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science for global insight

Challenges for sustainable energy and interactions with other sustainability goals

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SUSTAINABLE DEVELOPMENT GOALS


SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 ECONOMIC GROWTH
9
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Energy and Climate Change

Paris Agreement

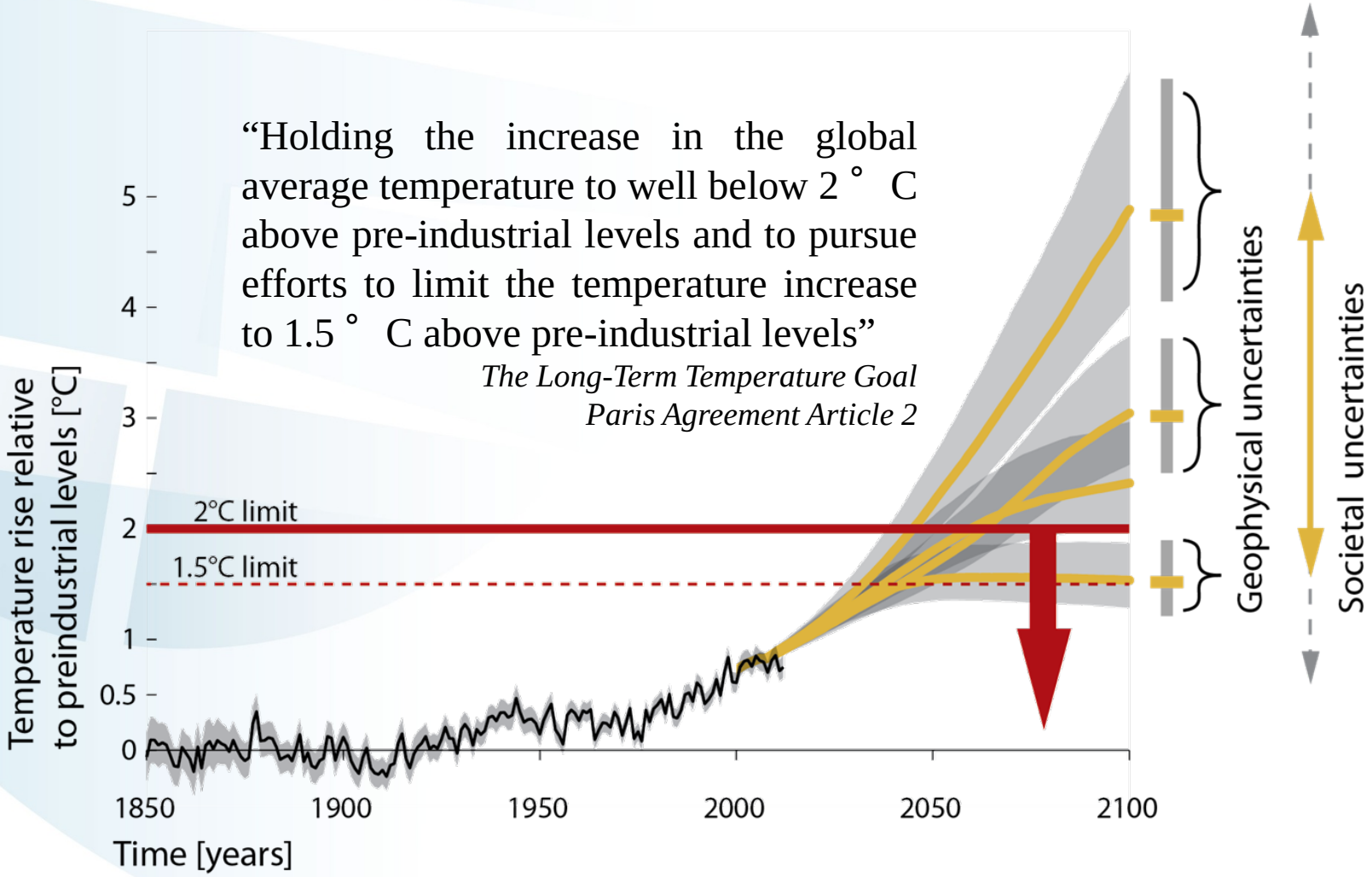


Image: Joeri Rogelj; History: HadCRUT4

Paris climate ambition

"Holding the increase in the global average temperature to well below 2° C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5 ° C above pre-industrial levels"

The Long-Term Temperature Goal, Paris Agreement Article 2

"In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach ***global peaking*** *of greenhouse gas emissions* ***as soon as possible*** *[…], and to undertake rapid reductions thereafter in accordance with best available science, so as to* ***achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century****"*

Paris Agreement Article 4

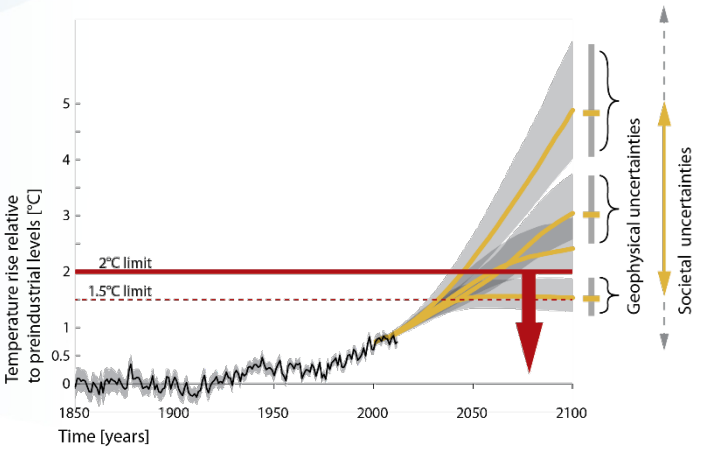


Image: Joeri Rogelj; History: HadCRUT4

Emissions implications

How much remains for 1.5°C and 2°C?

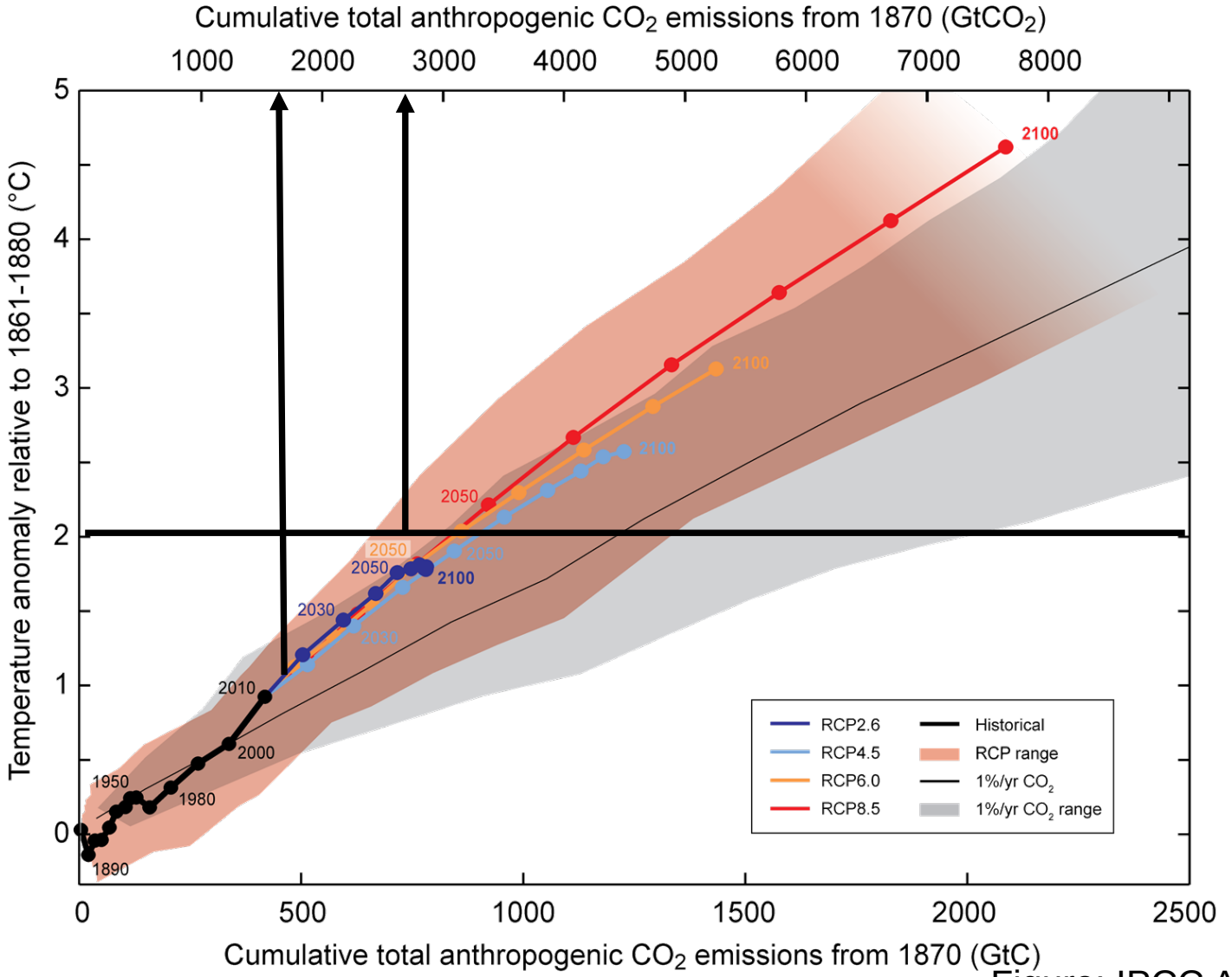
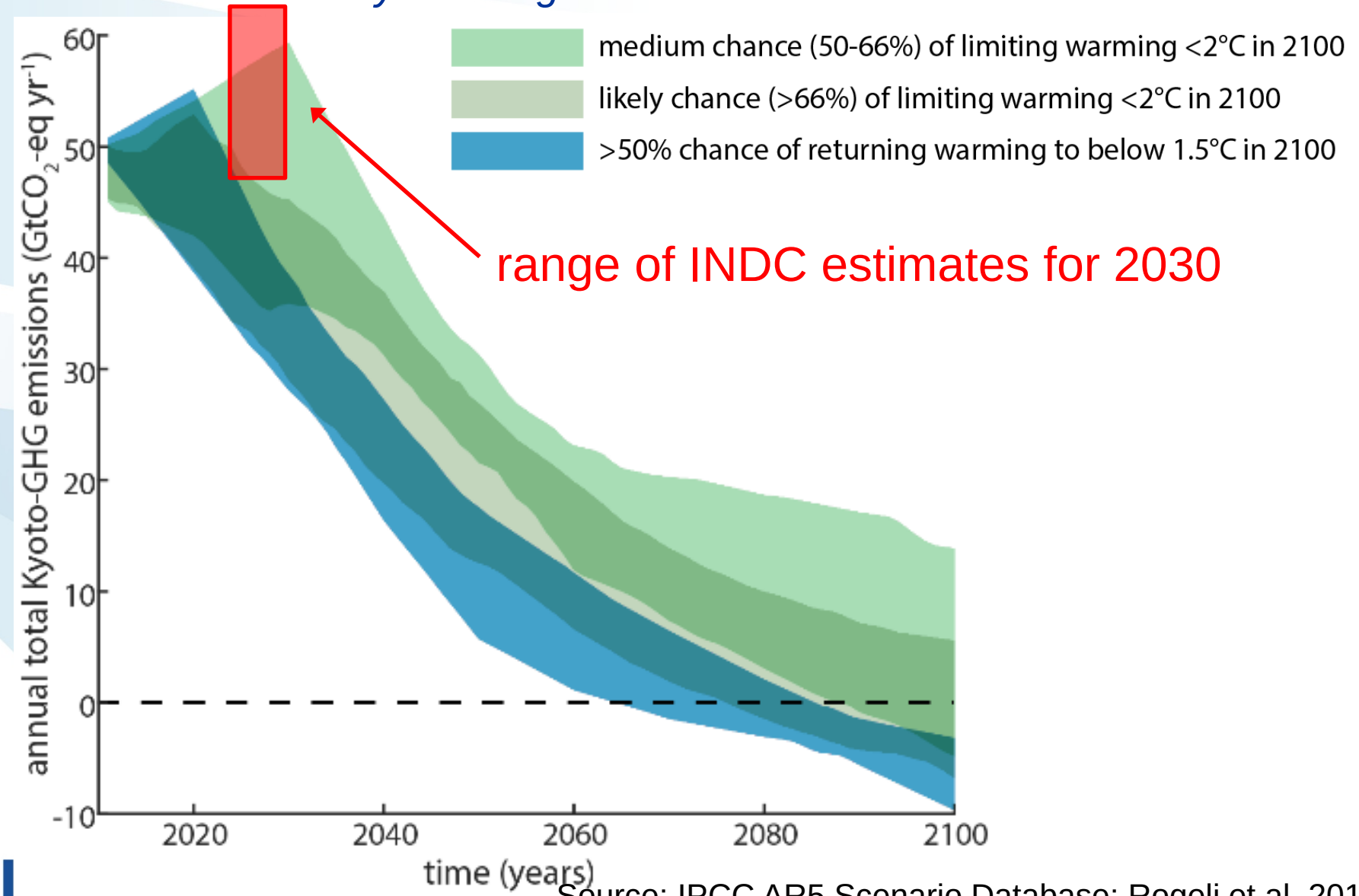


Figure: IPCC AR5 WGI SPM.10

Scenario implications

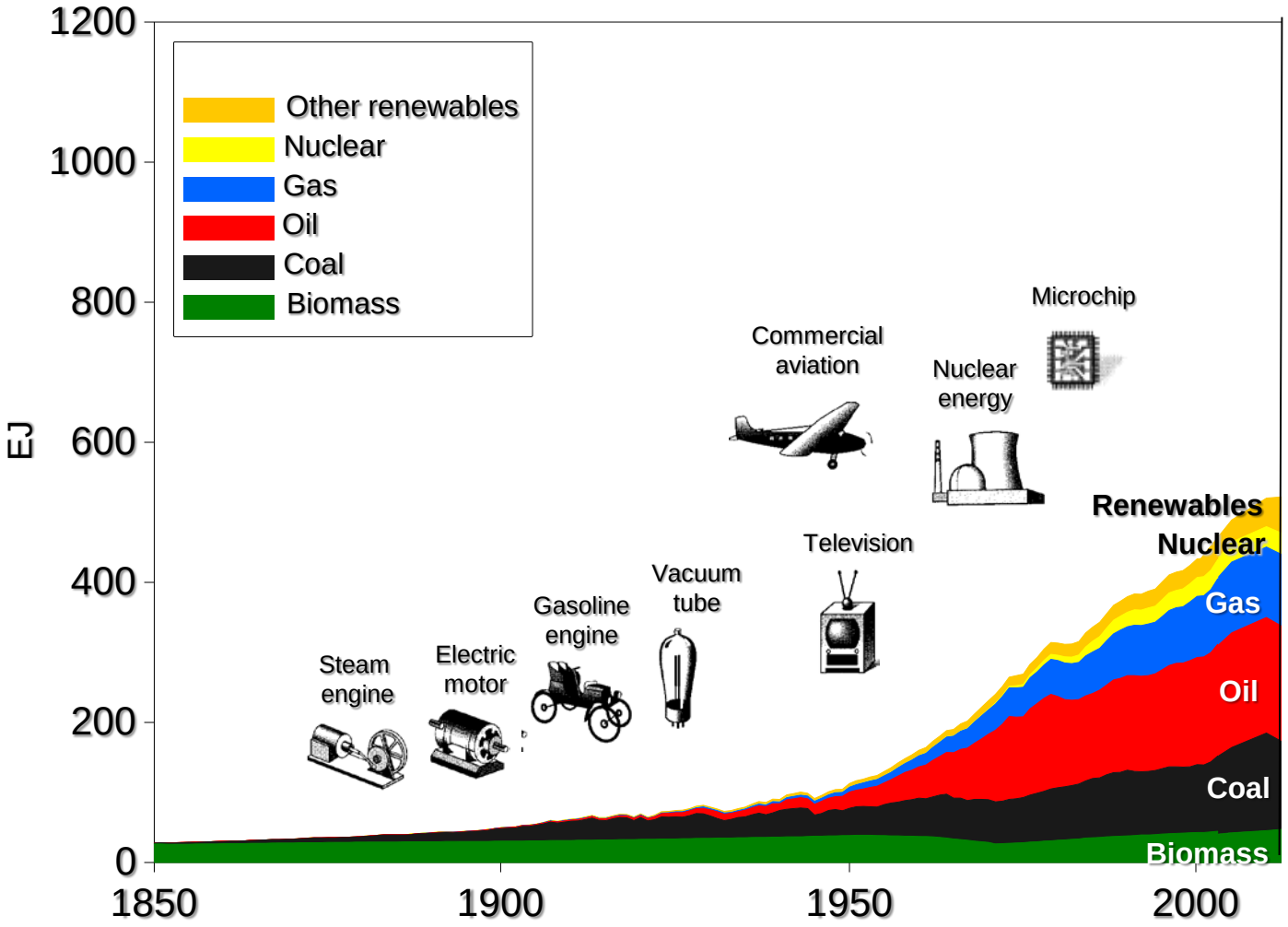
Internal consistency Paris Agreement

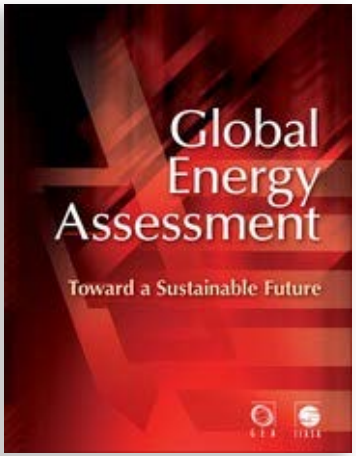


Source: IPCC AR5 Scenario Database; Rogelj et al. 2015

Global Primary Energy

Industrial Revolution until Today

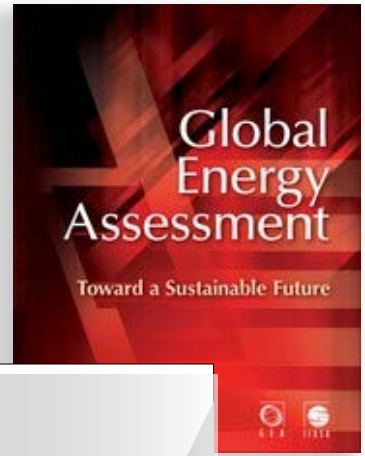


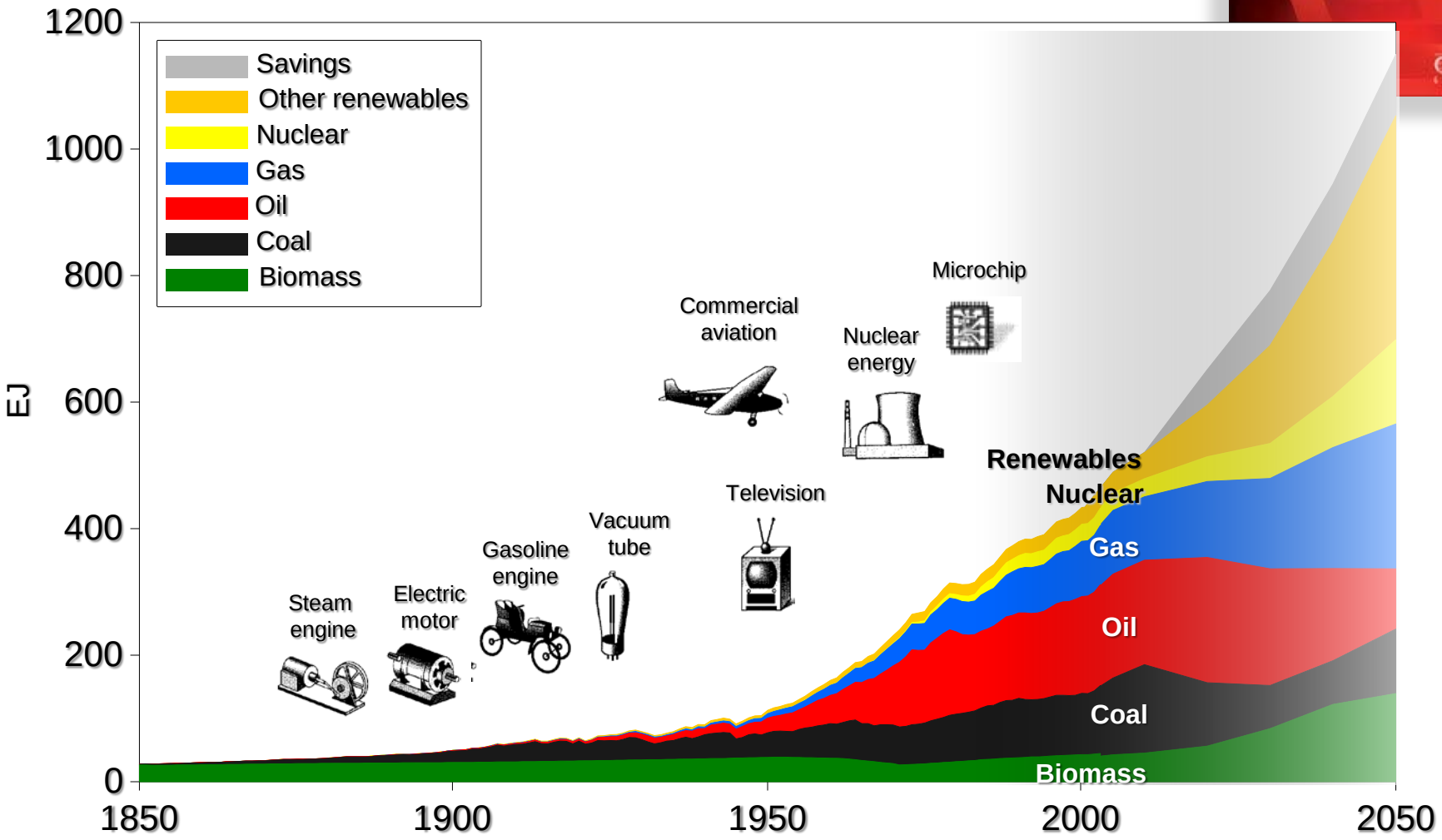


Source: Riahi et al. (2012)

Global Primary Energy

Supply focus – high Nuclear

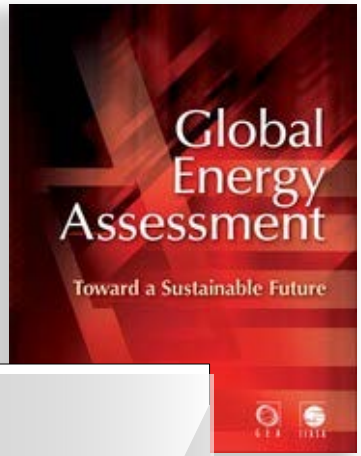


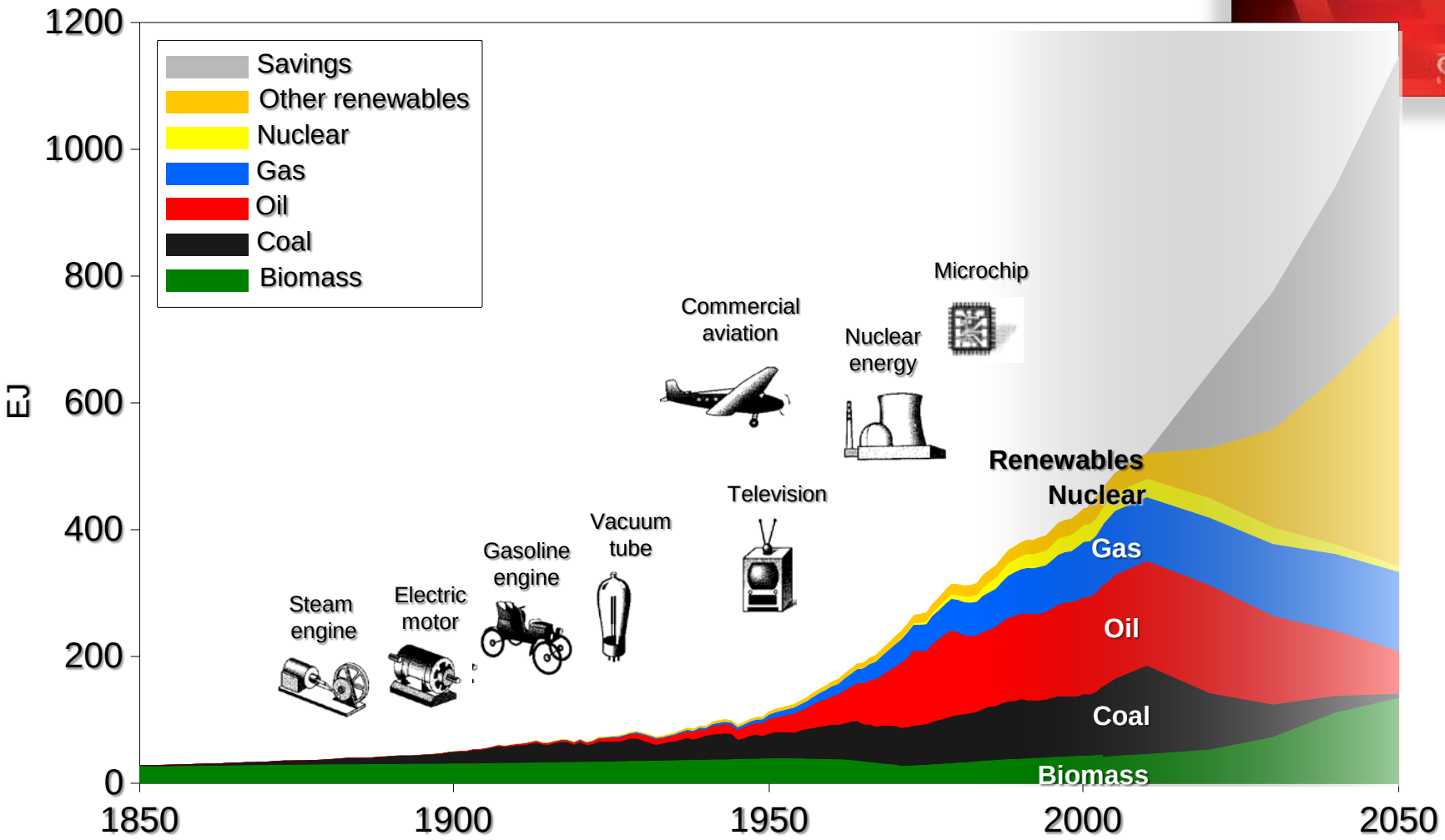


Source: Riahi et al. (2012)

Global Primary Energy

Efficiency focus – no CCS, no Nuclear

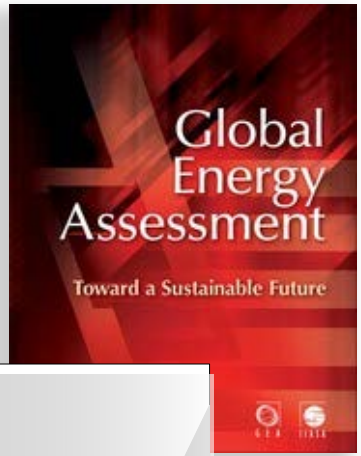


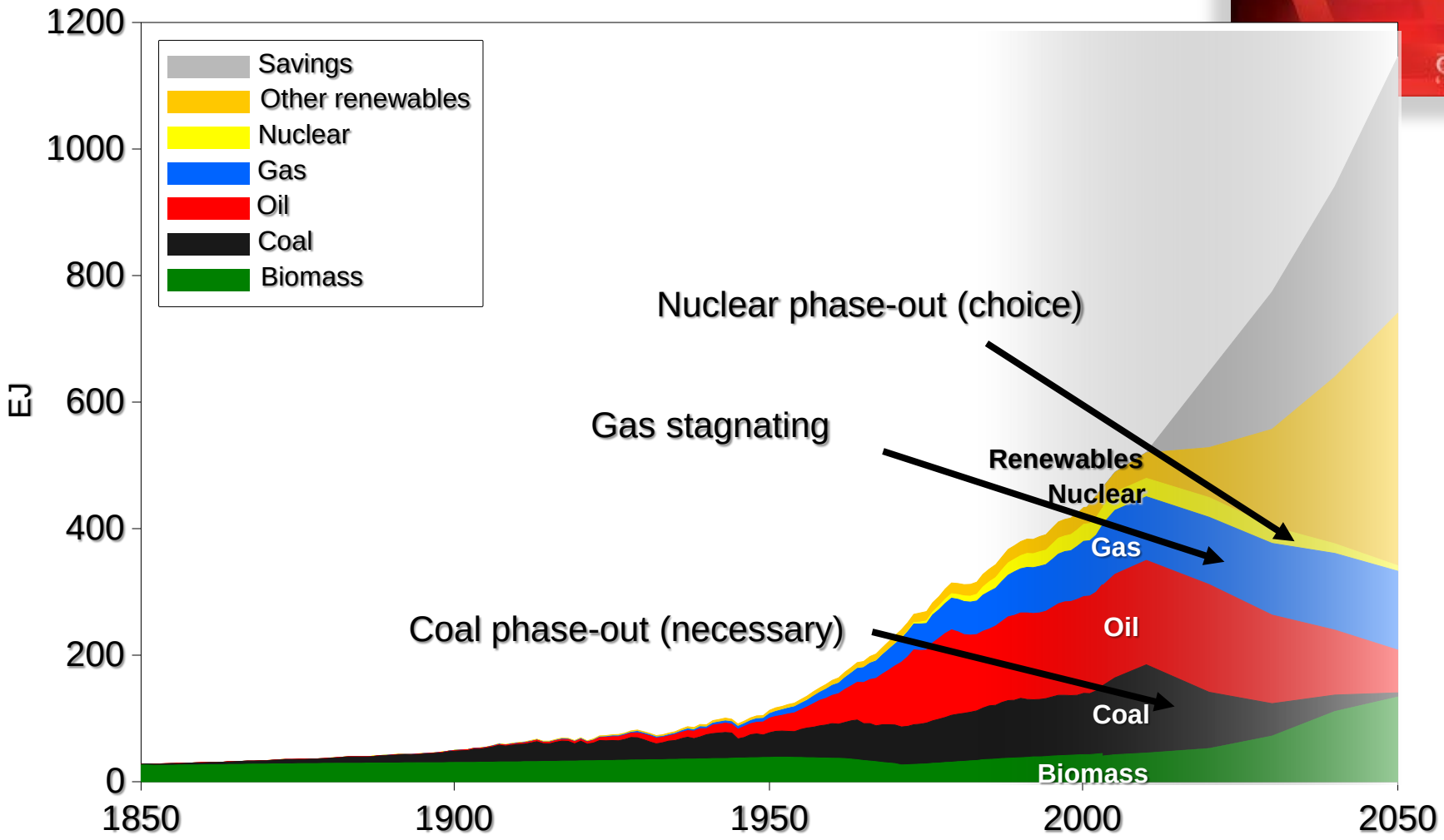


Source: Riahi et al. (2012)

Global Primary Energy

Efficiency focus – no CCS, no Nuclear

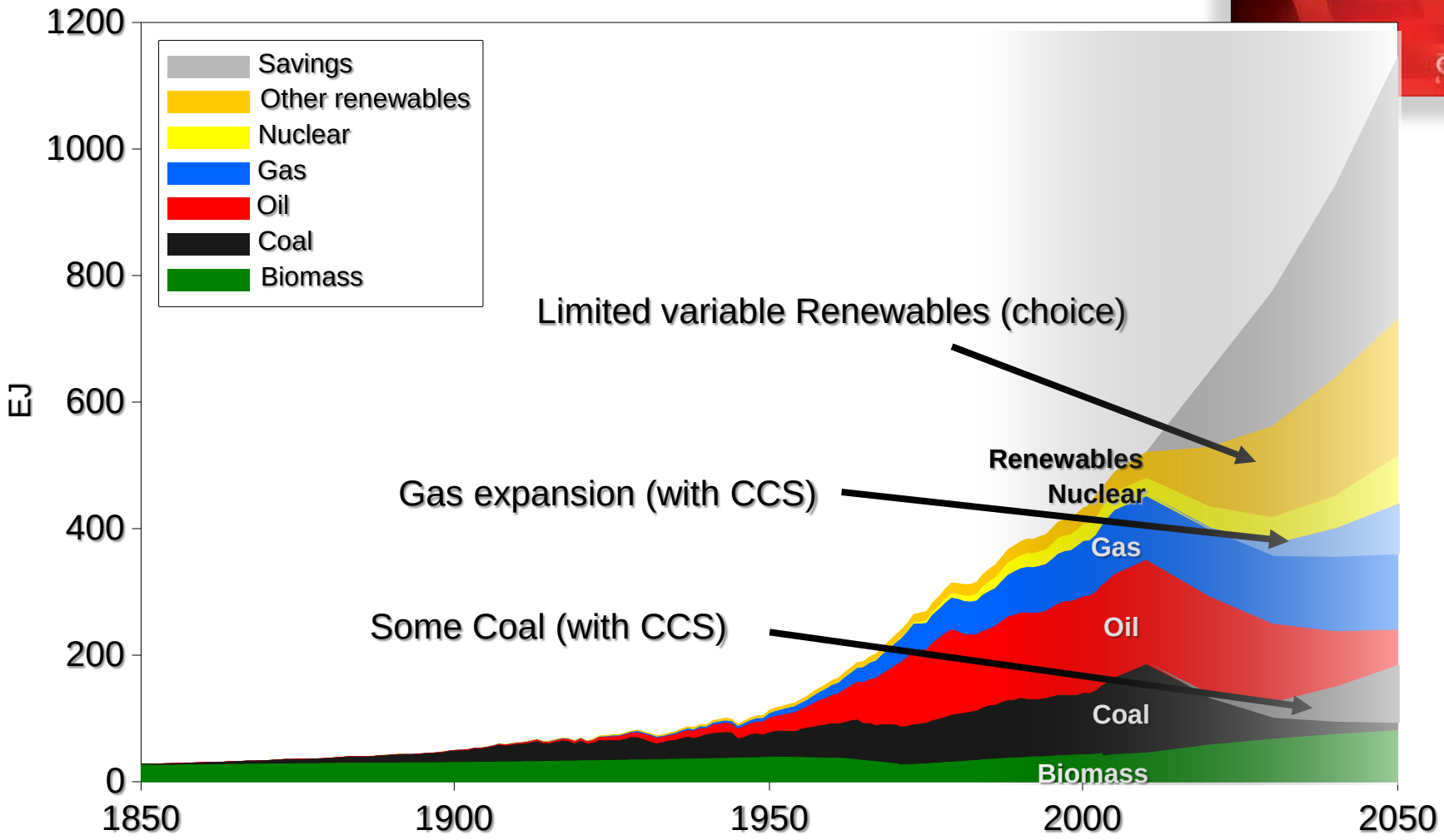




Source: Riahi et al. (2012)

Global Primary Energy

Efficiency focus – limited Bioenergy and variable Renewables

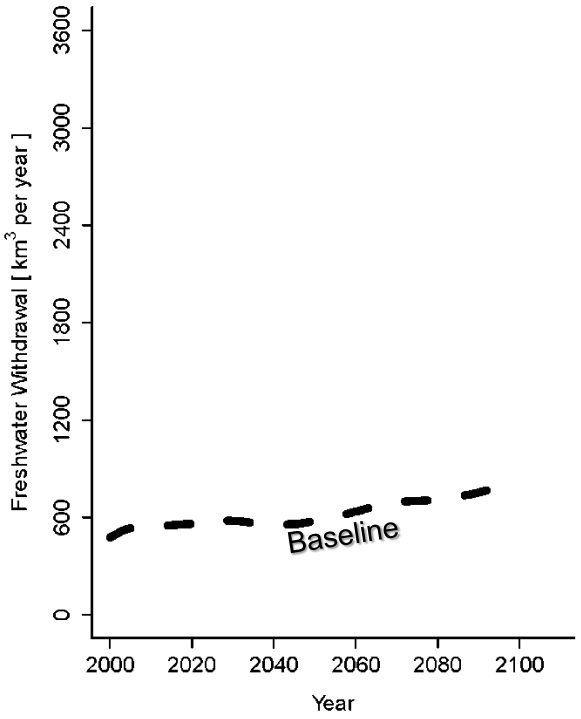


Source: Riahi et al. (2012)

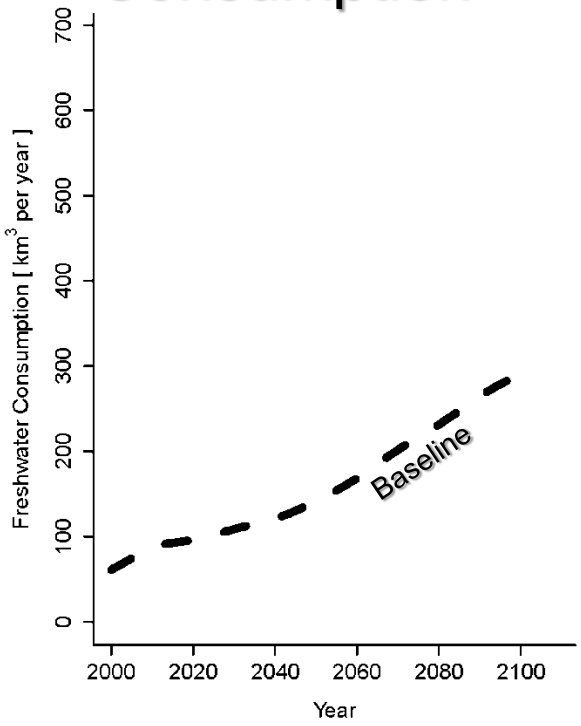
Water Use in the Energy Sector

Impact of Energy Sector on Water

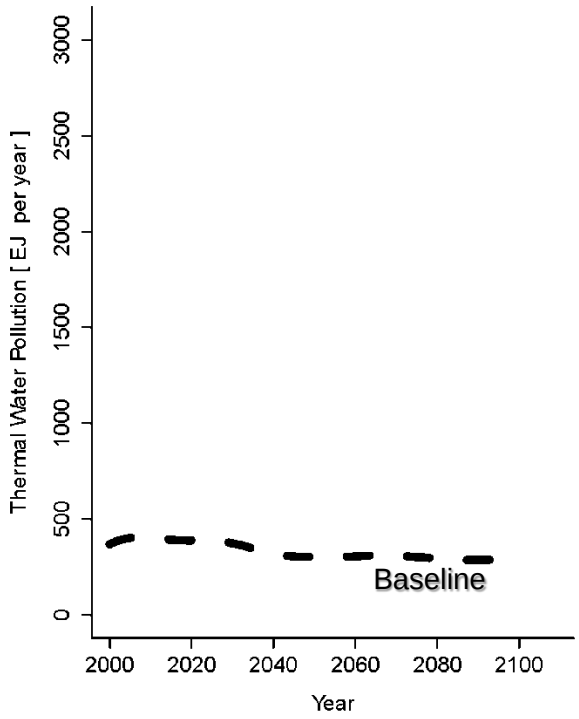
Withdrawal



Consumption



Thermal Pollution



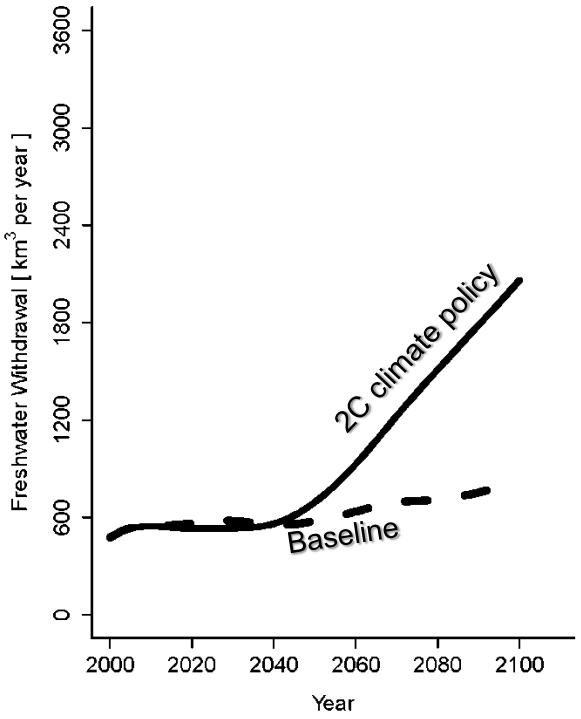
No climate policy

Reference

Source: Fricko, Parkinson et al., 2016

Impact of Energy Sector on Water

Withdrawal



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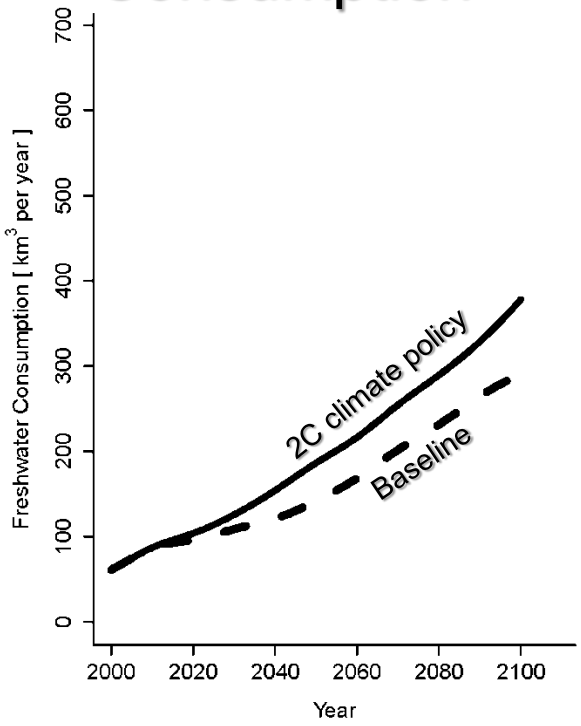
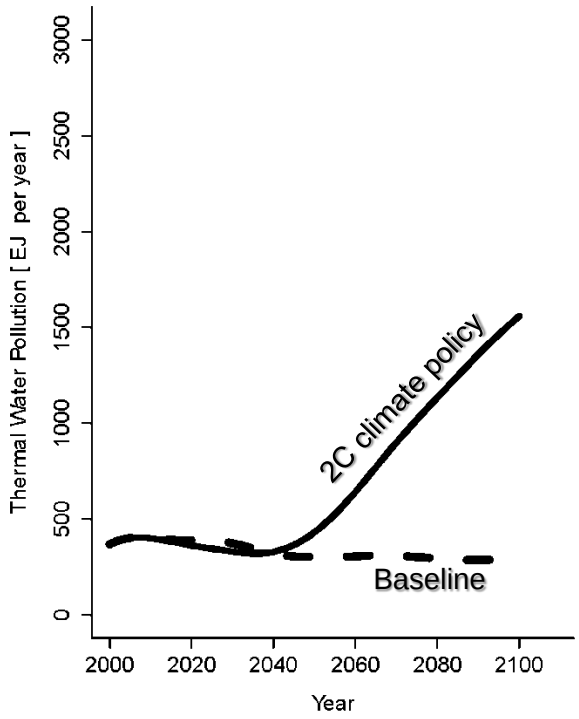


Thermal Pollution



No climate policy

Reference

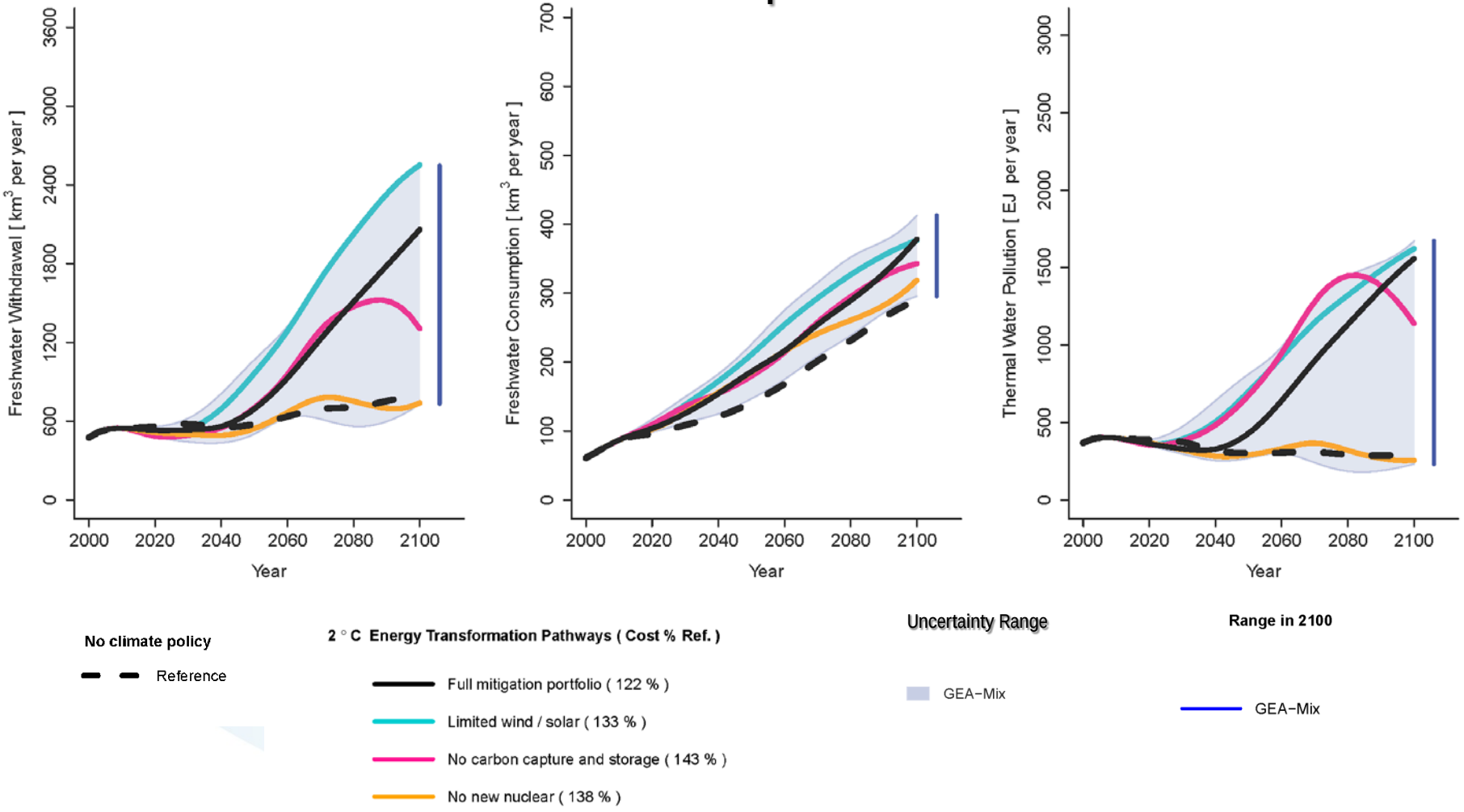
2 ° C Energy Transformation Pathways (Cost % Ref.)

Source: Fricko, Parkinson et al., 2016

Impact of Energy Sector on Water

Alternative Technology Choices for 2C (intermediate energy demand)

Withdrawal | Consumption | Thermal Pollution

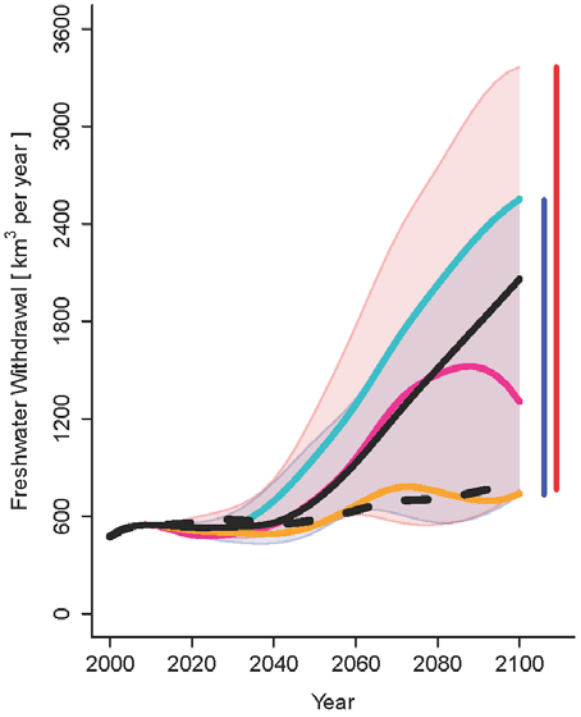


Source: Fricko, Parkinson et al., 2016

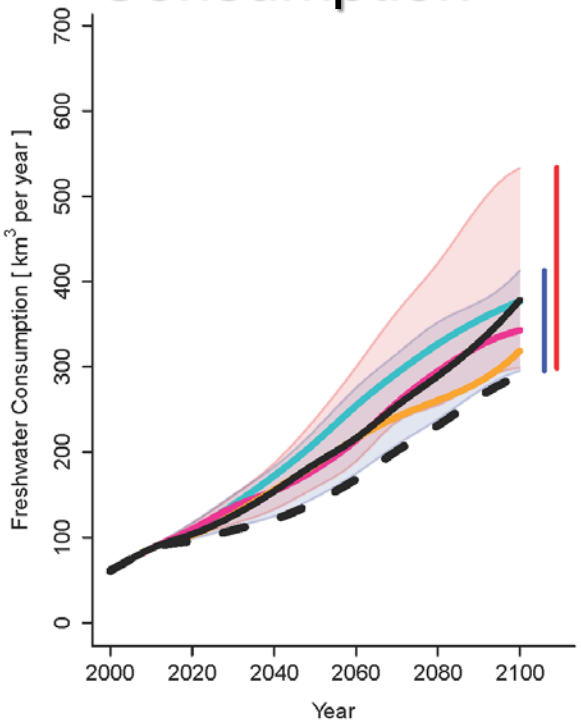
Impact of Energy Sector on Water

High Energy Demand

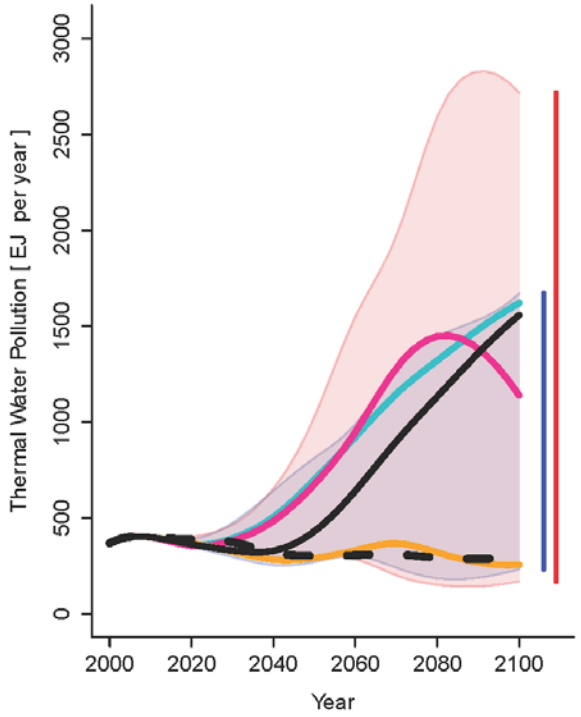
Withdrawal

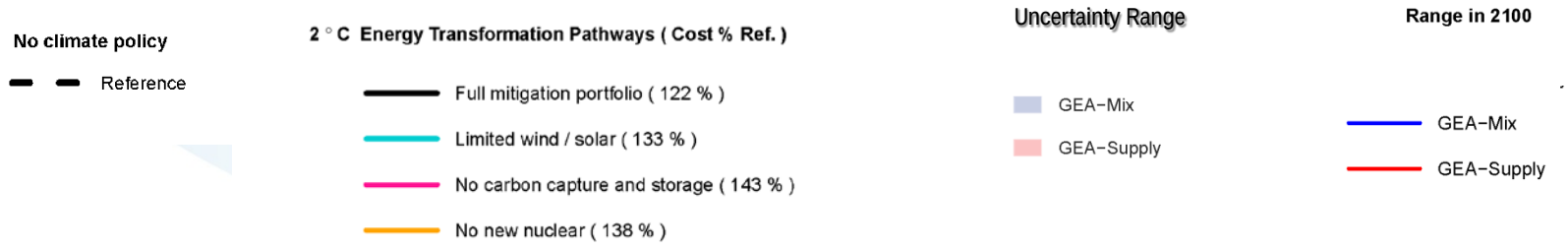


Consumption



Thermal Pollution



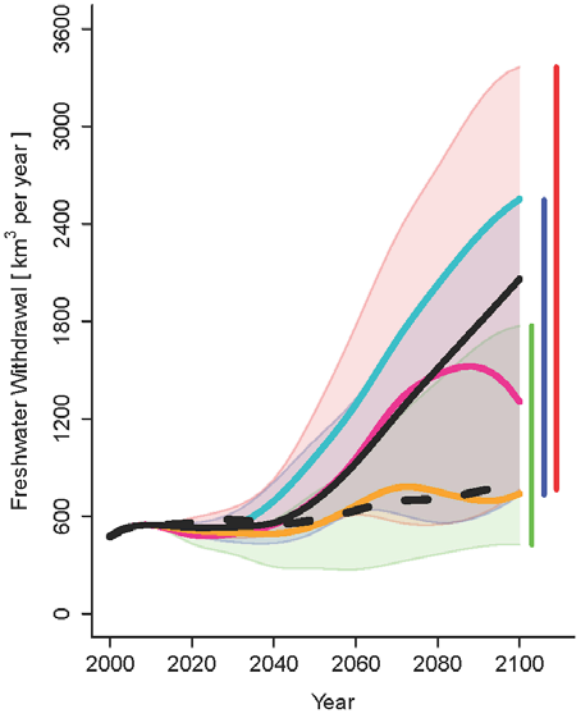


Source: Fricko, Parkinson et al., 2016

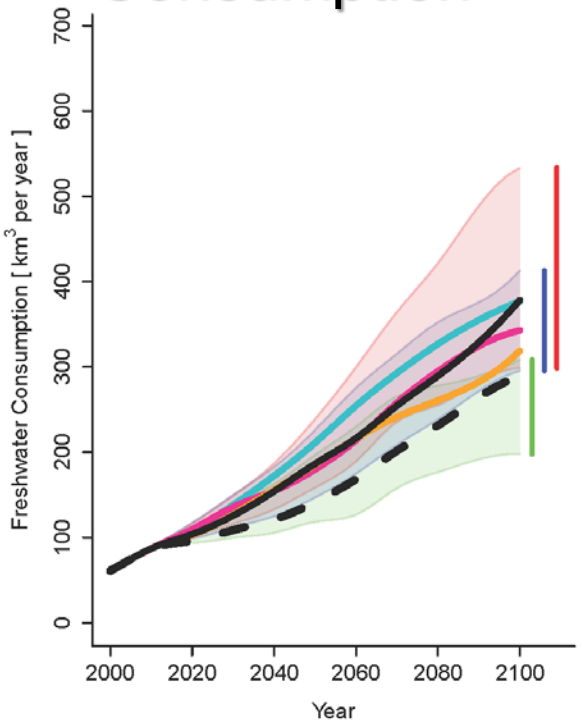
Impact of Energy Sector on Water

Low Energy Demand (Efficiency)

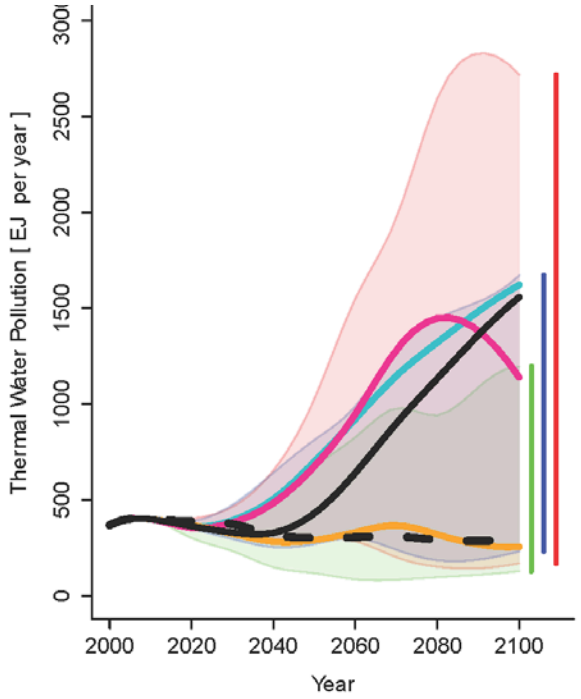
Withdrawal

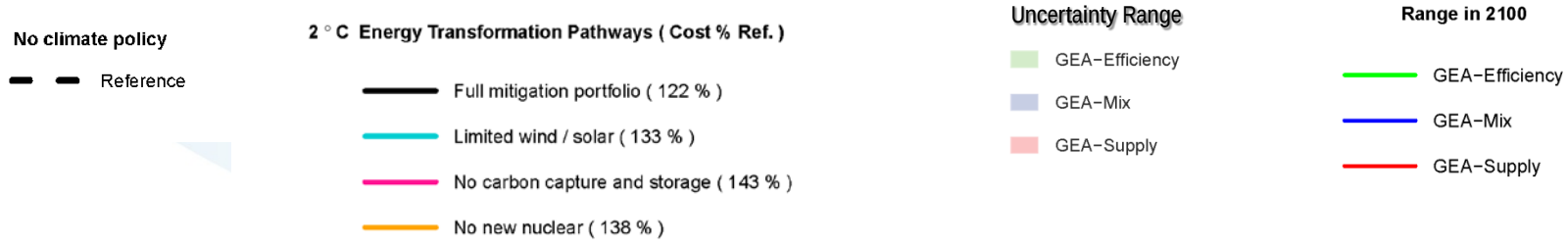


Consumption



Thermal Pollution



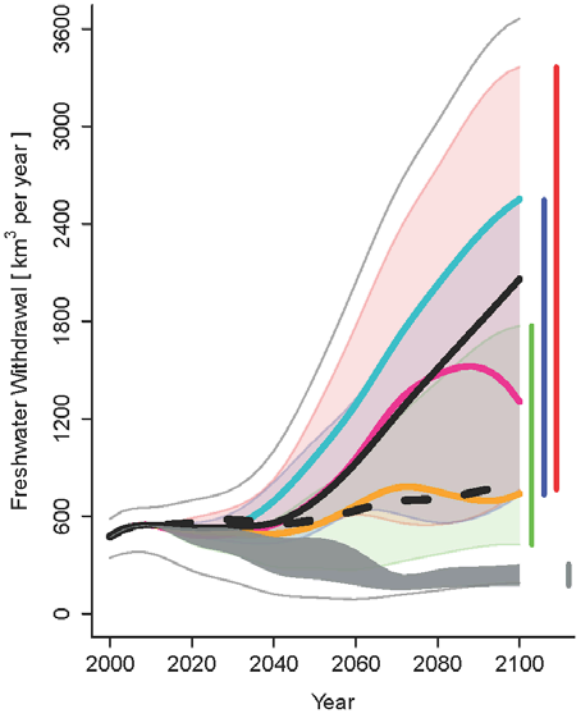


Source: Fricko, Parkinson et al., 2016

Impact of Energy Sector on Water

Efficiency + Water Adaptation Policies

Withdrawal



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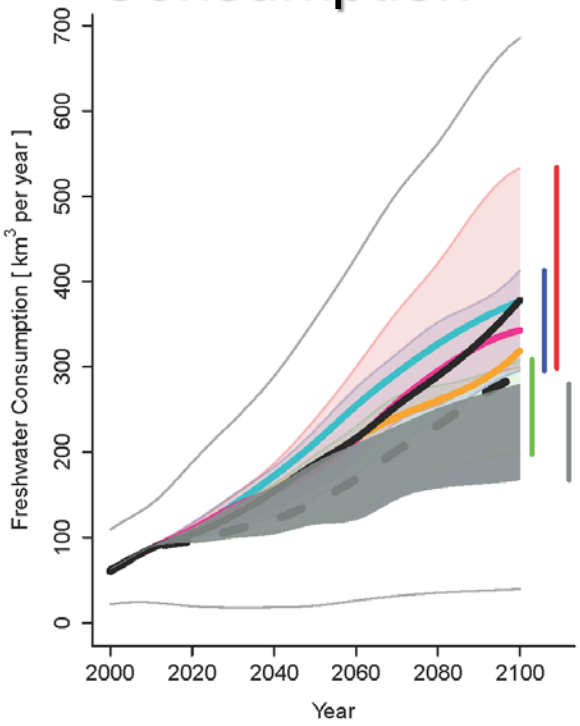
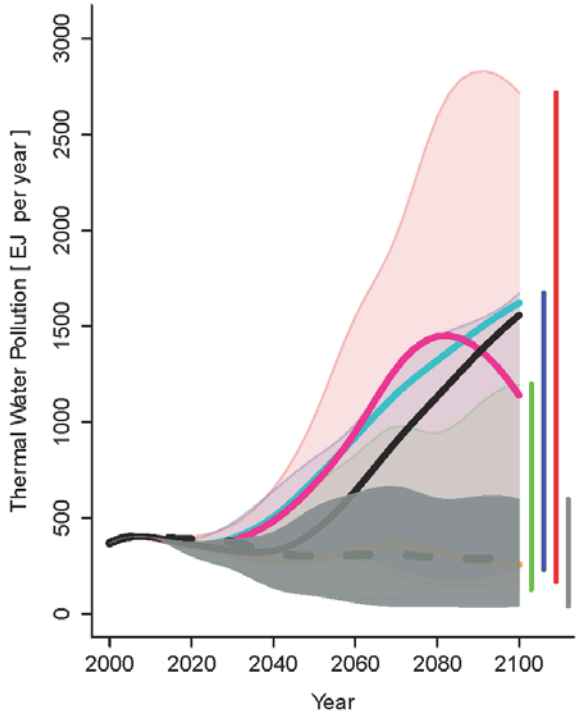
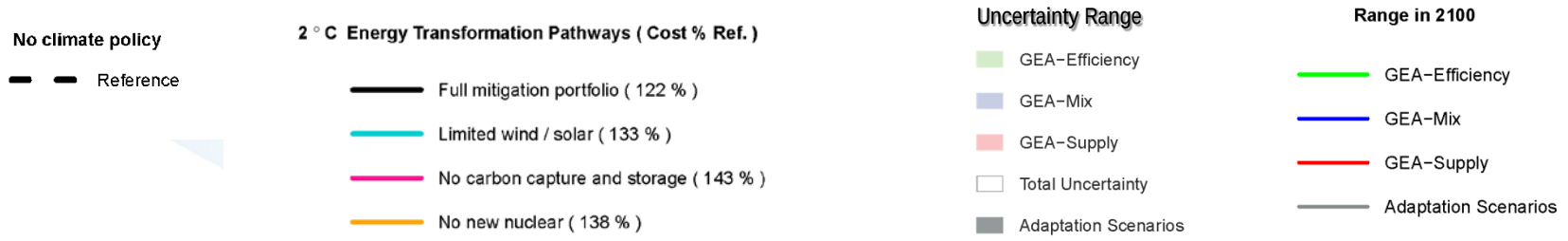


Thermal Pollution



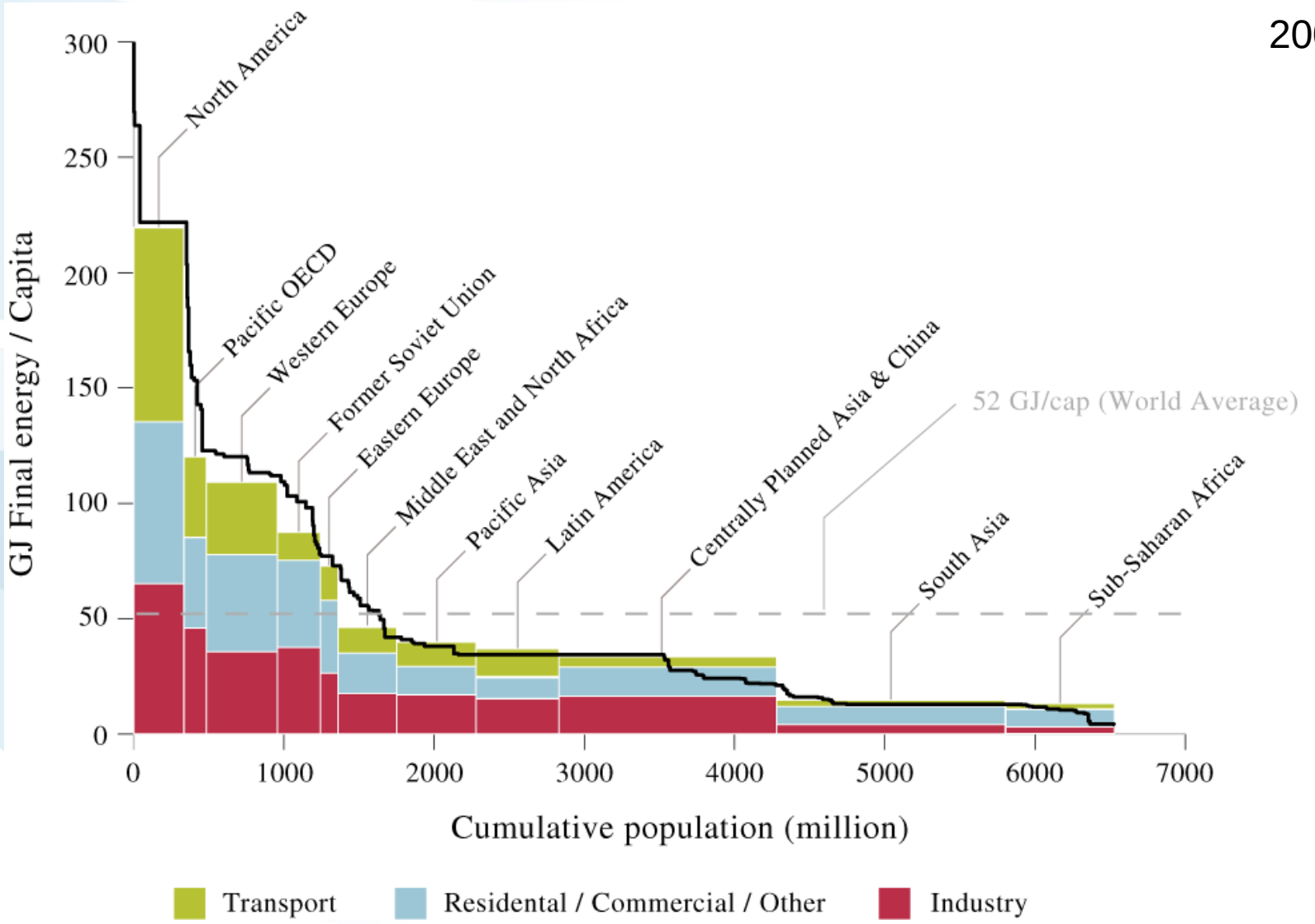


Source: Fricko, Parkinson et al., 2016

Equity and Energy Poverty

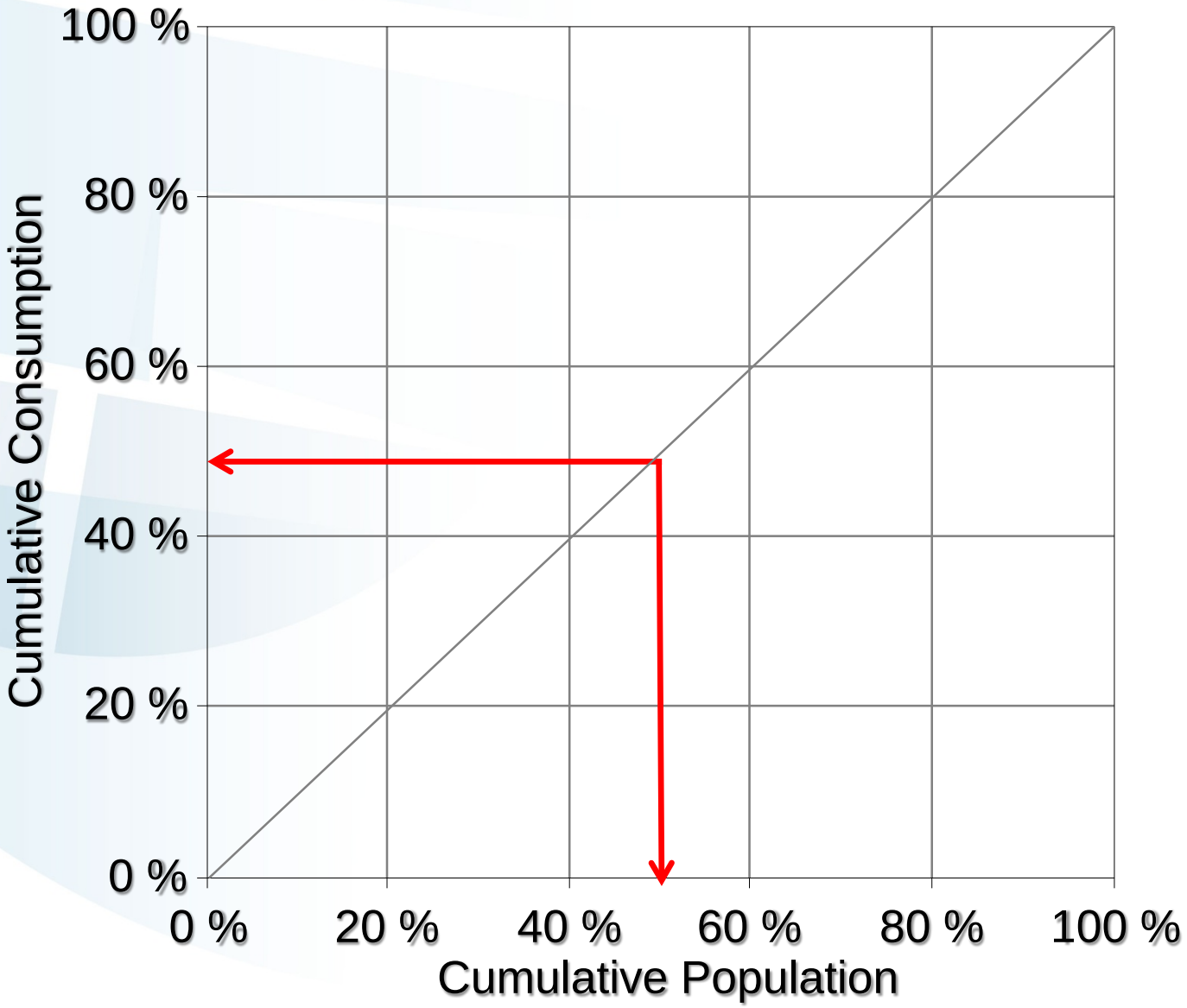
Final Energy – Regional Distribution

2005

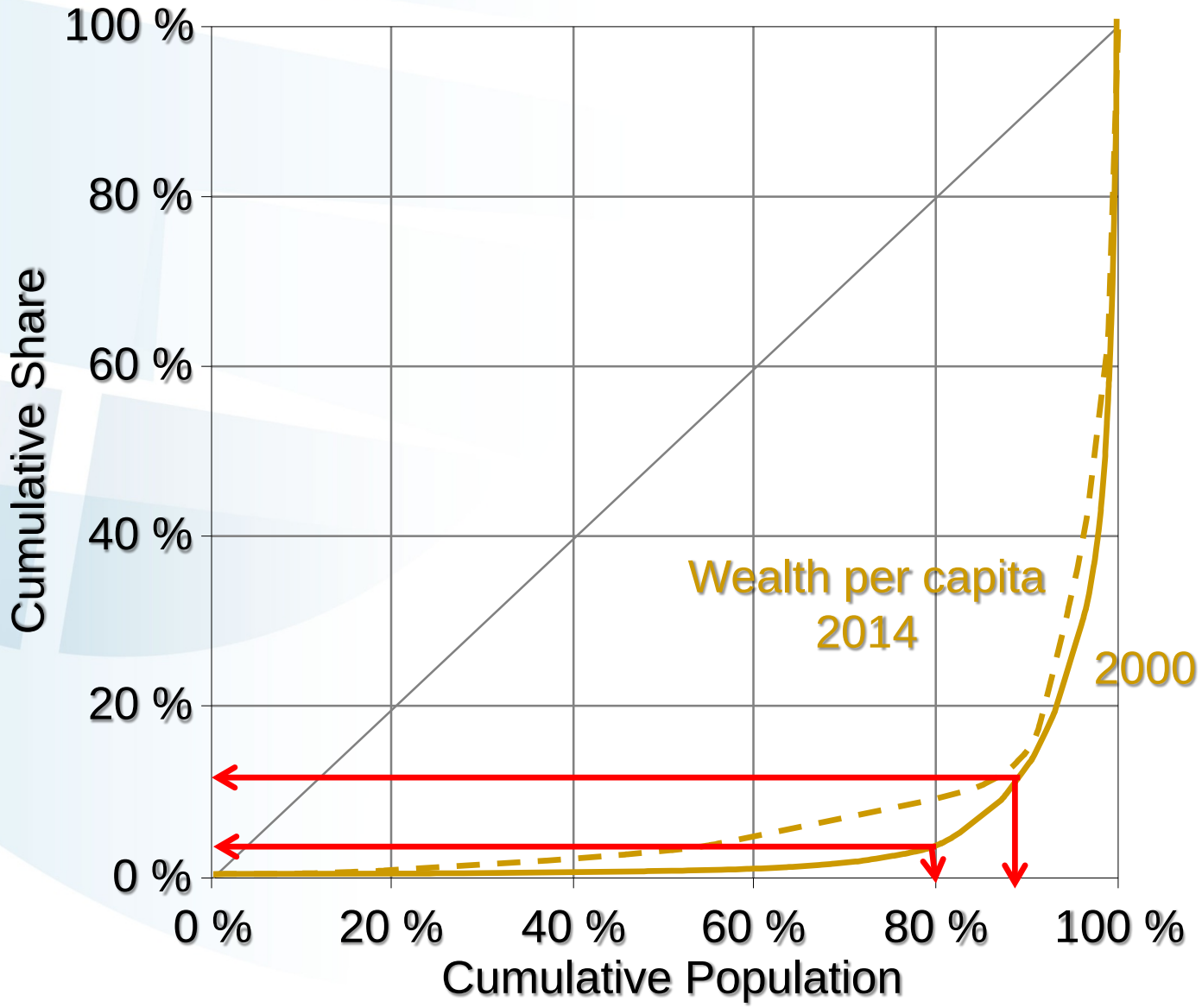


Source: Global Energy Assessment – Grubler et al. (2012)

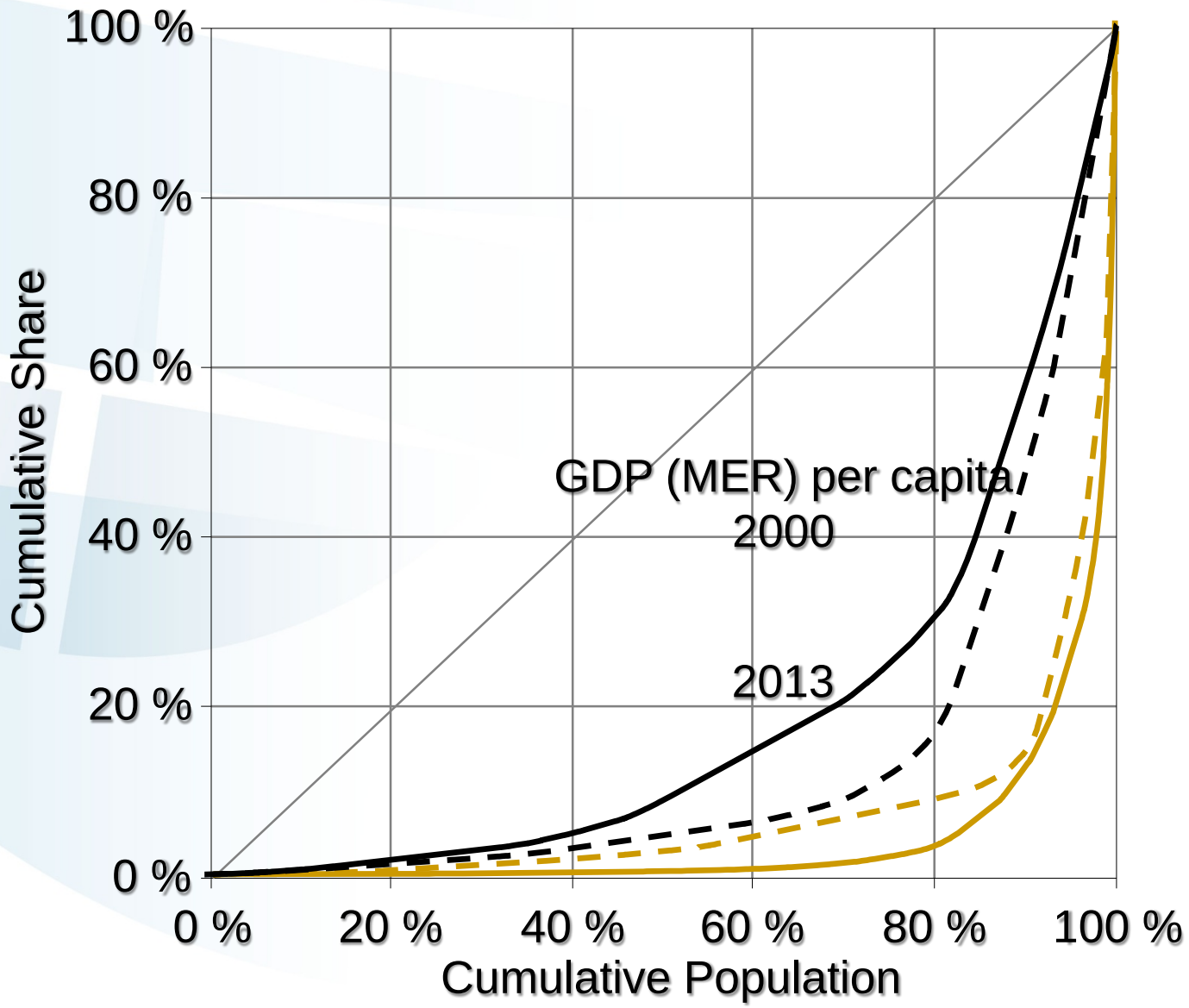
Global Lorenz Distributions



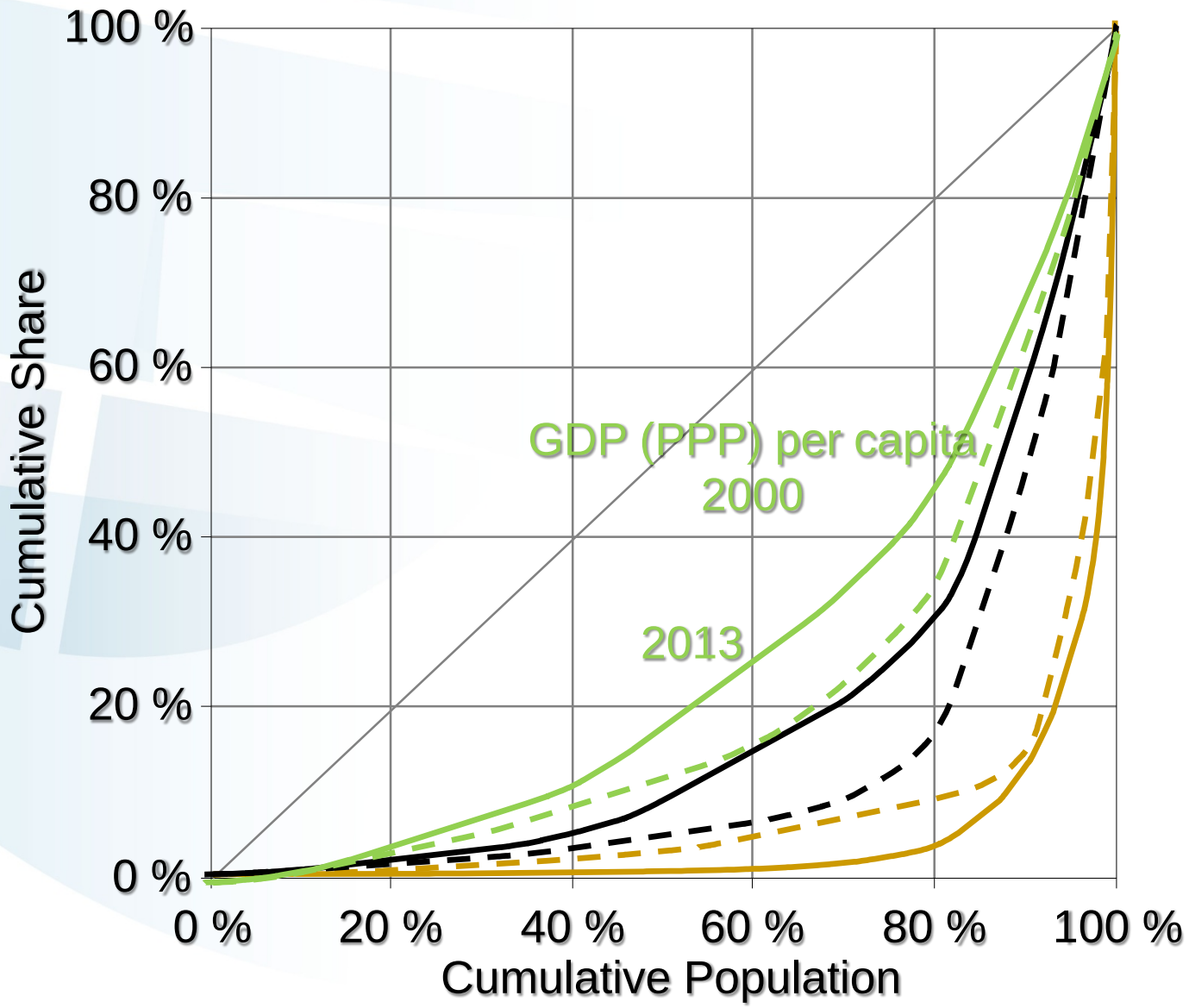
Global Lorenz Distributions



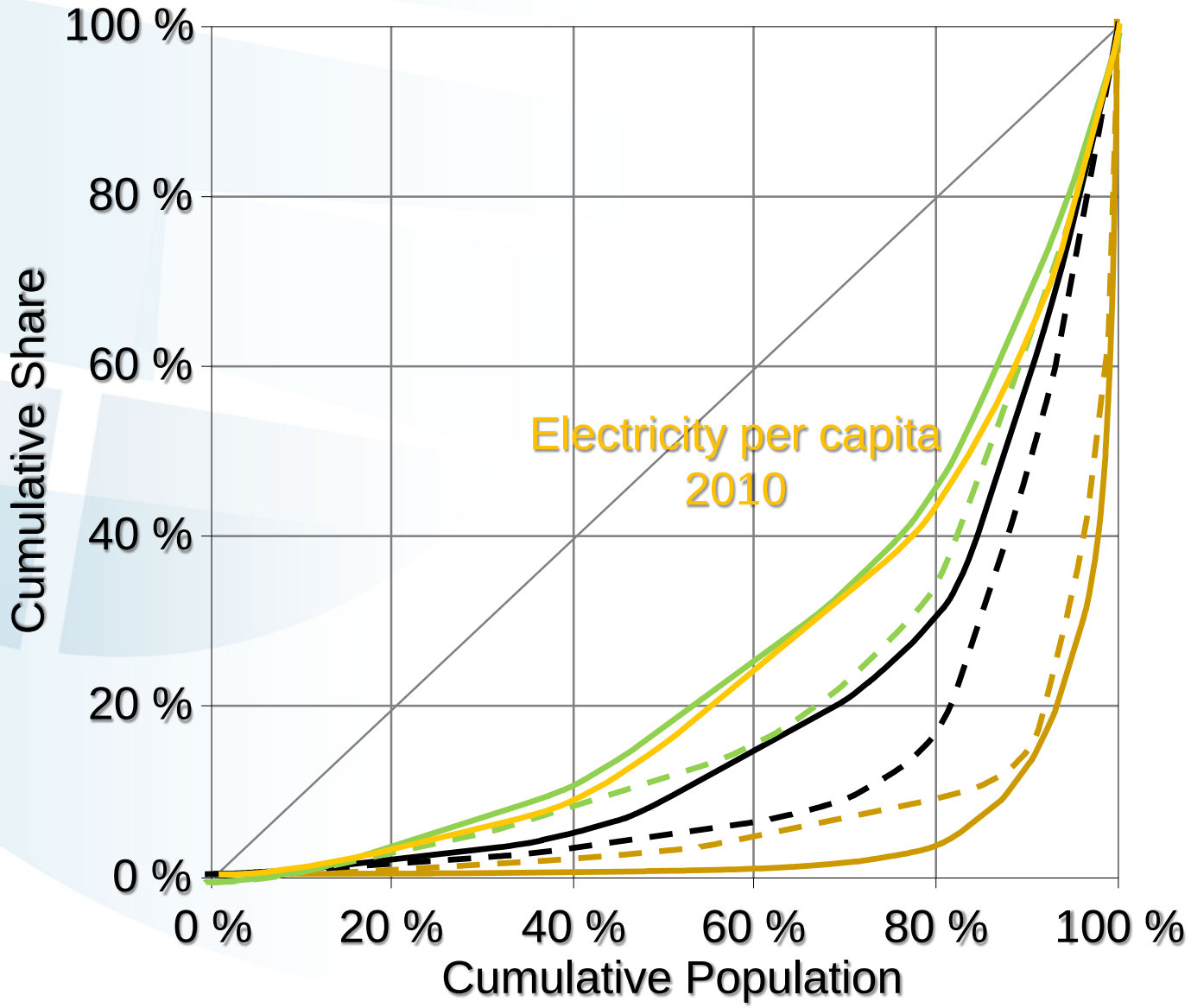
Global Lorenz Distributions



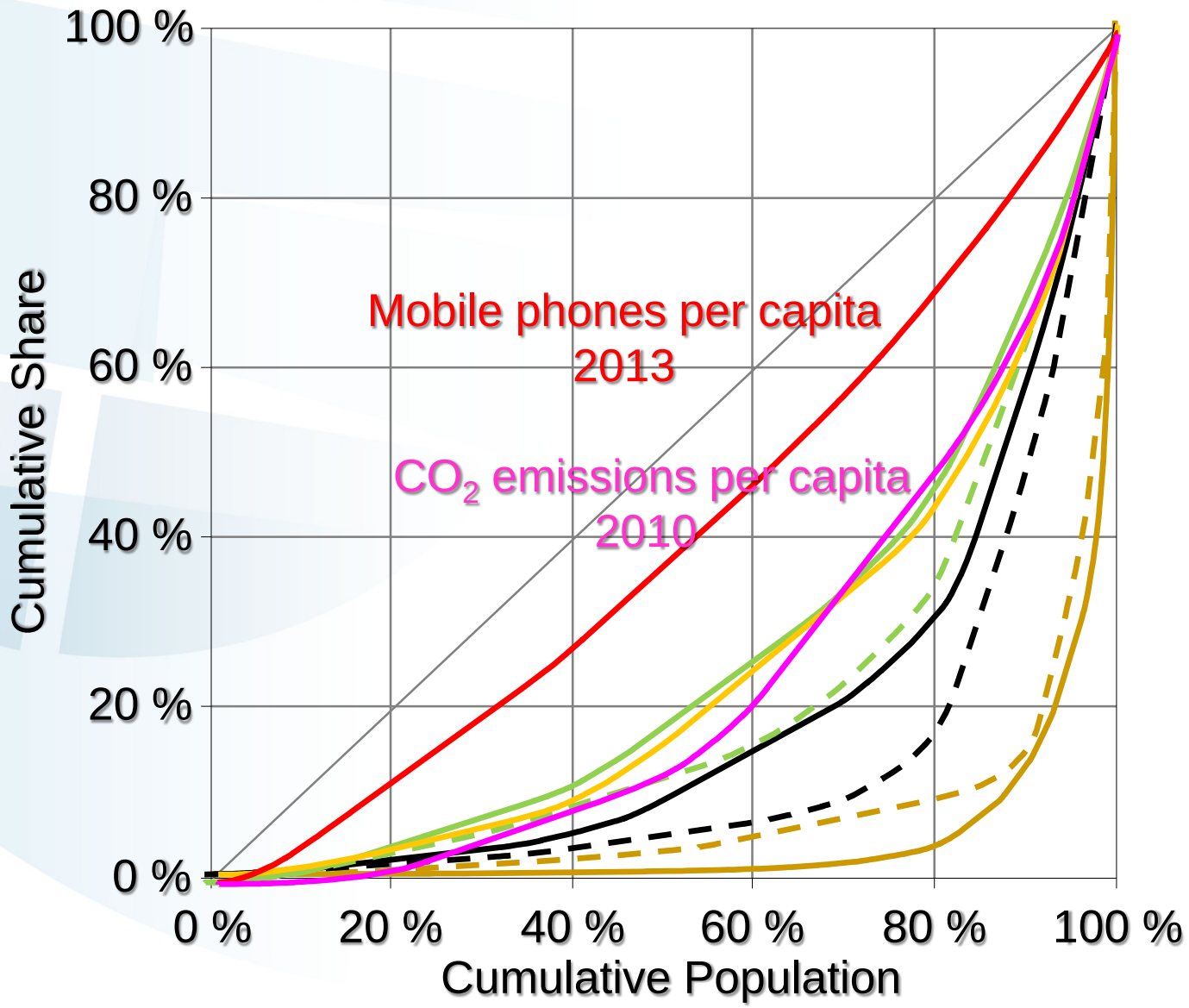
Global Lorenz Distributions



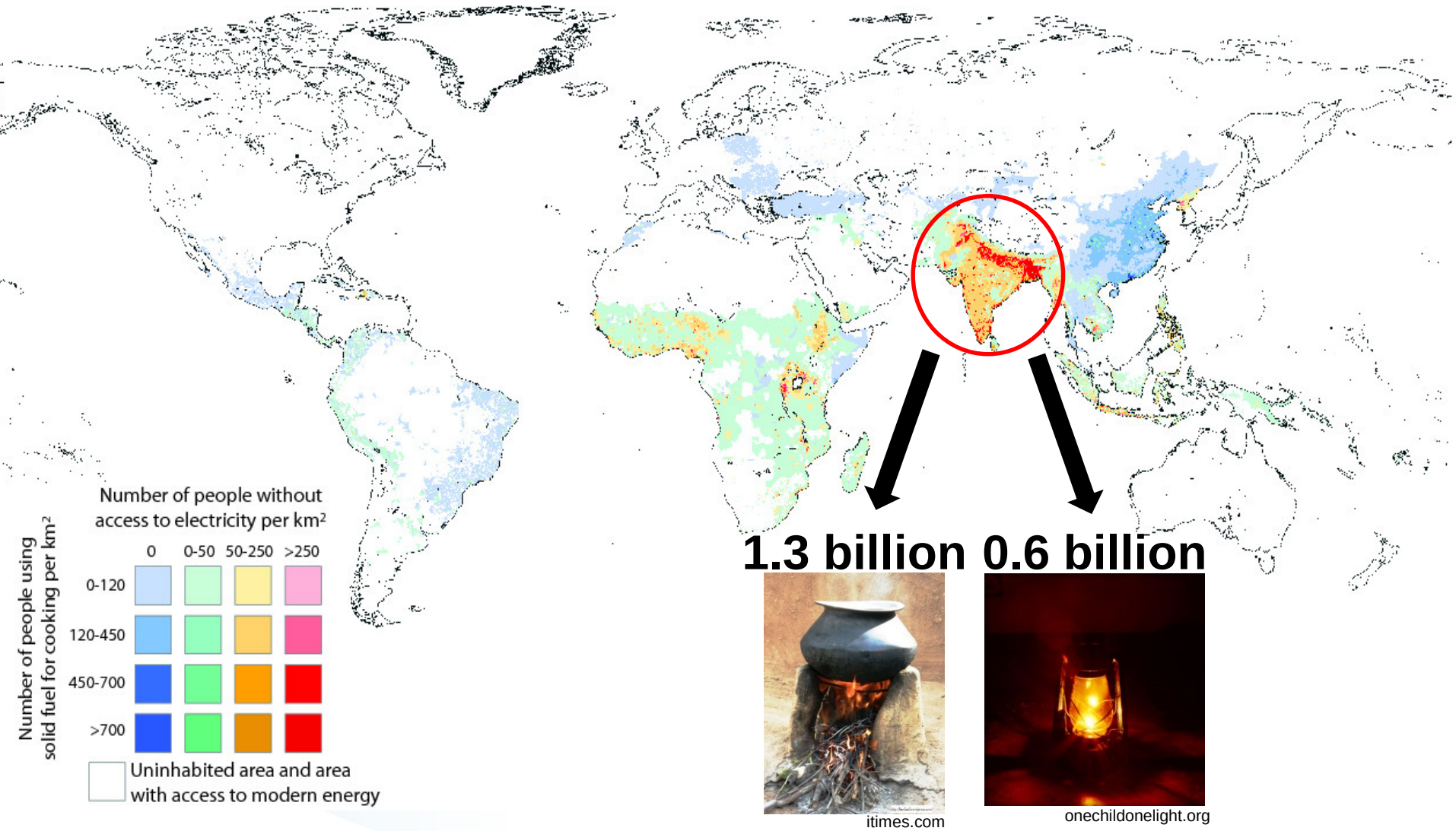
Global Lorenz Distributions



Global Lorenz Distributions



Energy Poverty in South Asia

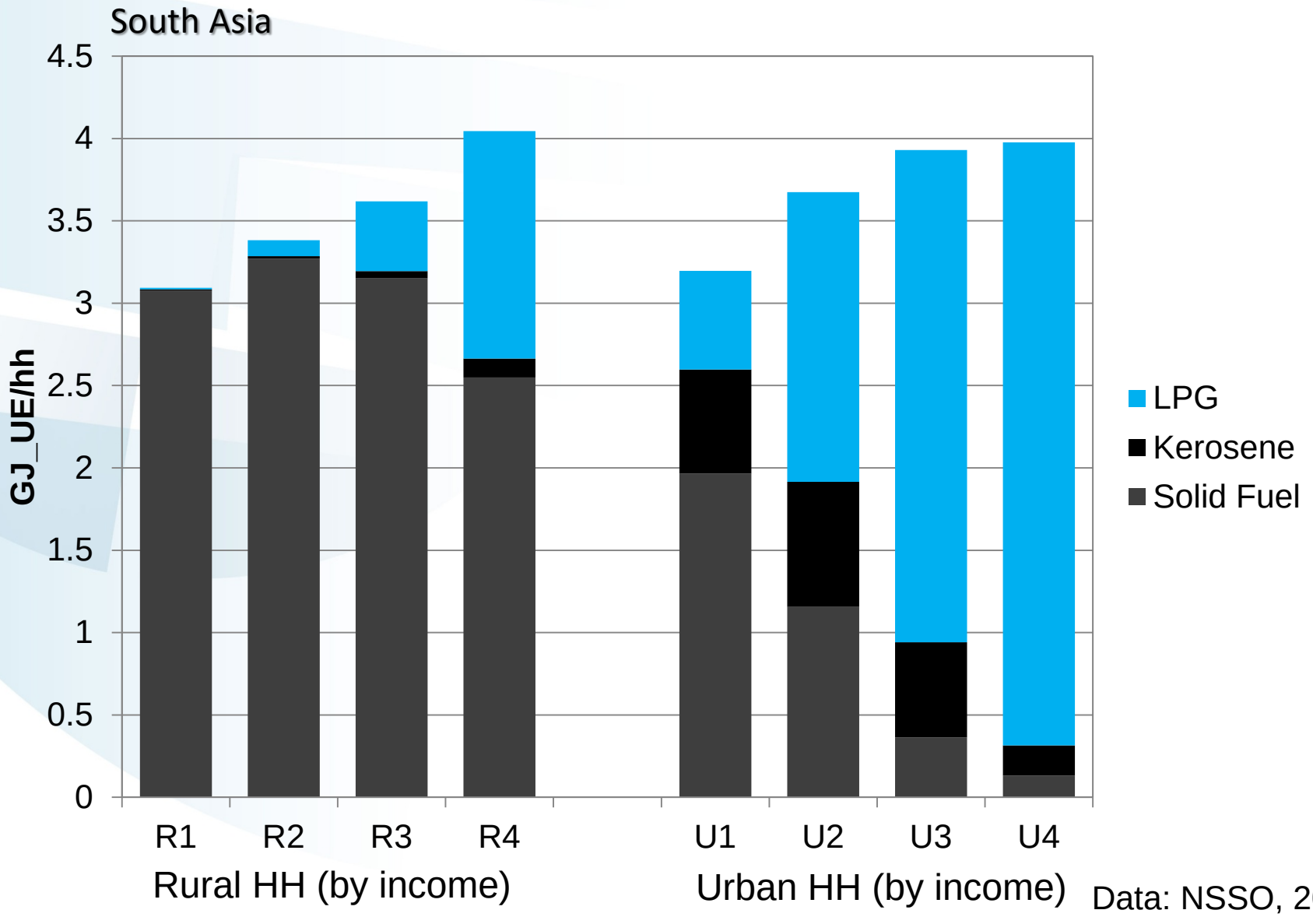


itimes.com

onechildonelight.org

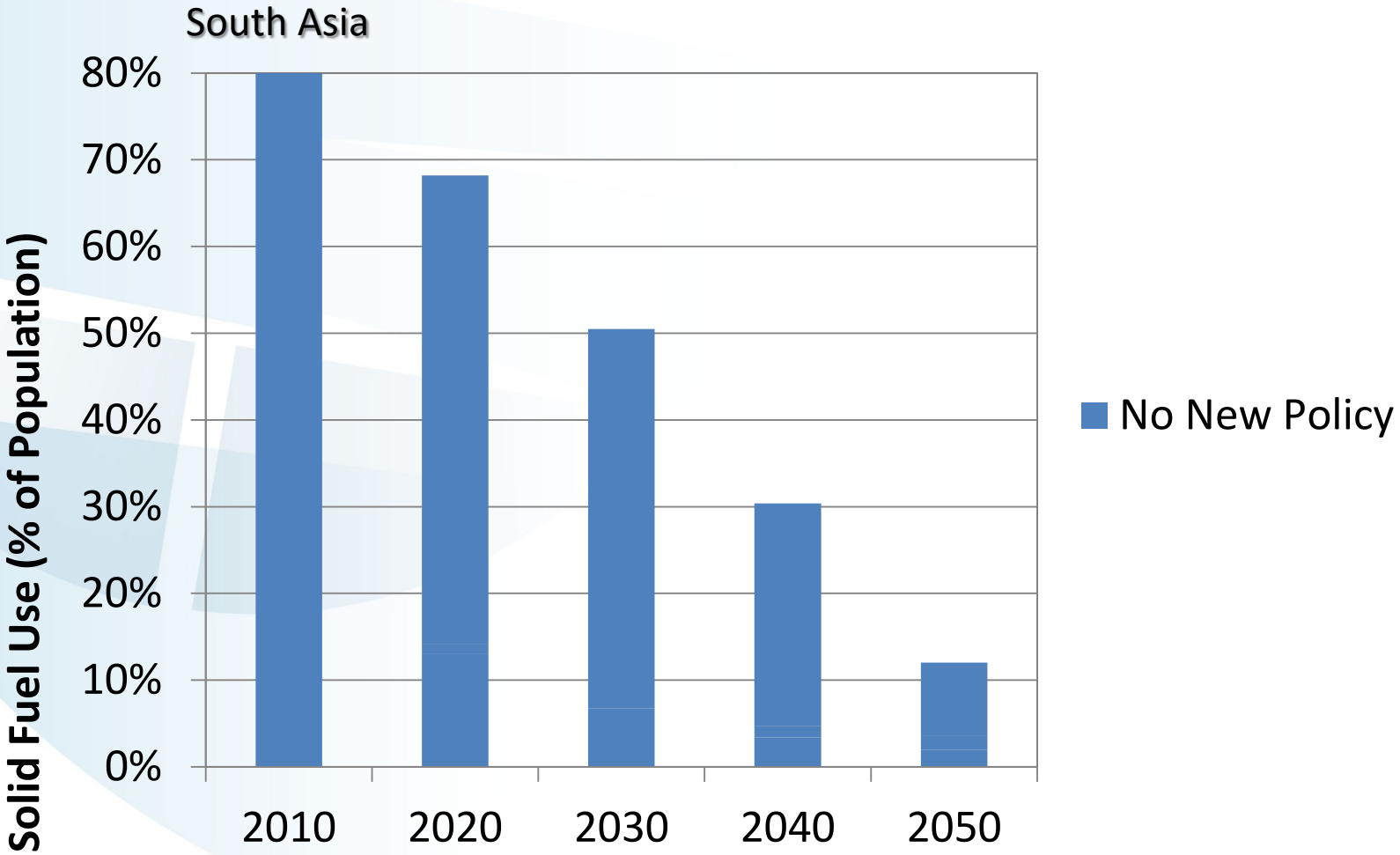
Source: Global Energy Assessment, IIASA

Useful Energy for Cooking per HH



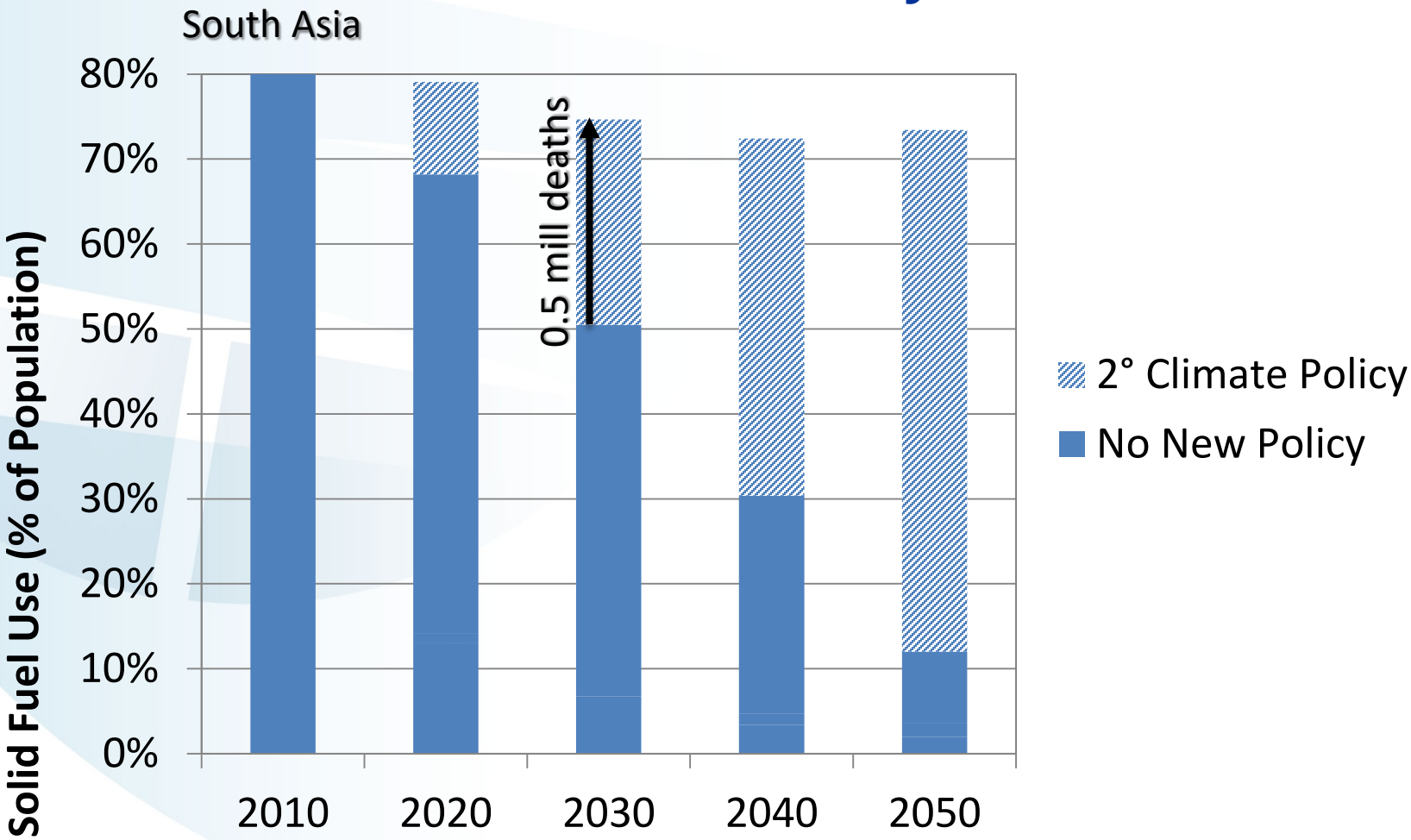
Data: NSSO, 2007

Solid Fuel Dependence
No New Policies



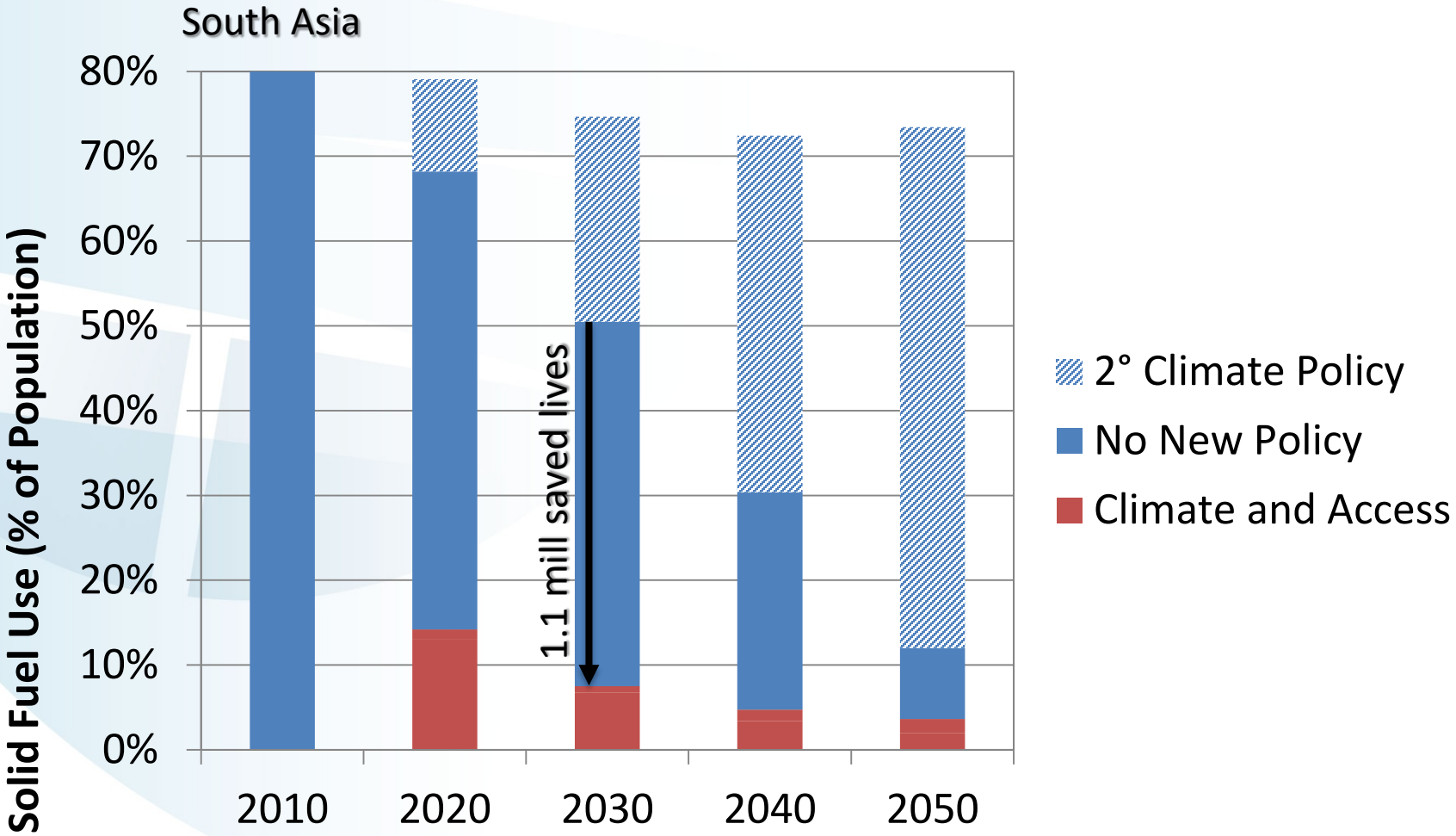
Source: Cameron et al., 2016

Solid Fuel Dependence
Effect of 2°C Climate Policy



Source: Cameron et al., 2016

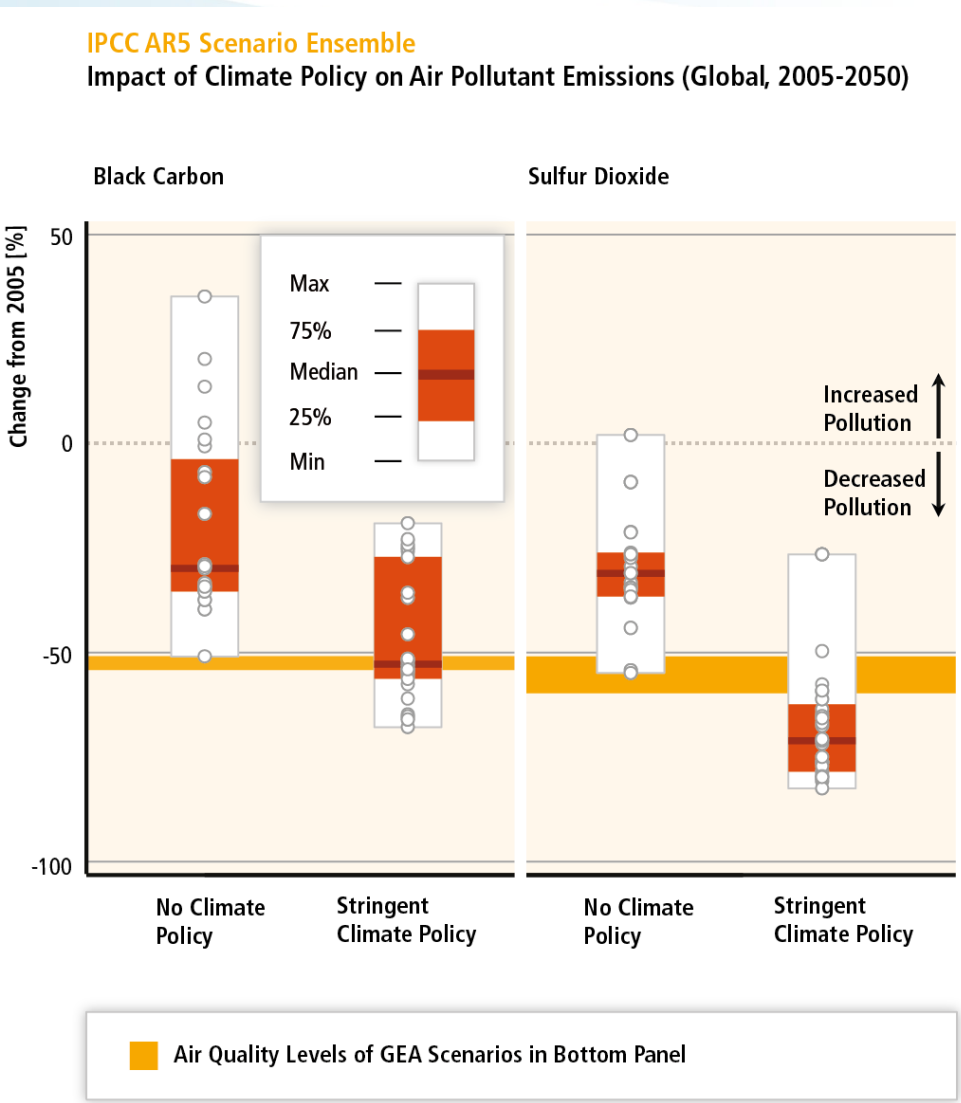
Integrated Climate and Access Policies

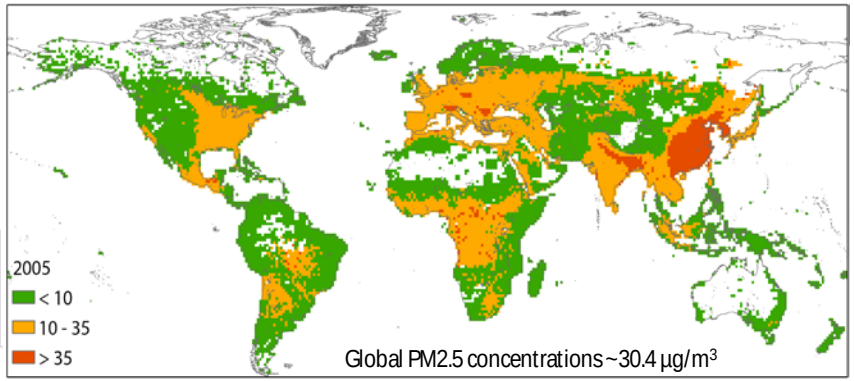


Source: Cameron et al., 2016

Air Quality and Health Co-Benefits of Climate Policy

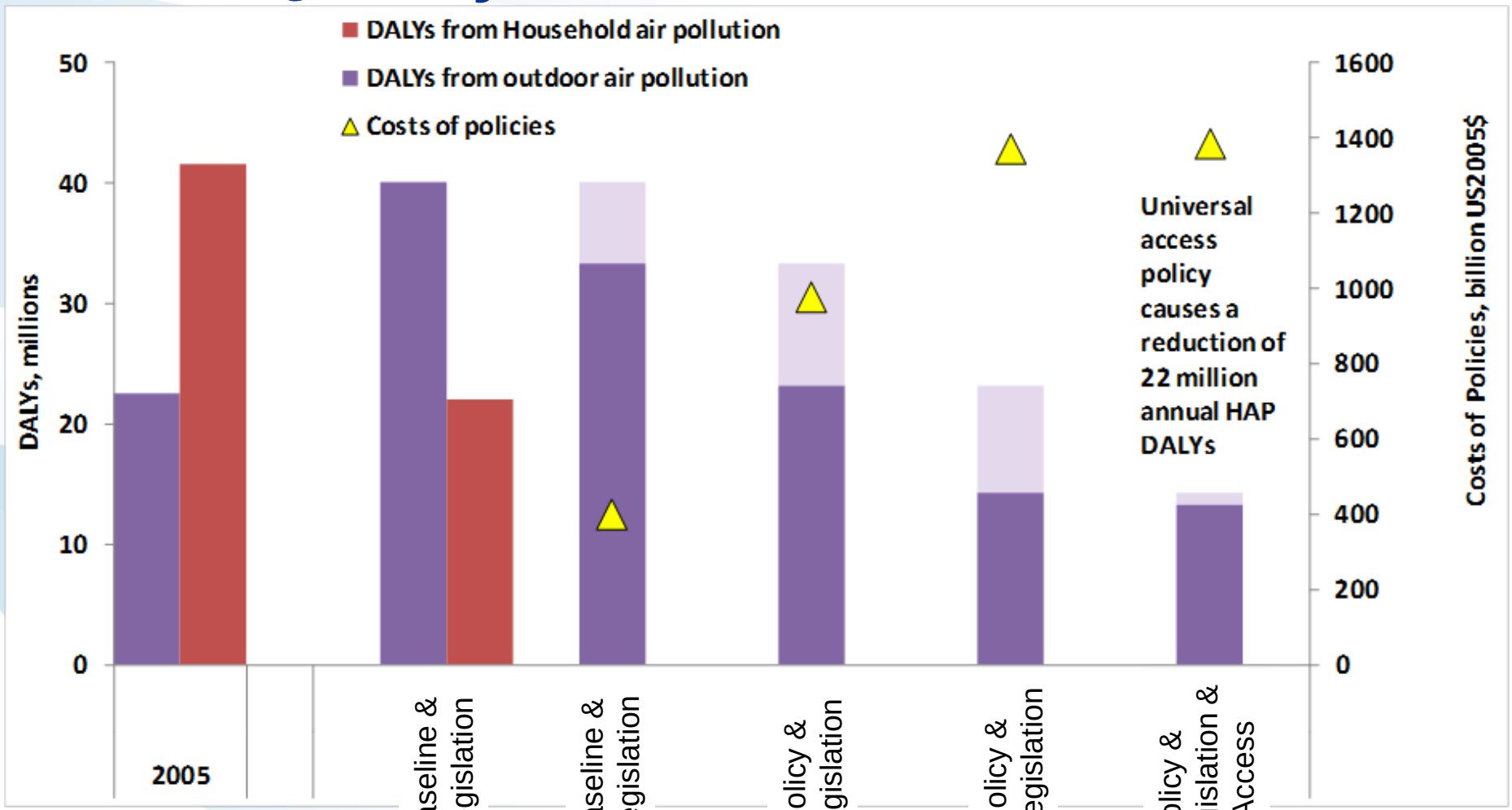
Air Quality and Health Co-Benefits





Source: IPCC WGIII AR5, Figure SPM.6/6.33

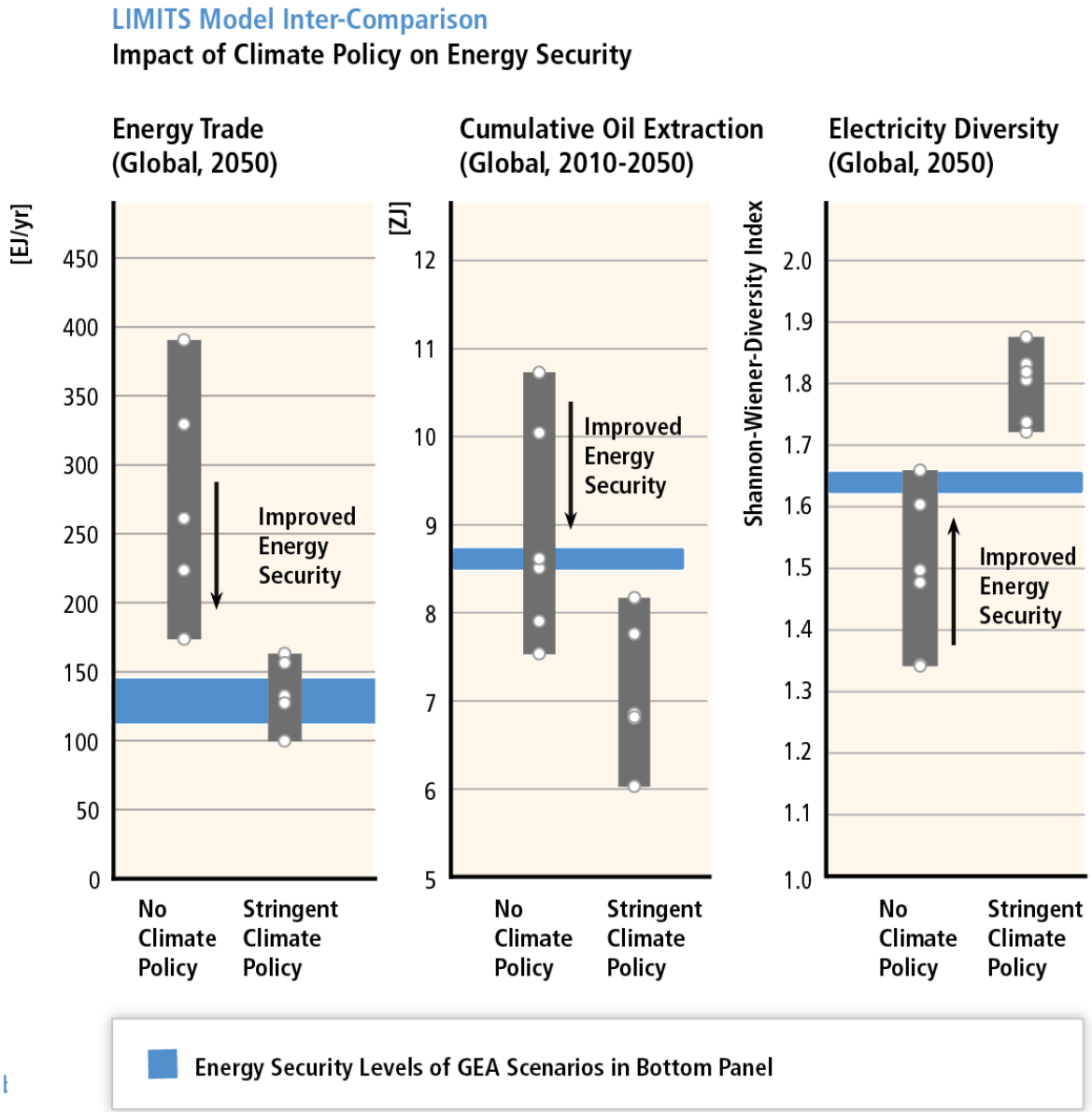
Air Quality and Health Co-Benefits



Source: Rao, Pachauri et al., 2013

Energy Security

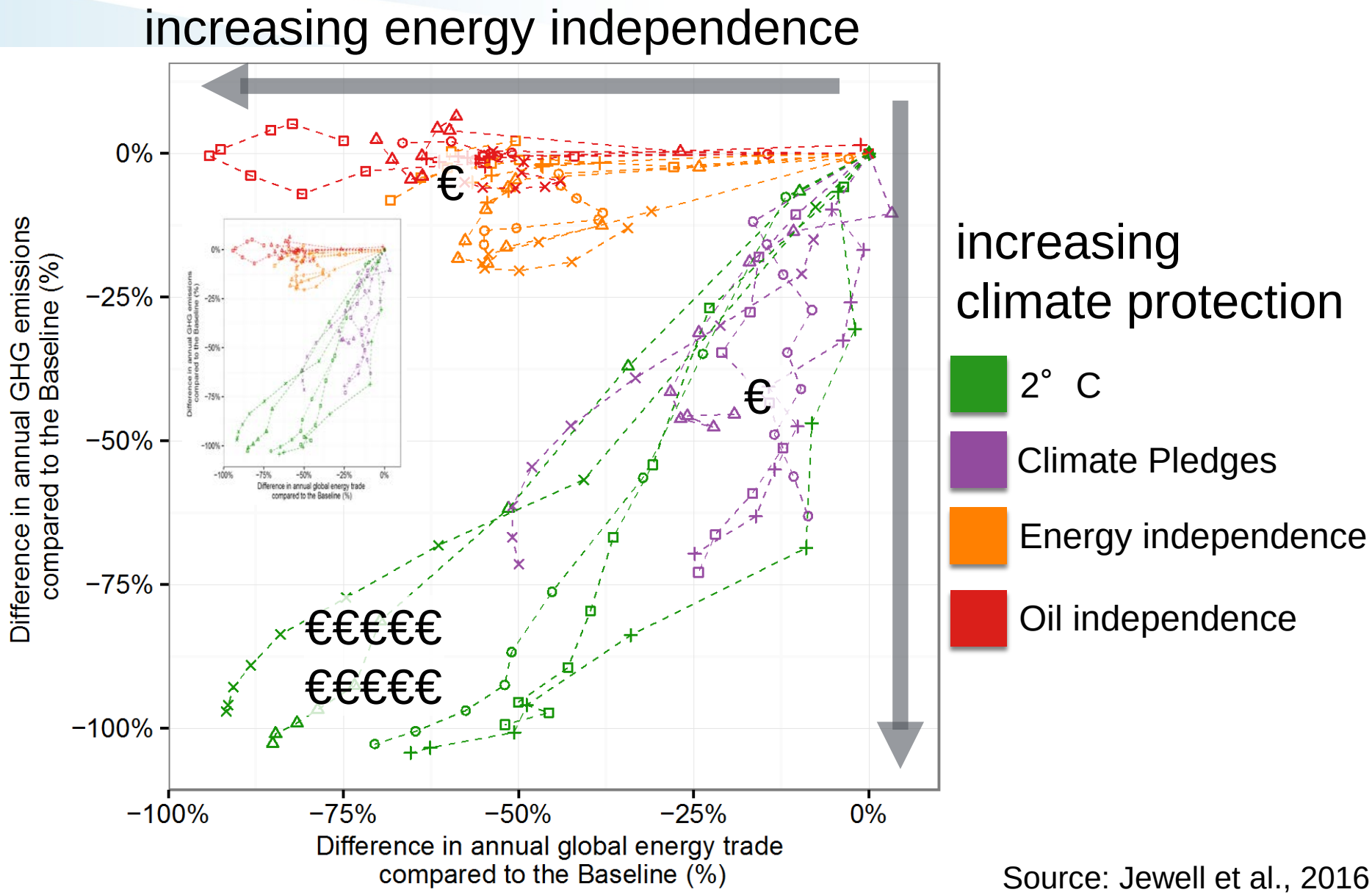
Co-Benefits of Climate Policy for Energy Security



Working Group III contril

Source: IPCC WGIII AR5, Figure 6.33

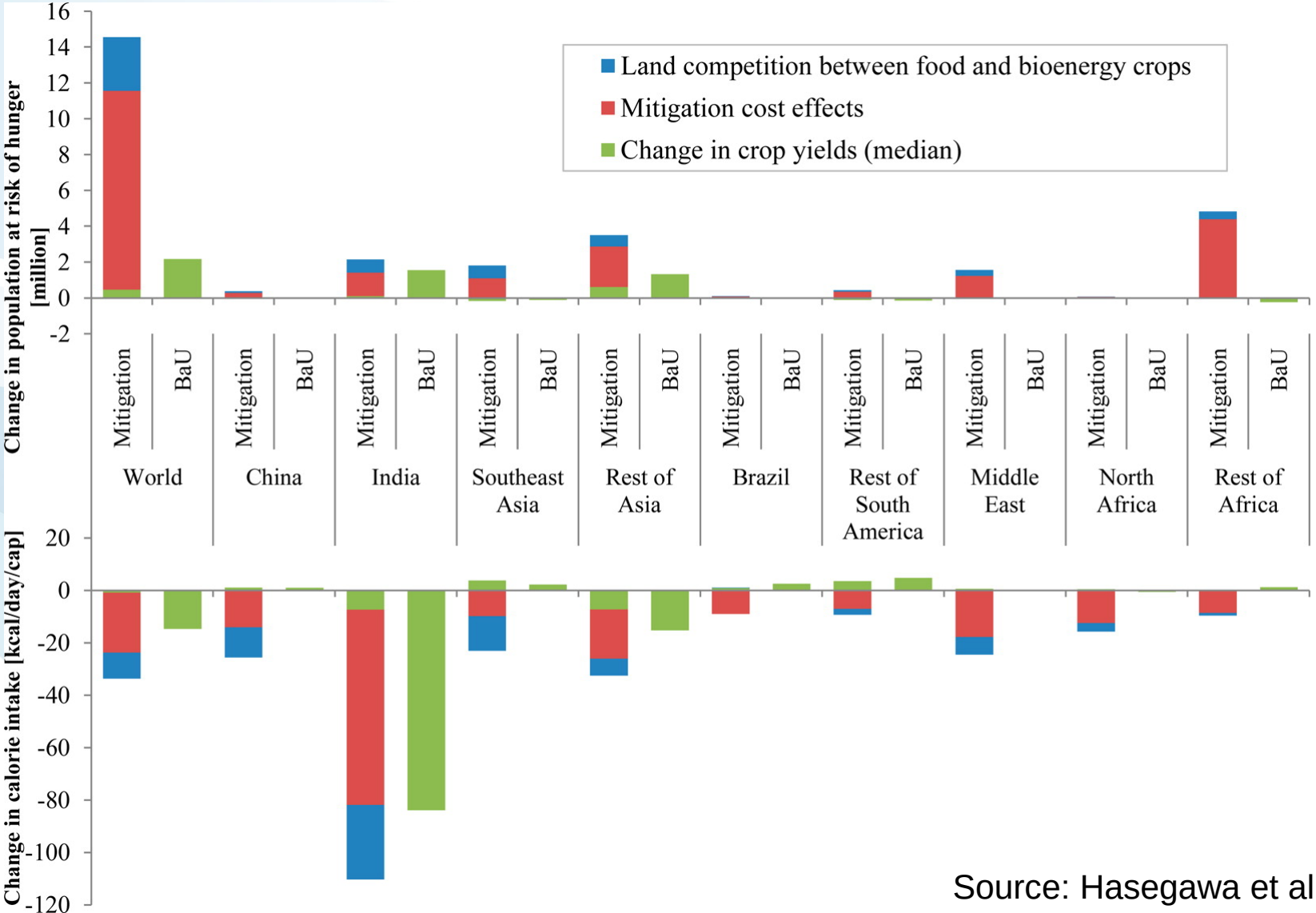
Energy Independence vs. Climate Policy



Source: Jewell et al., 2016

Food Security, Climate Impacts and Mitigation

Food availability and hunger



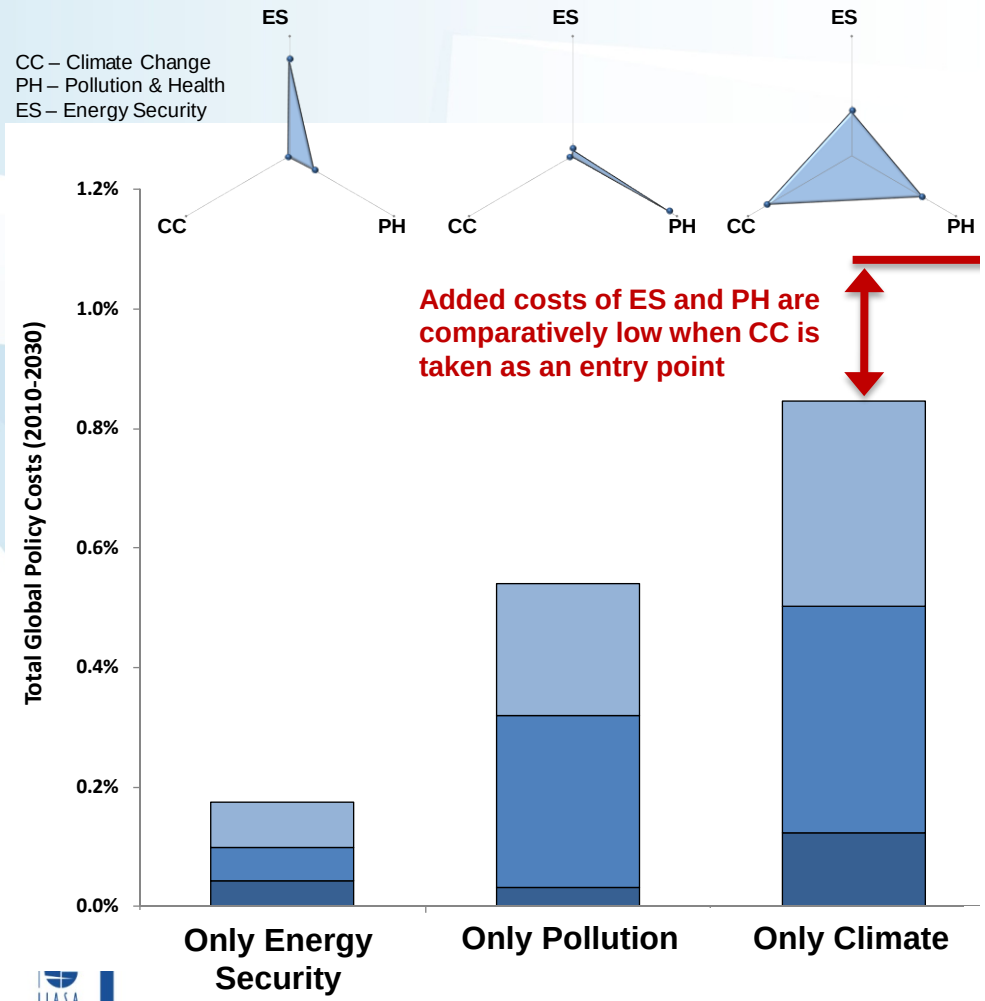
Source: Hasegawa et al. 2015

Holistic Strategies (and more Research) needed

nature climate change

D. McCollum, V. Krey, K. Riahi (2011)

Synergies of Multiple Energy Objectives



"Single minded" approaches for multiple challenges

Integrated Climate Pollution-Security Policies

Literature

Climate Change

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Water

- Fricko, Parkinson et al. (2016) Energy sector water use implications of a 2 °C climate policy. Environmental Research Letters 11:034011.

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- Cameron, Pachauri et al. (2016) Policy trade-offs between climate mitigation and clean cook-stove access in South Asia. Nature Energy 1:15010.

Air quality and health

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Energy Security

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Thank You!

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