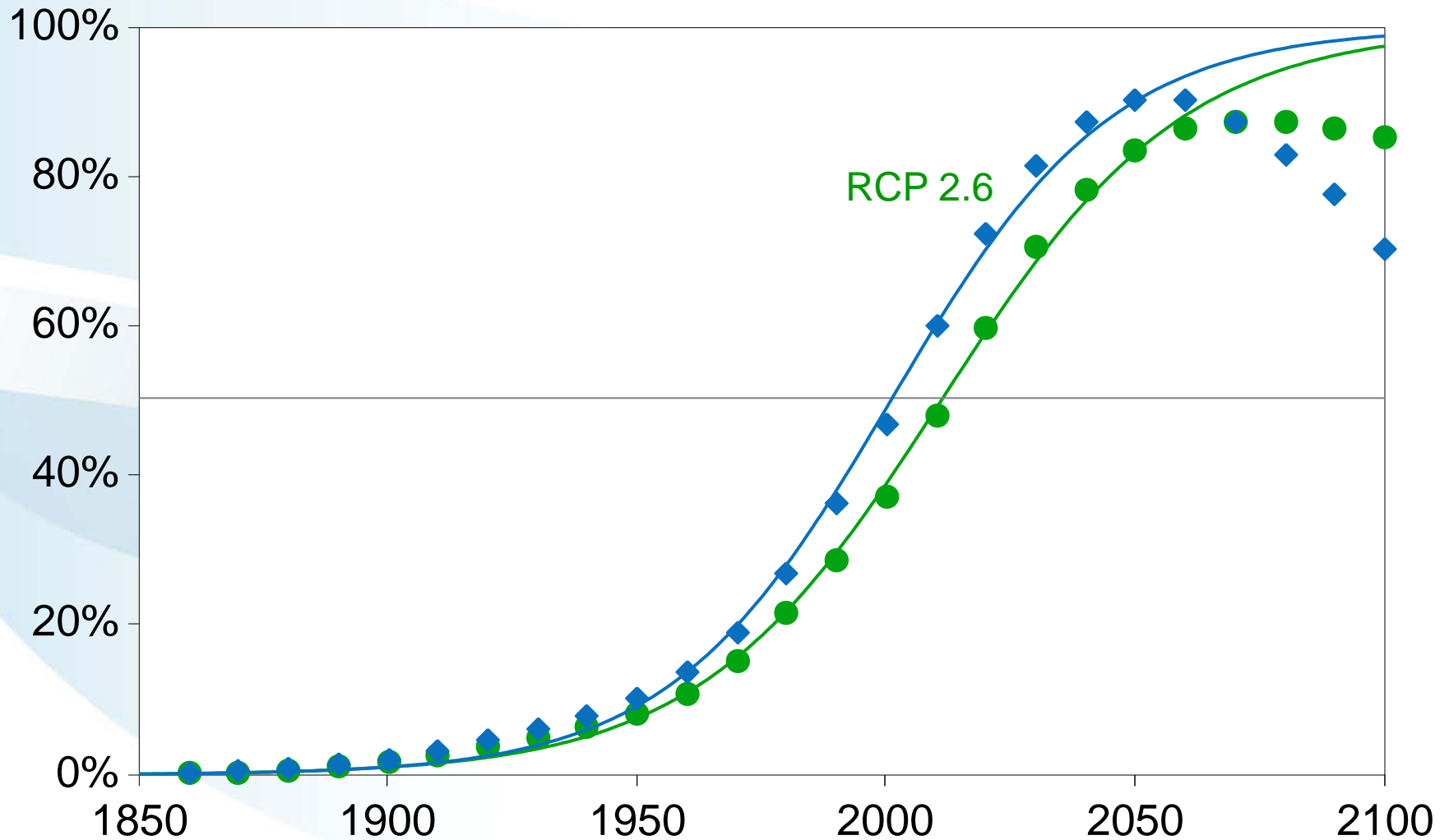
# Participatory Governance Slavery Abolishment



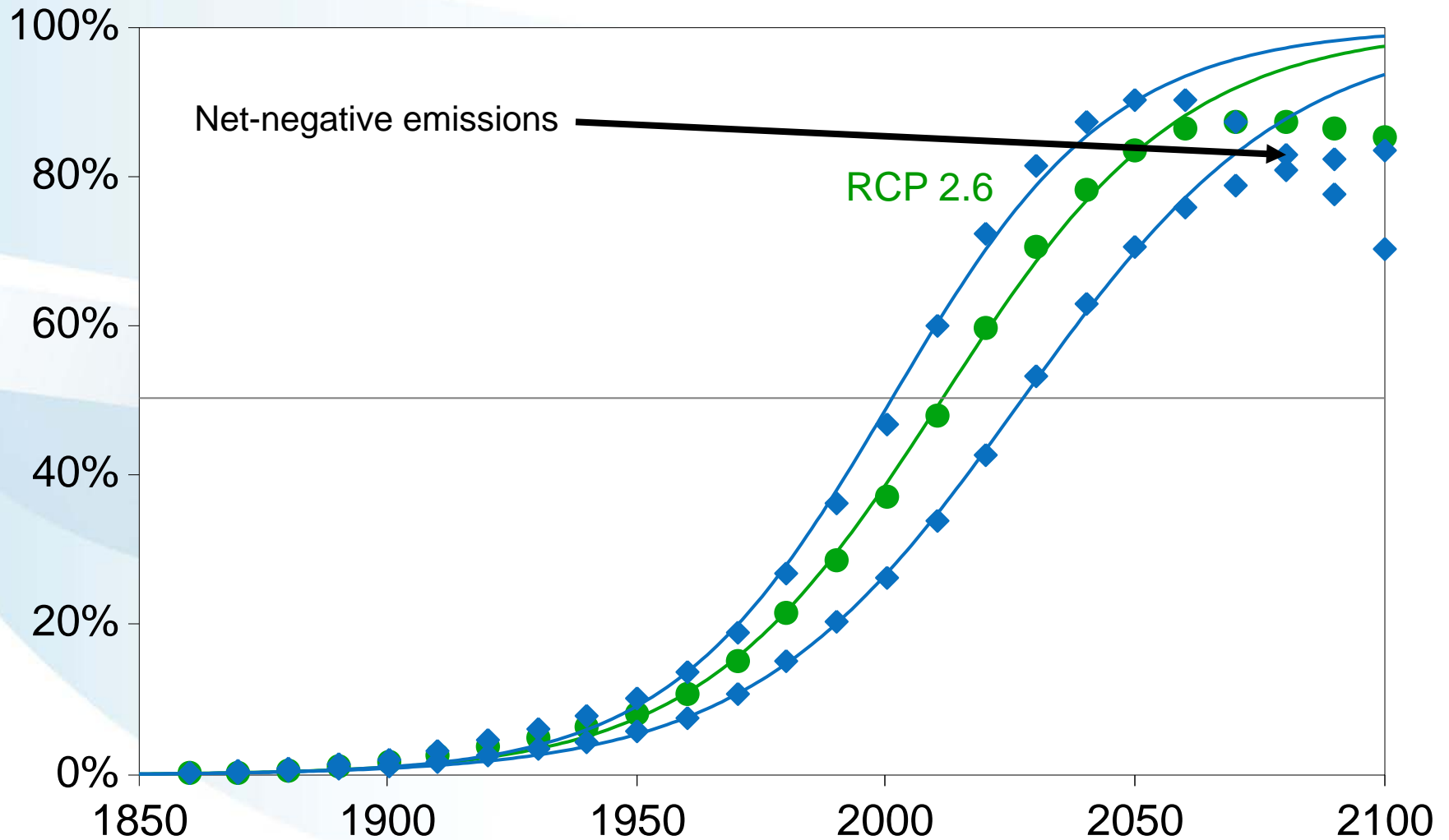
# Cumulative Carbon Emissions



# Cumulative Carbon Emissions



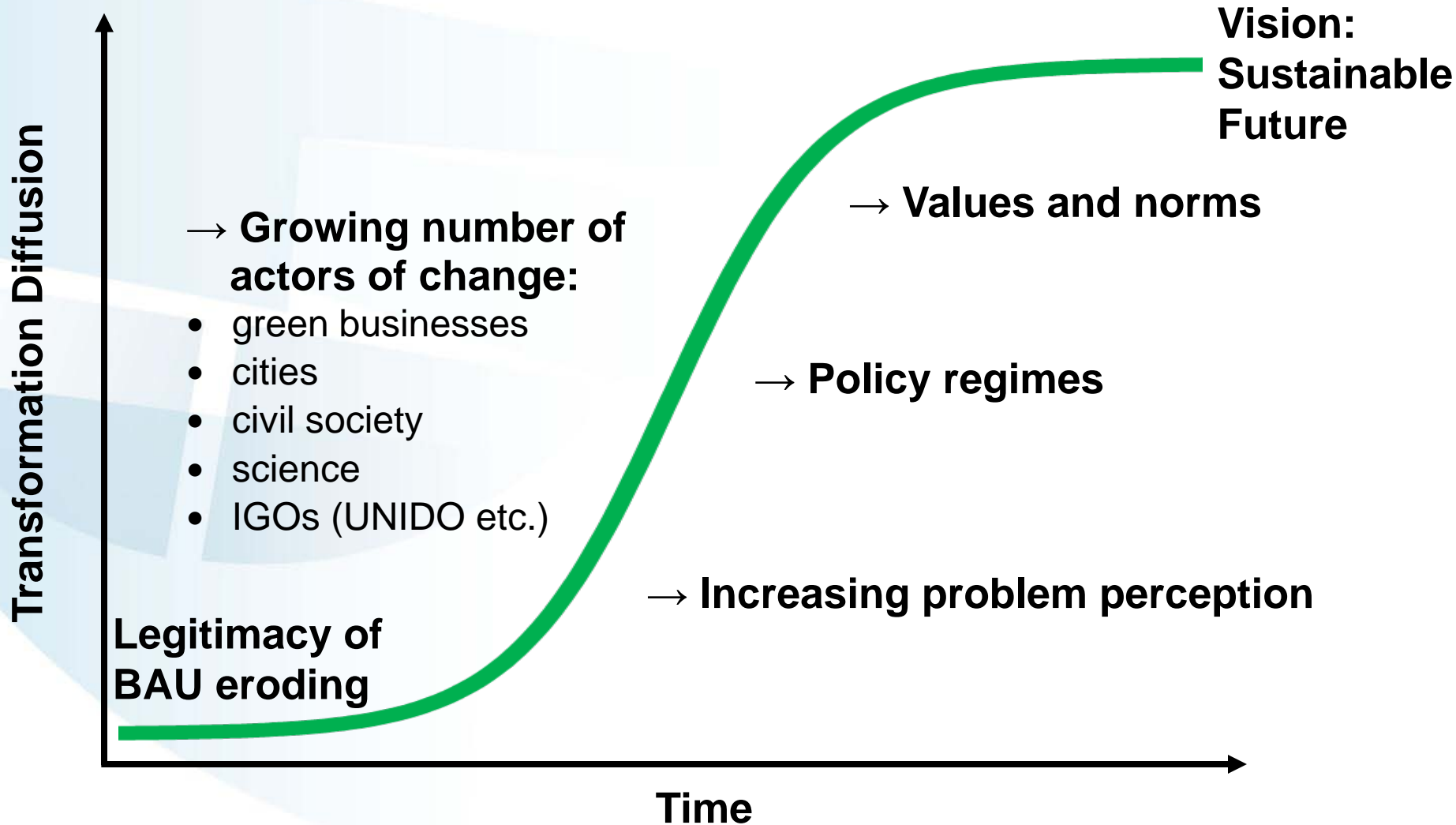
# Cumulative Carbon Emissions





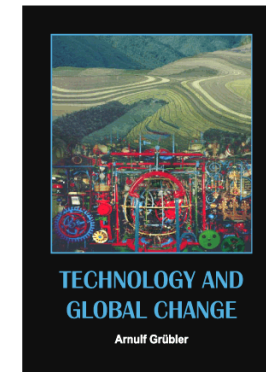
# Sustainability Transformation

“Doing More with Less” within Boundaries



# Transformation Drivers

## Learning from the Past



- **Normative goals, visions**

Abolition of slavery, participatory governance, EU

- **Crises, “gales of creative destruction”**

The Great Depression, financial crises, disasters

- **Technology, rapid innovation diffusion**

Substitution of carriages by cars, IT-revolution

- **Knowledge, research-driven society**

Precautionary principle - ozone layer, climate change



2012 INTERNATIONAL YEAR OF  
SUSTAINABLE ENERGY  
FOR ALL

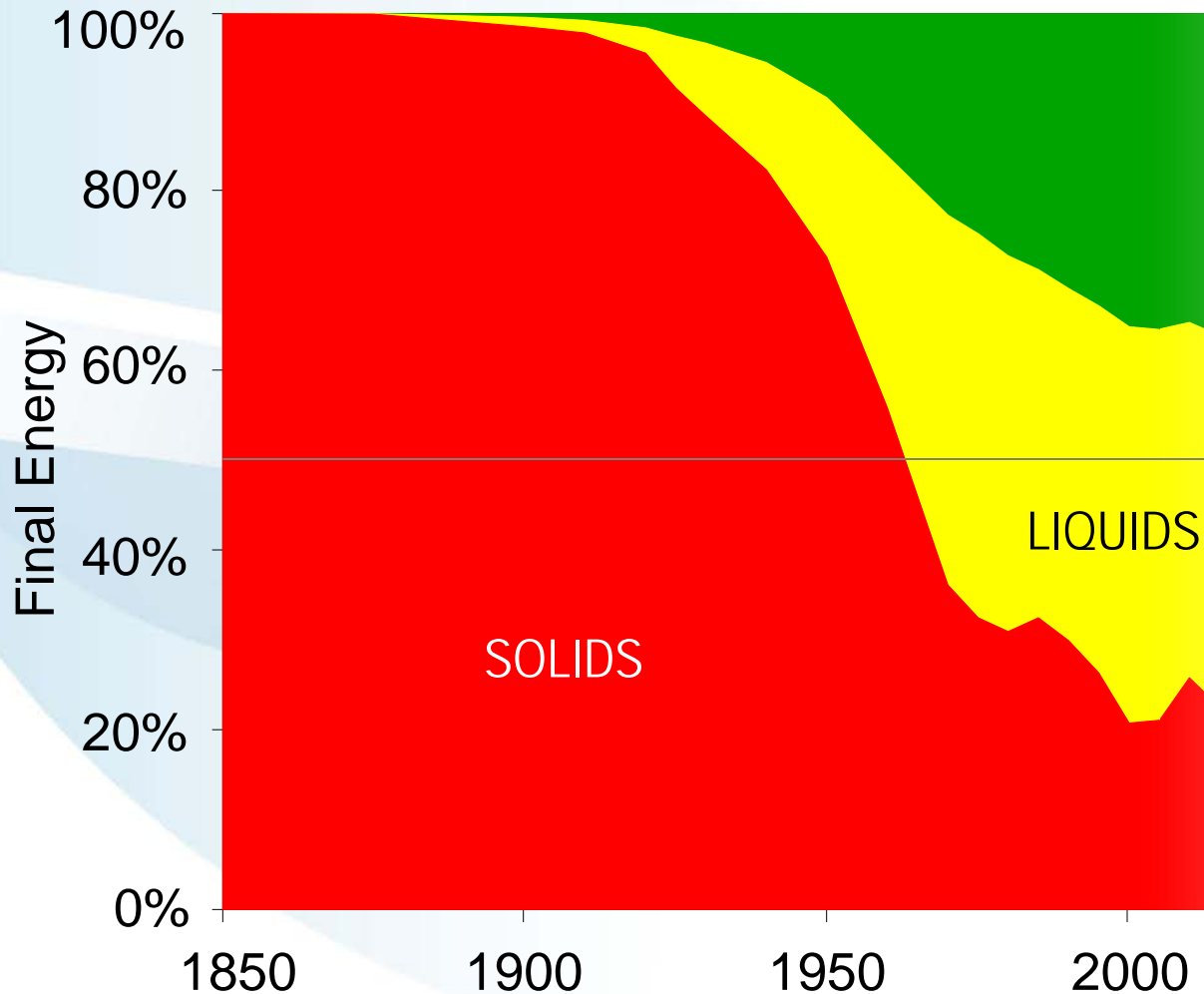
## **2030 Energy Goal**

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

**Aspirational & Ambitious but Achievable**

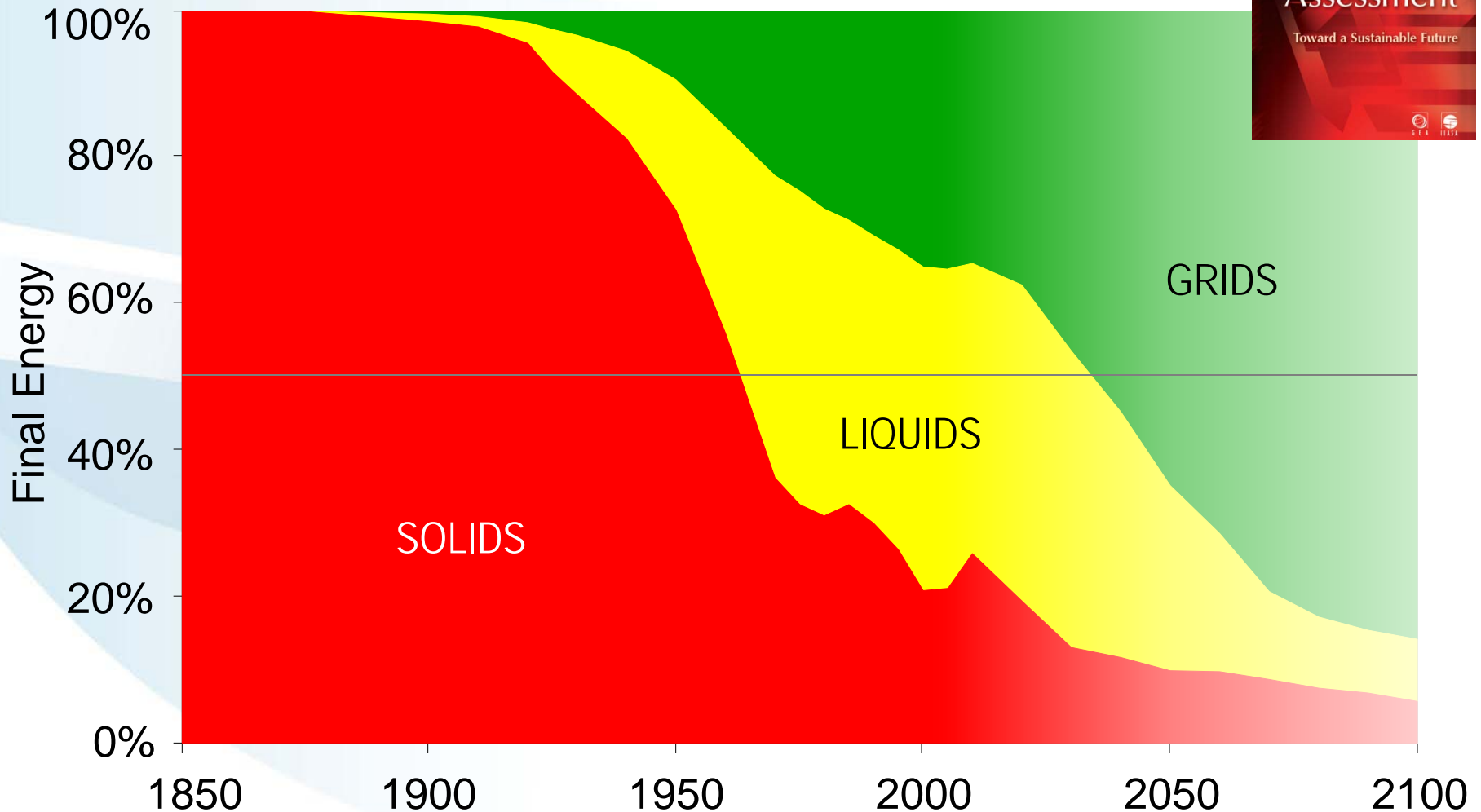
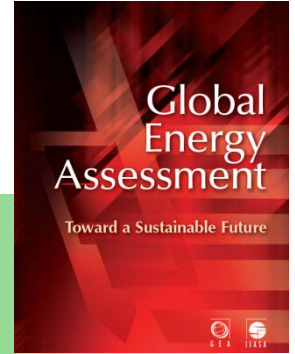
# Transformation of Energy Systems

## One of 41 GEA Pathways

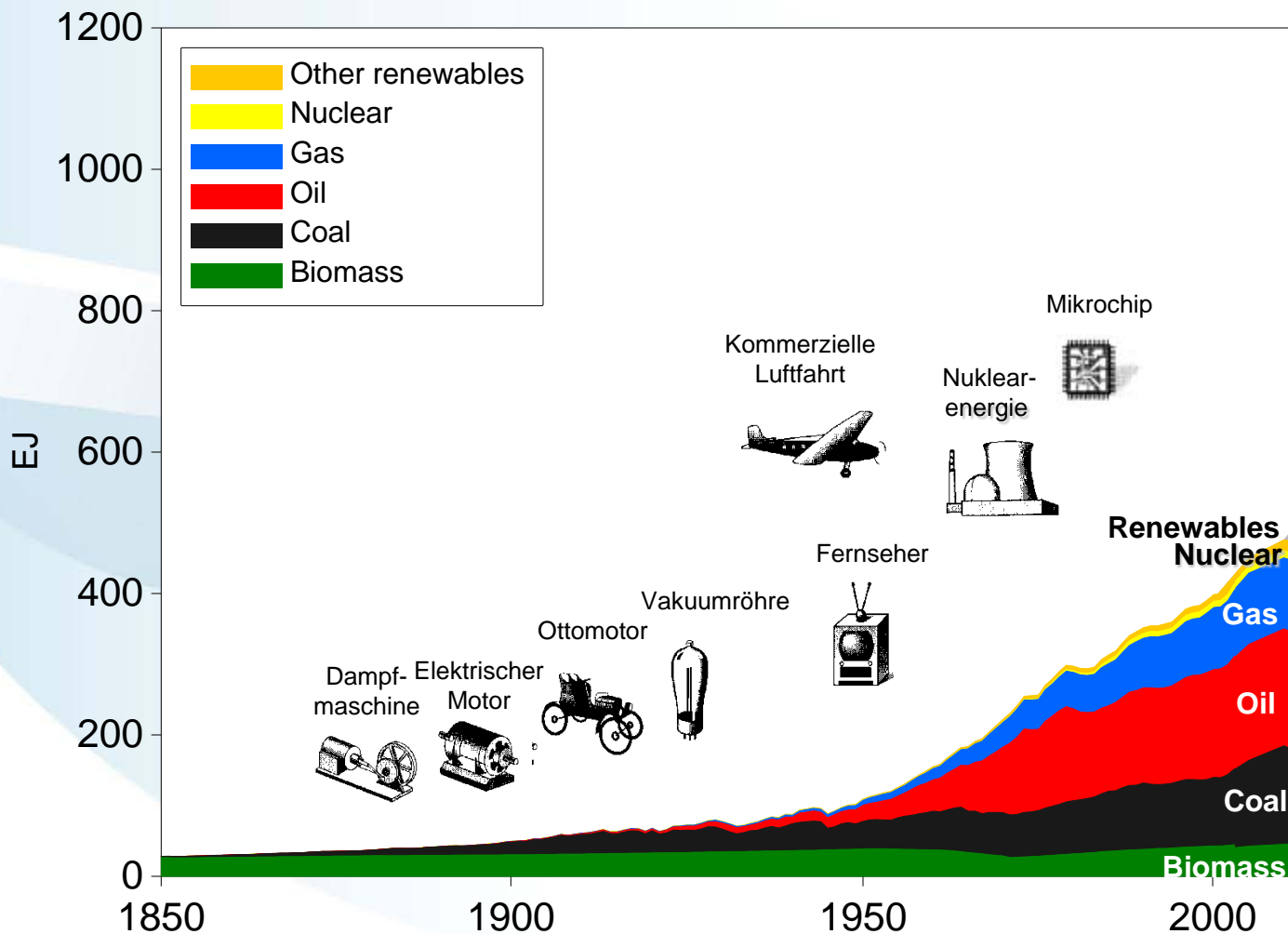
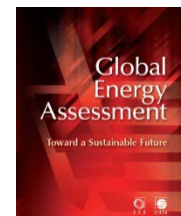


# Transformation of Energy Systems

## One of 41 GEA Pathways

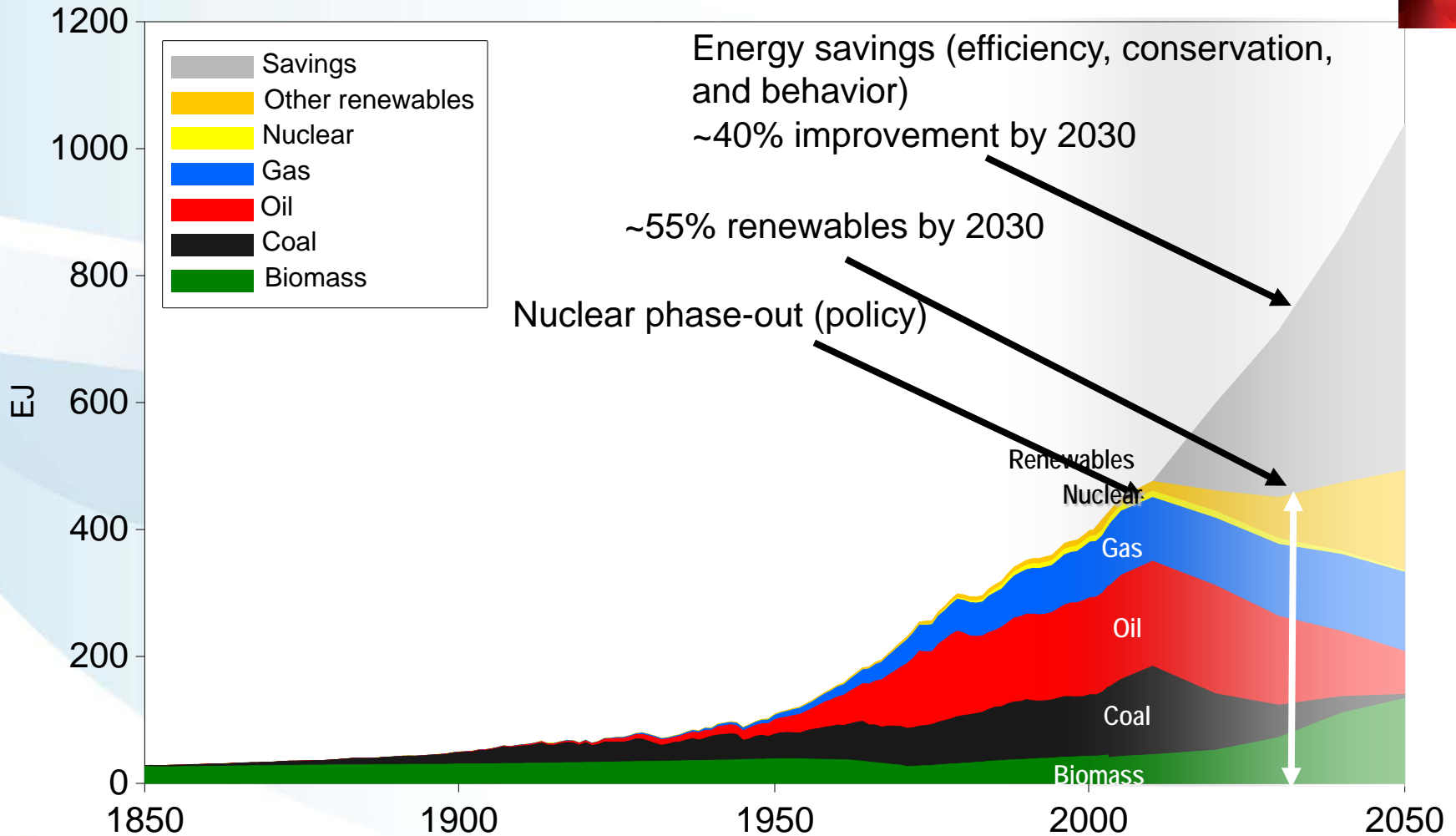
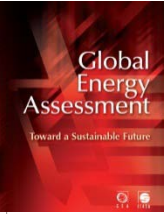


# Global Primary Energy Historical Evolution



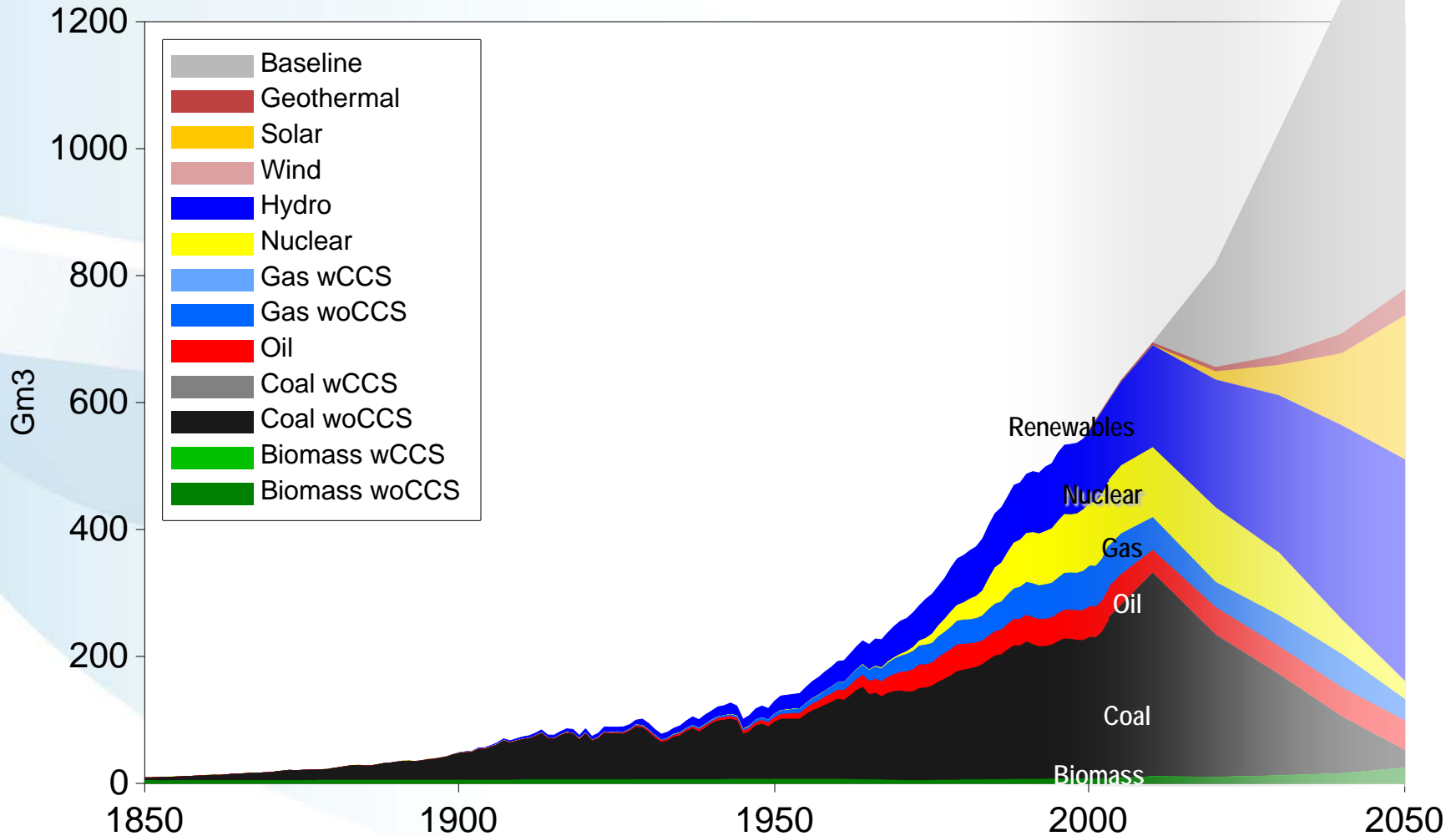
# Global Primary Energy

## no CCS, no Nuclear



# Global Water Withdrawals

## no CCS, no Nuclear



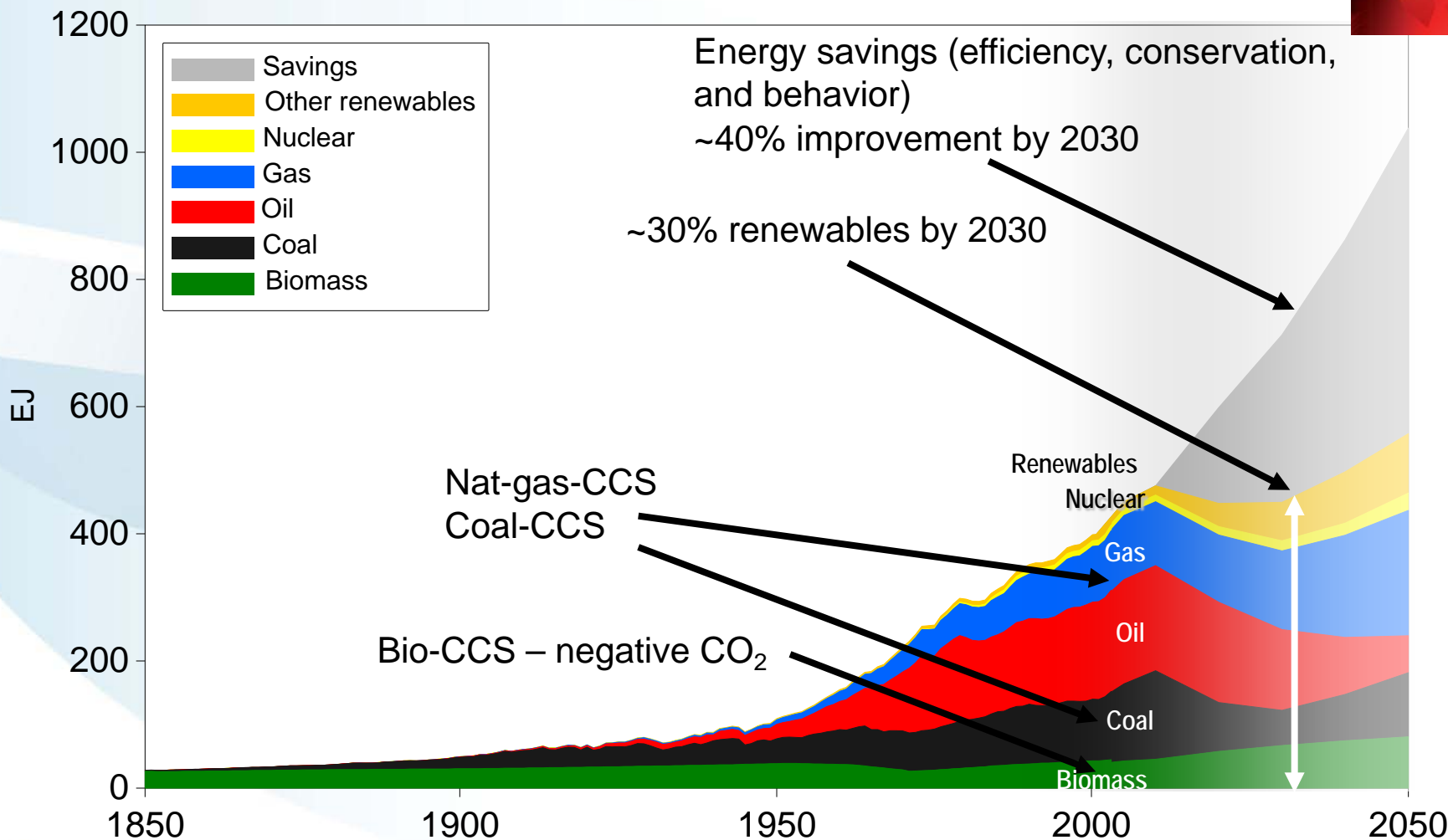
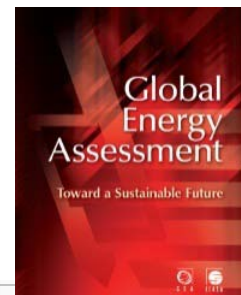


## Water for Energy



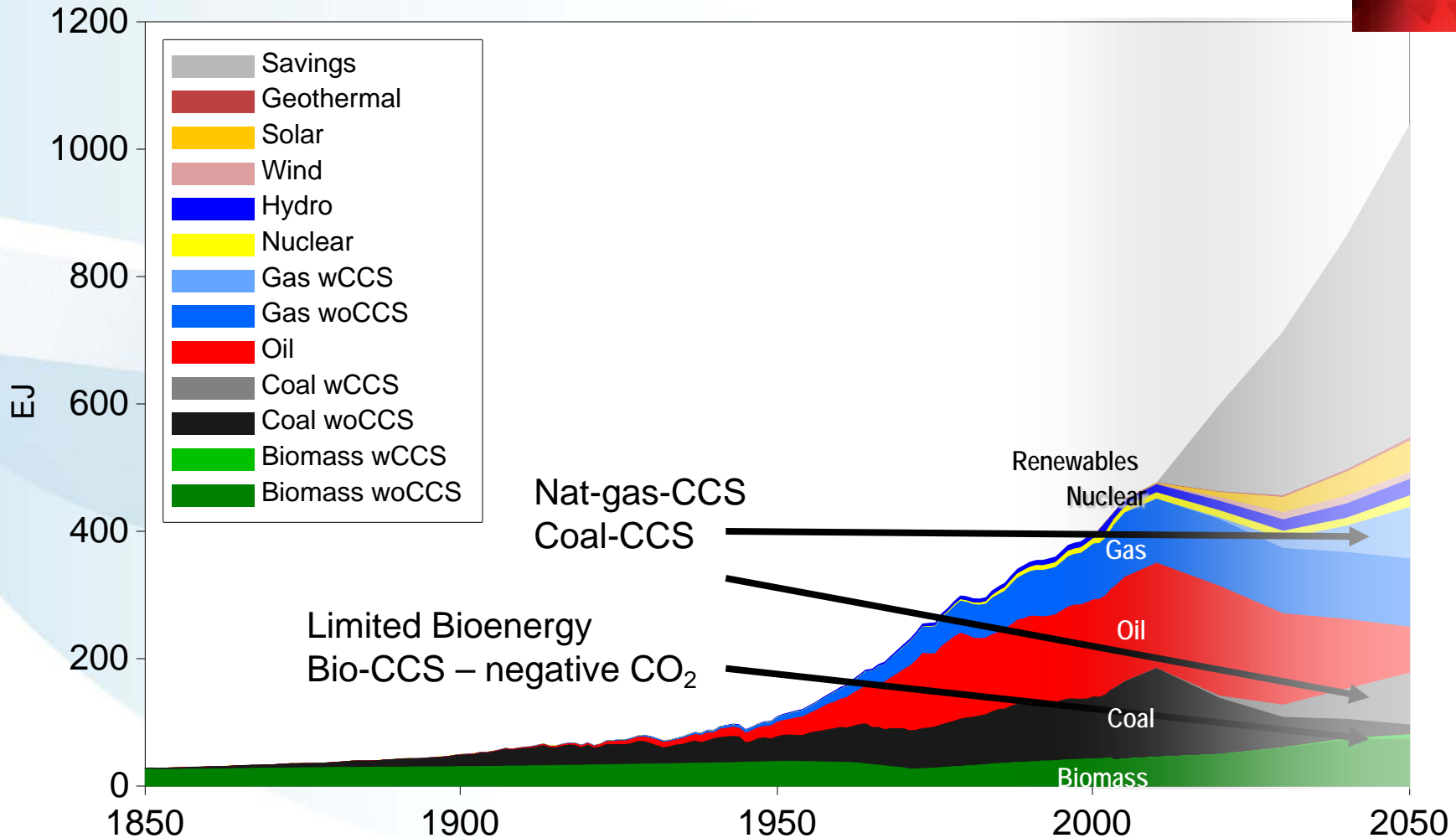
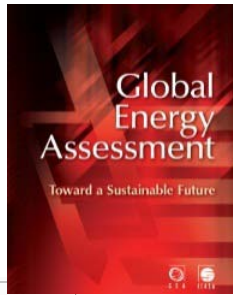
# Global Primary Energy

## A Transformational Pathway



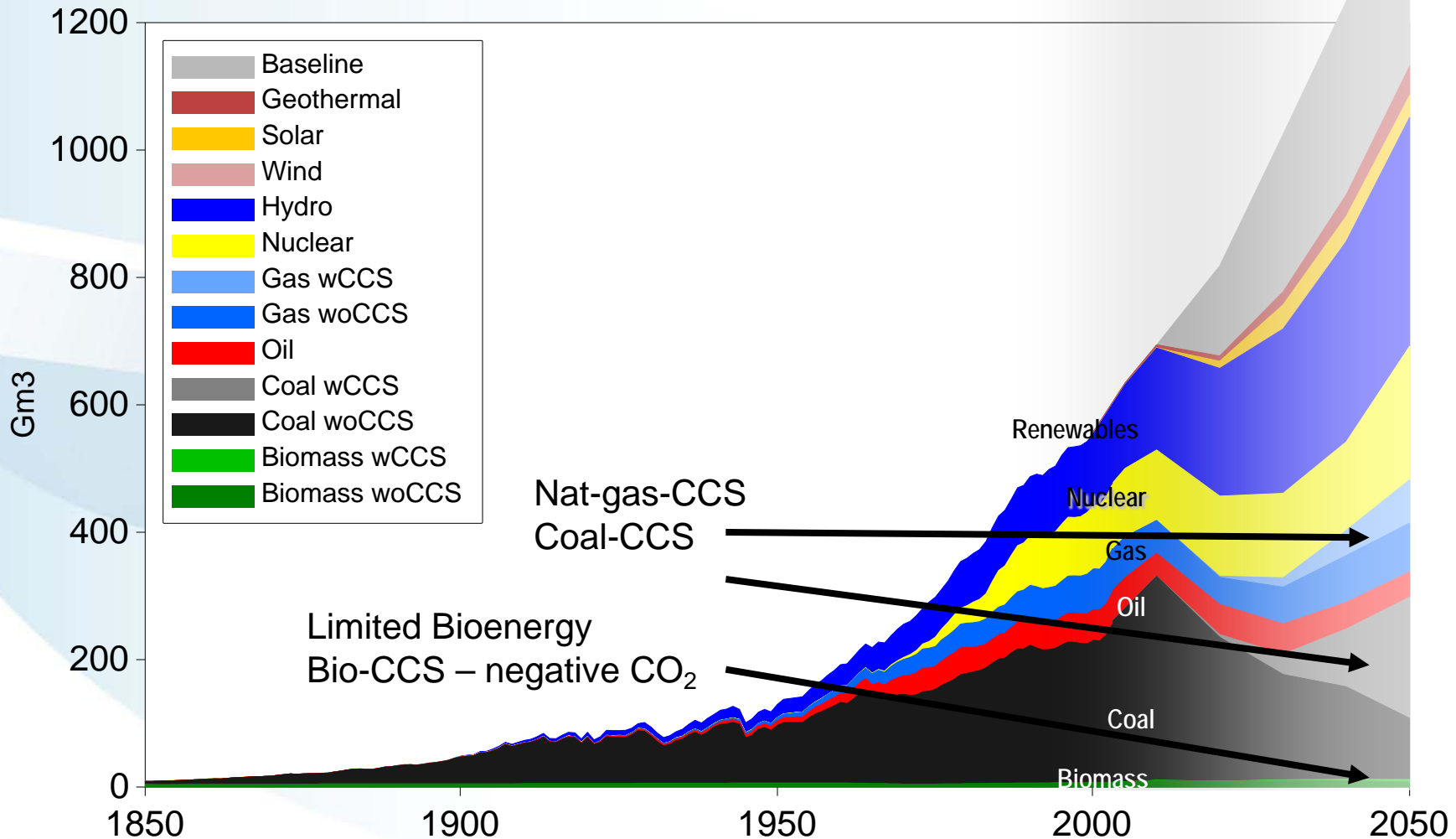
# Global Primary Energy

## A Transformational Pathway



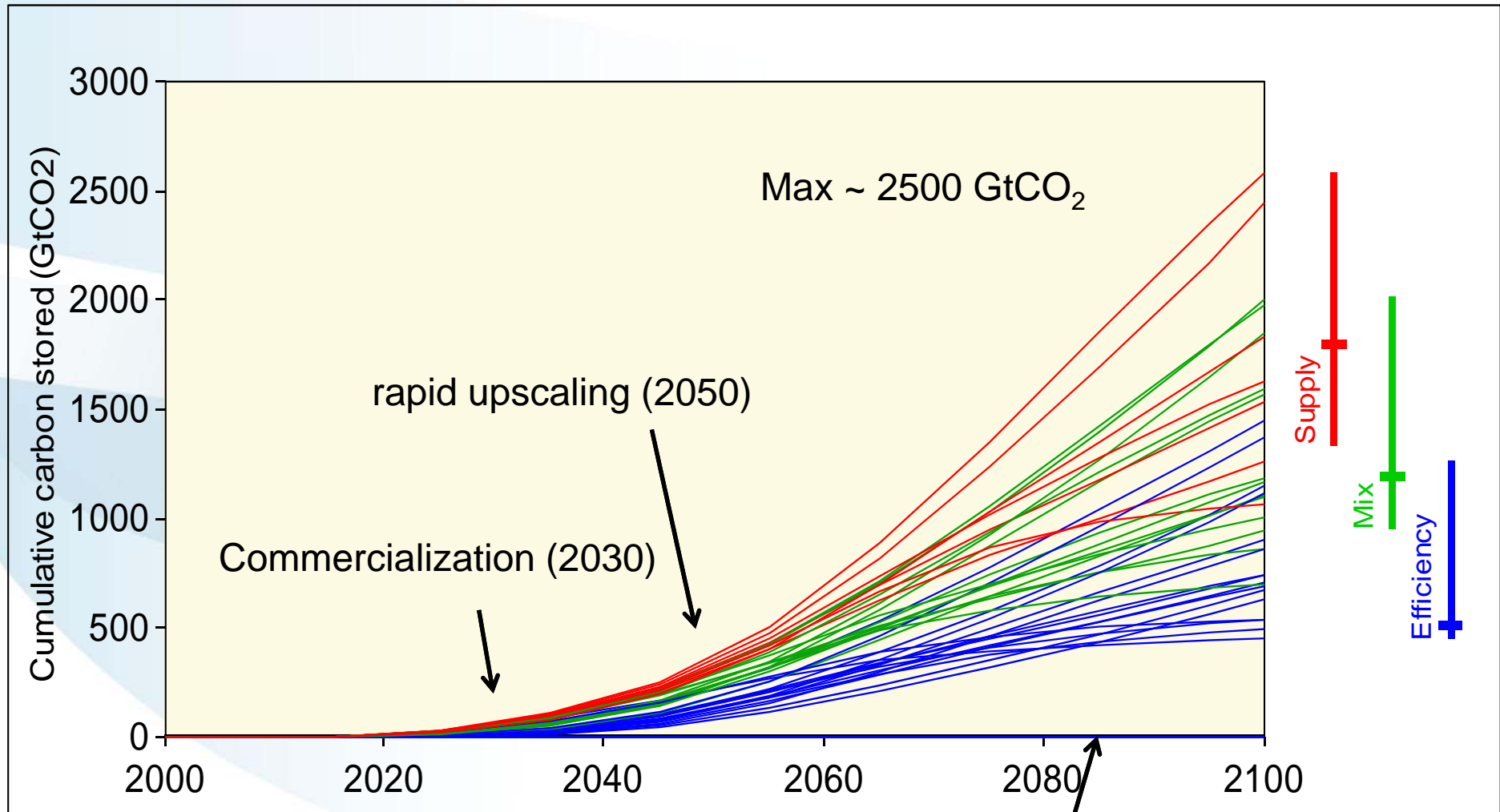
# Global Water Withdrawals

## A Transformational Pathway



# Carbon Capture and Storage

## GEA scenarios: World (GtCO<sub>2</sub>)

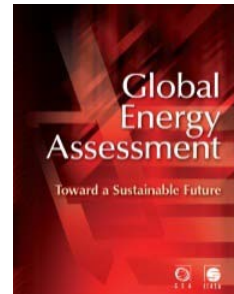
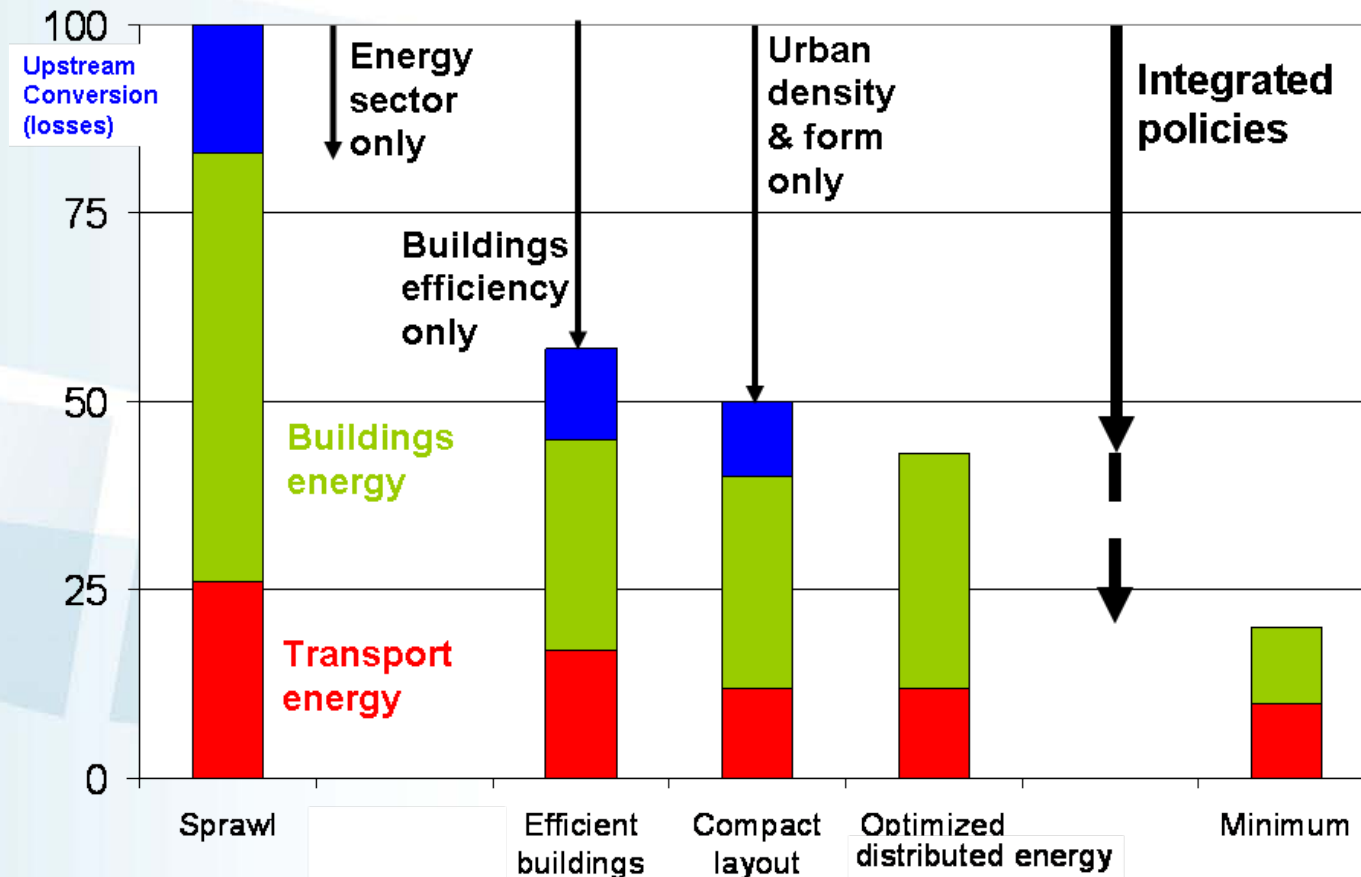


Transformation possible without CCS  
(however, needs strong efficiency focus!)

Source: Riahi, GEA  
2015 #29

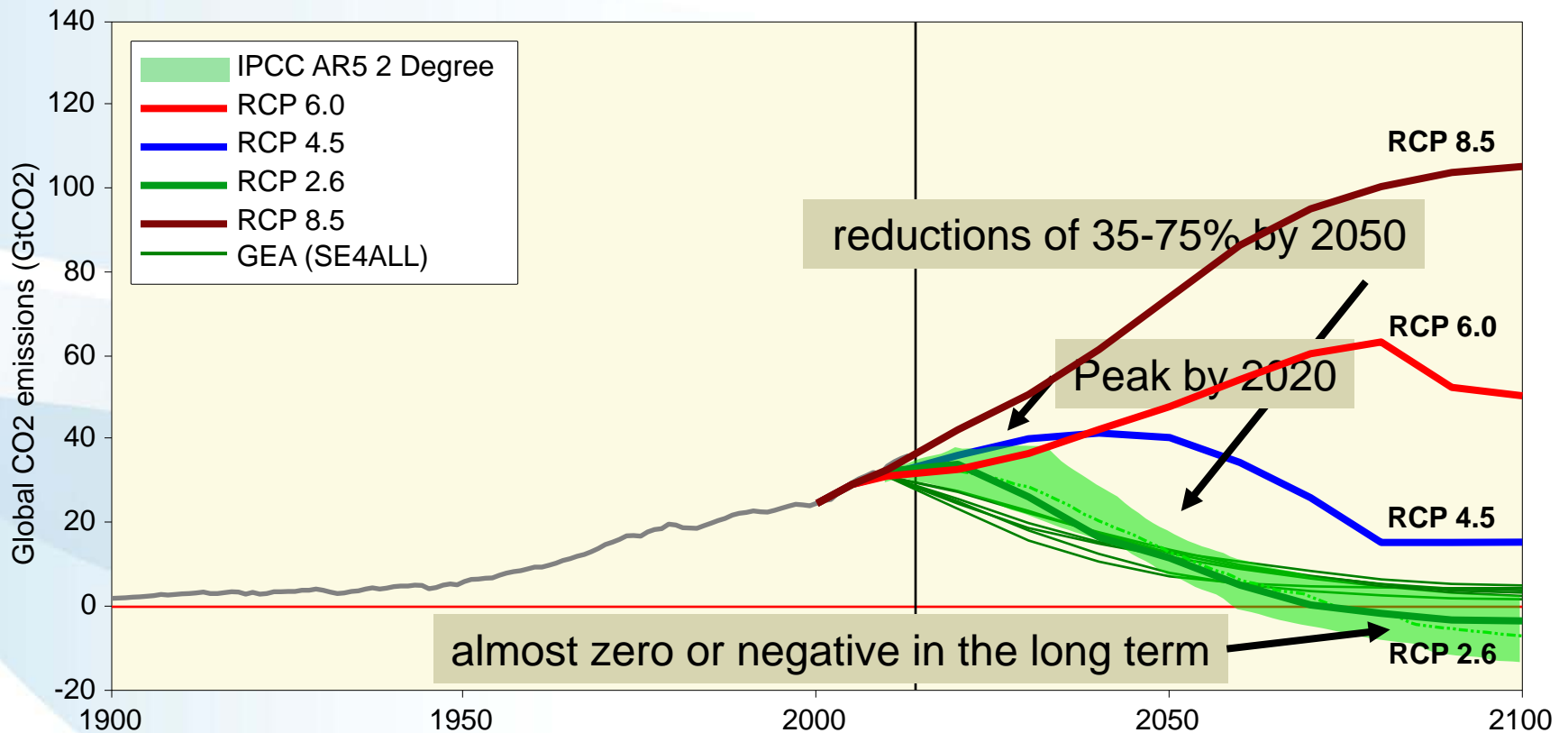


# Policy Integration at the Urban Scale

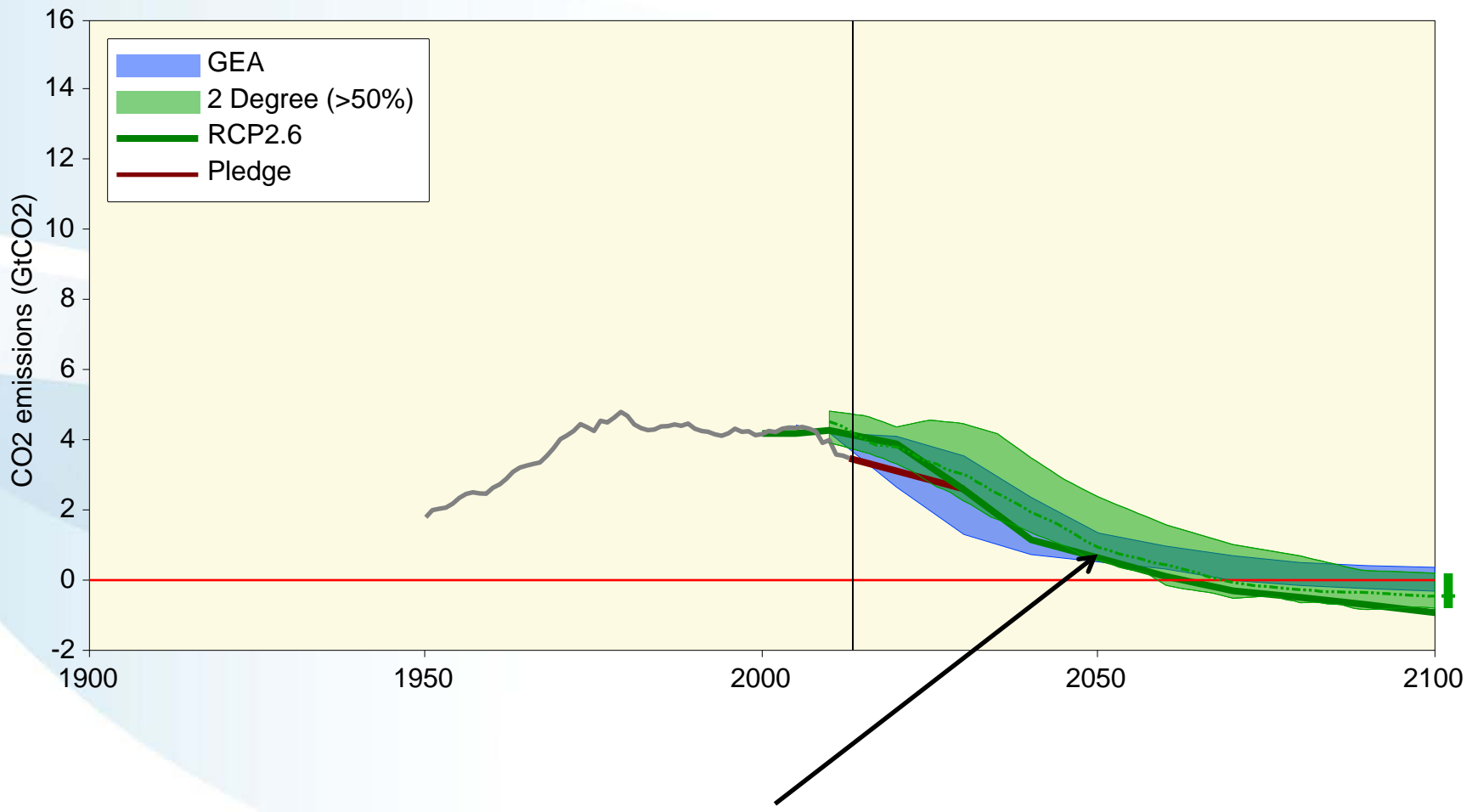


Simulated energy use, urban settlement of 20,000, using the SimCity Model

# Global CO<sub>2</sub> Emissions

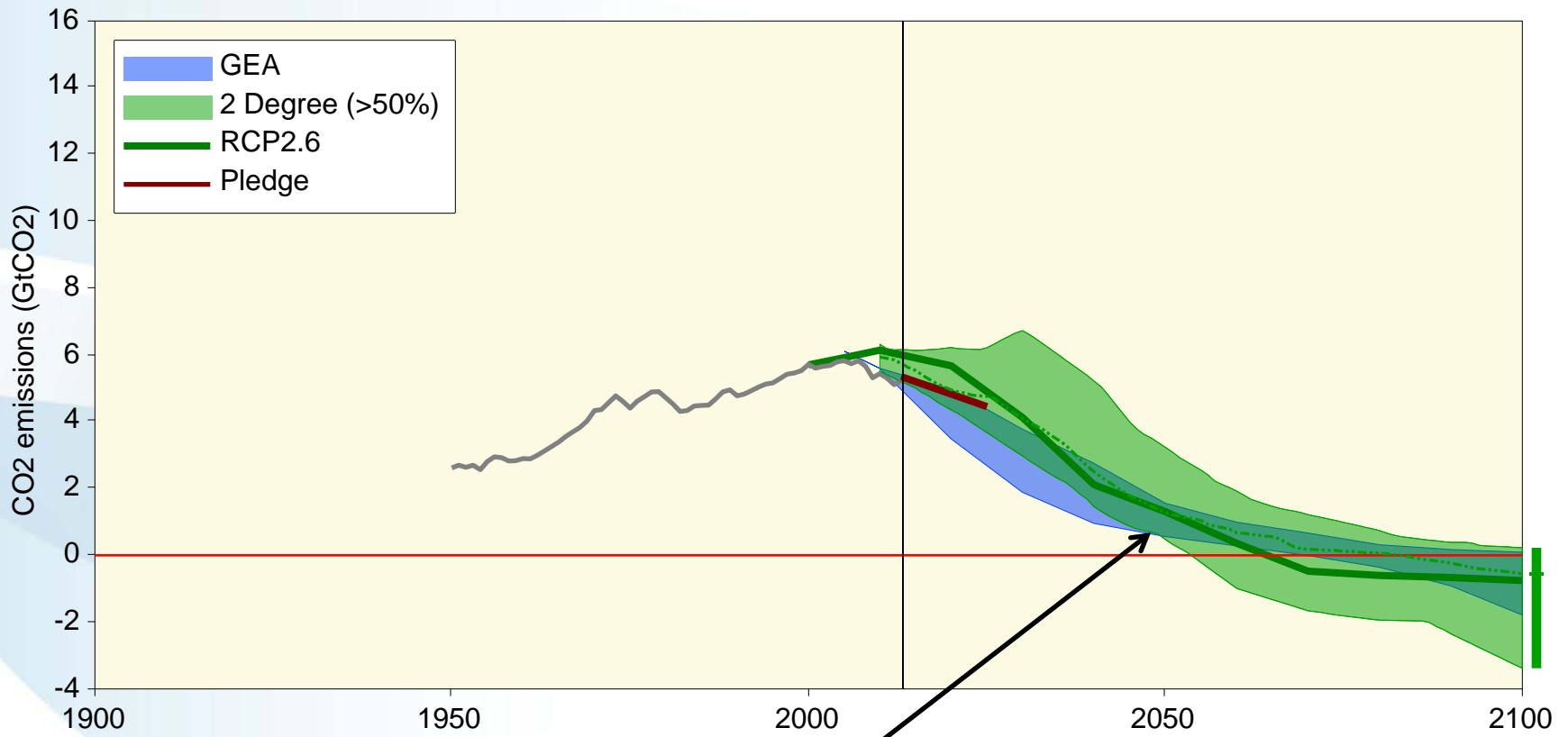


# EU CO<sub>2</sub> Emissions

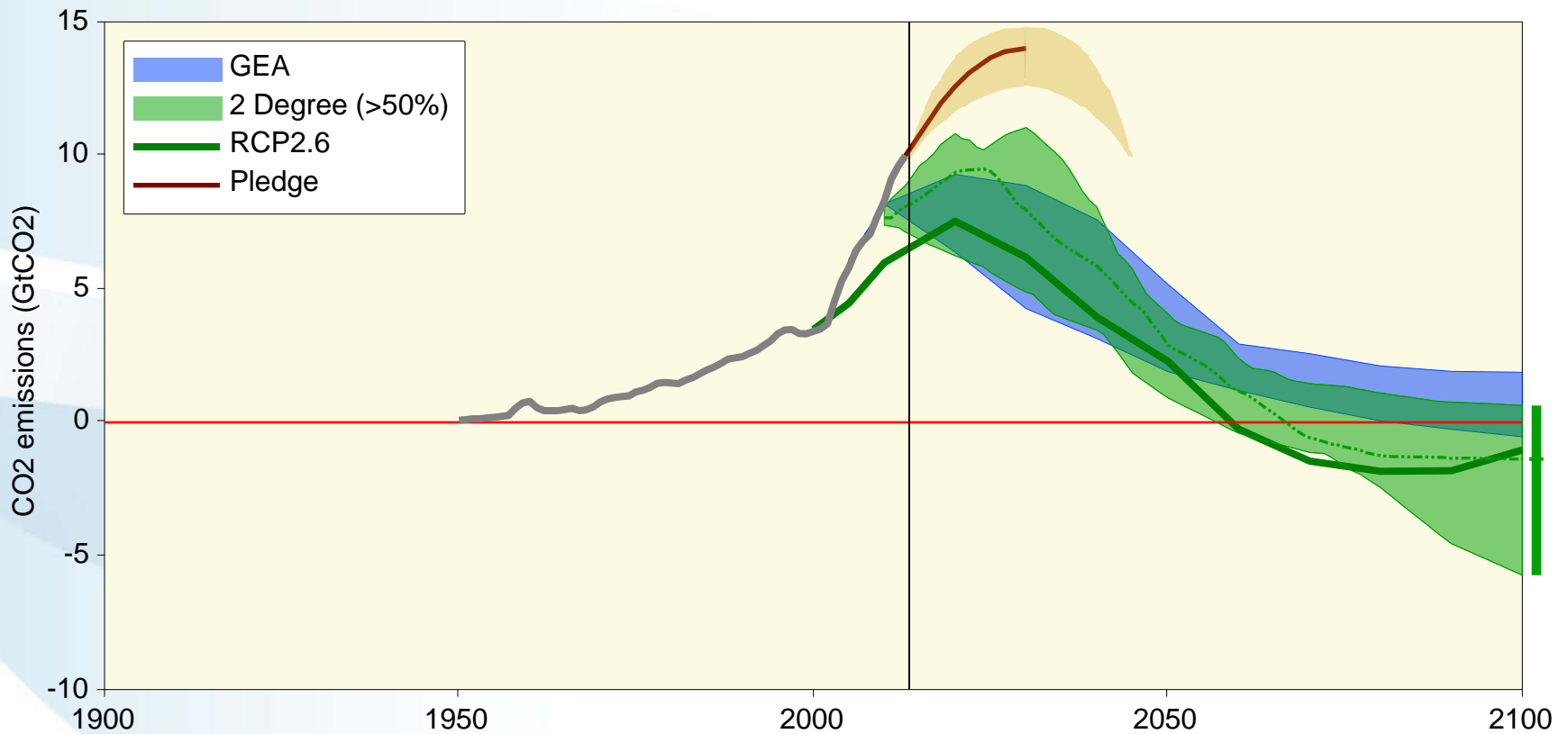




# USA CO<sub>2</sub> Emissions



# China CO<sub>2</sub> Emissions



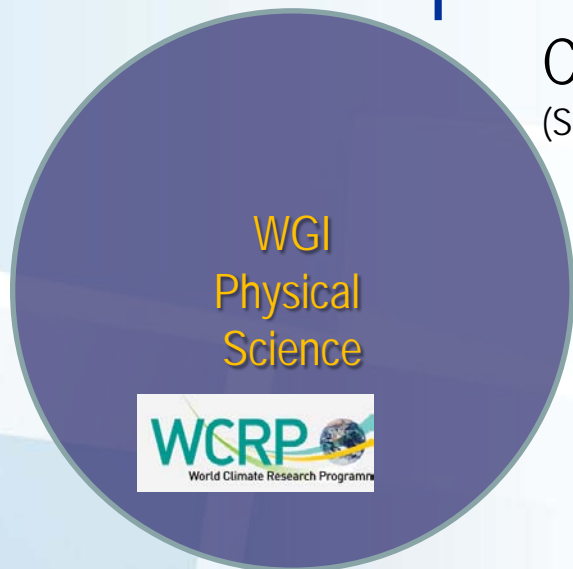
# Co-benefits of GHG Mitigation

## Policy Costs of Achieving Different Objectives

Global Energy Assessment Scenario Ensemble (n=624)



# Community science organizations critical for a comprehensive assessment

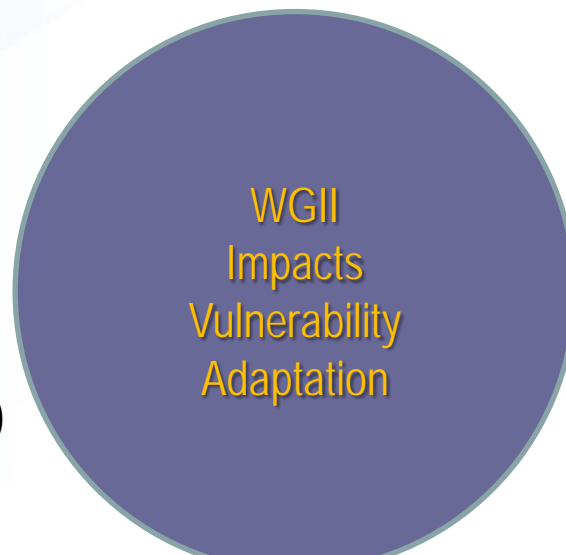


C4MIP  
(SRES +)

Well organized, long tradition

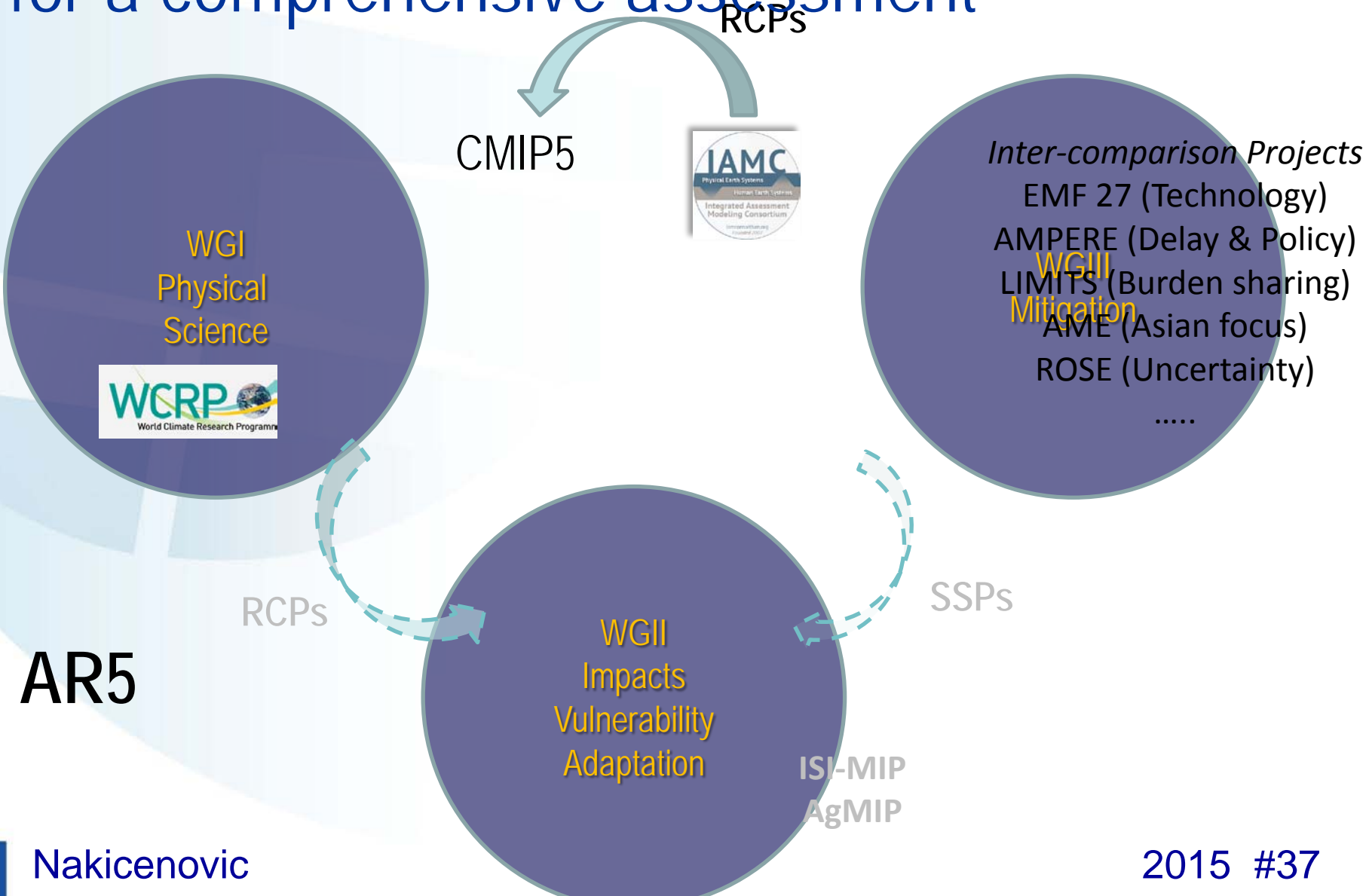
## AR4

SRES and non-SRES studies (highly diverse)



Some community efforts  
More loosely organized  
EMF22 (non-Co2)  
SRES and non-SRES

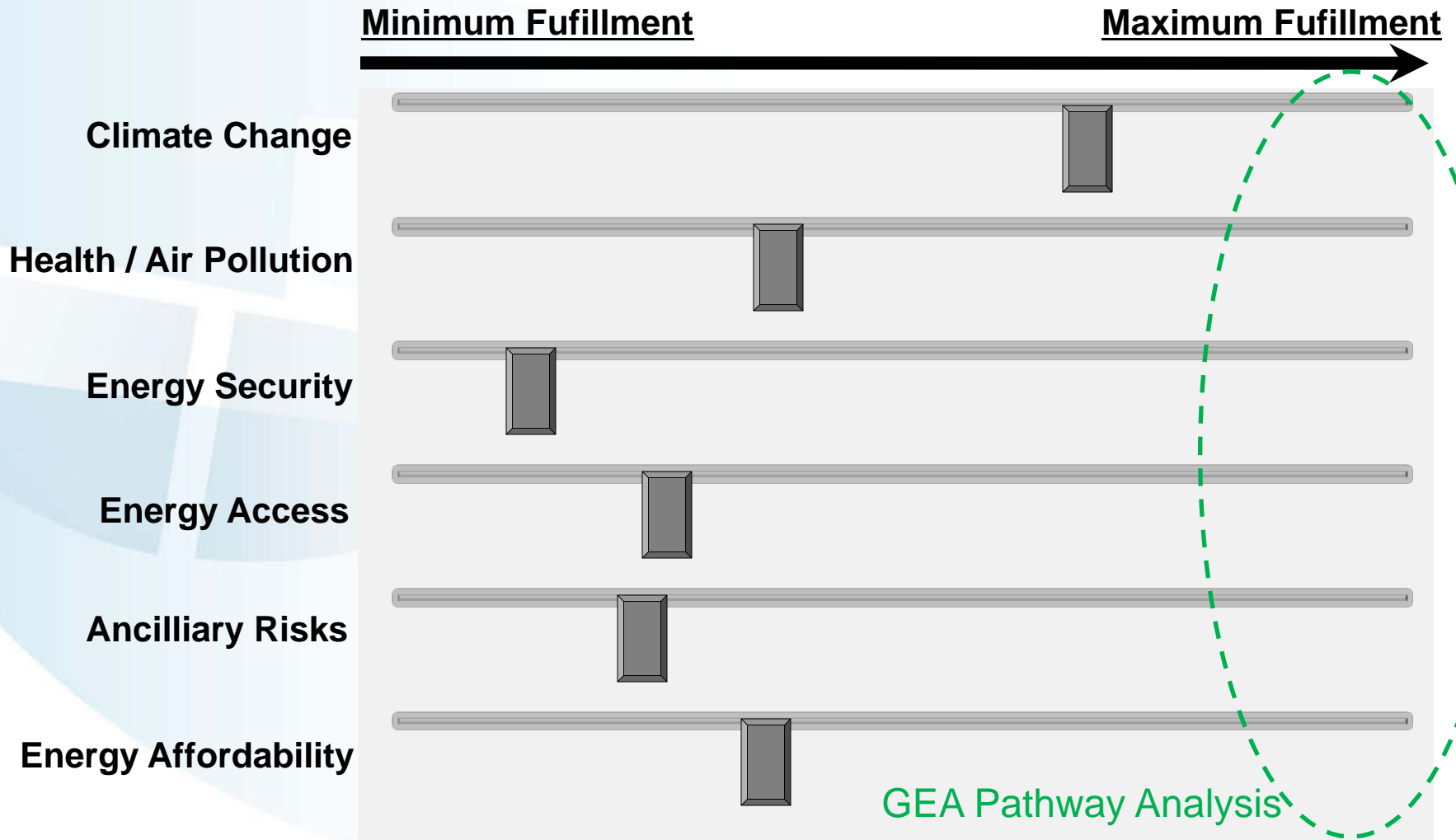
# Community science organizations critical for a comprehensive assessment



# Science for Transformation

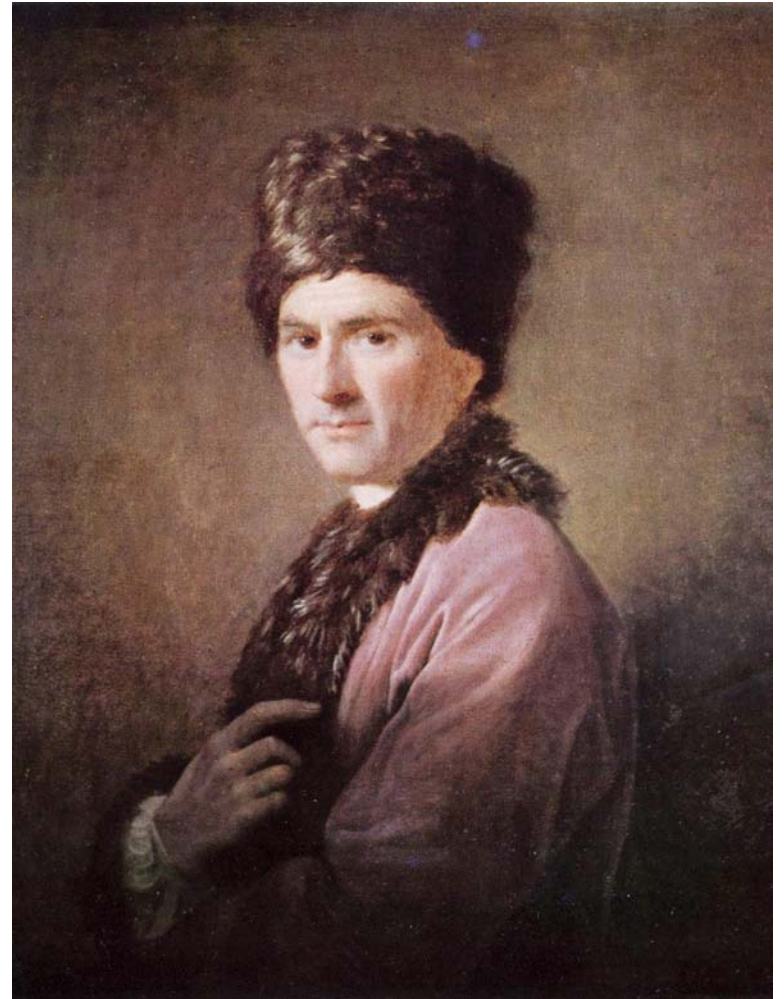
- **Better integration across science communities**  
“Climate or development first” approach too narrow
- **More integrated & holistic assessment of climate change policy in the context of other priorities:**
  - Multi-objective & multi-policy framing to better understand climate policy tradeoffs & benefits
  - “Nexus” approaches to reach multiple objectives simultaneously: energy, water, food & urbanization
- **Challenges are huge:**
  - Different constraints and priorities across scales
  - Normative goals involved in policy prioritization

# Policy Tools for Decision Making



# Jean-Jacques Rousseau

Social contract:  
"Man is born free,  
and everywhere  
he is in chains"







International Institute for  
Applied Systems Analysis  
www.iiasa.ac.at

# THANK YOU

science for global insight



**naki@iiasa.ac.at**



IIASA, International Institute for Applied Systems Analysis