



# Cambridge Institute for Sustainability Leadership Lecture

With Professor Jorgen Randers



CENTER FOR  
CLIMATE STRATEGY

***The 2052 Forecast:  
What will happen in the world to 2052?  
What should be done?***

Jorgen Randers  
Professor Emeritus  
Climate Strategy  
BI Norwegian Business School

Cambridge Institute for Sustainability Leadership  
Cambridge, October 13<sup>th</sup>, 2016

A Global Forecast  
for the Next Forty Years



Jorgen Randers

A REPORT TO THE CLUB OF ROME  
COMMEMORATING THE 40TH ANNIVERSARY OF  
*The Limits to Growth*



## 2052 – A Global Forecast for the Next Forty Years

A forecast of global  
developments to 2052,  
predicting that global  
warming will exceed +2  
deg C in mid-century  
**See [www.2052.info](http://www.2052.info)**



# World population will peak in 2040

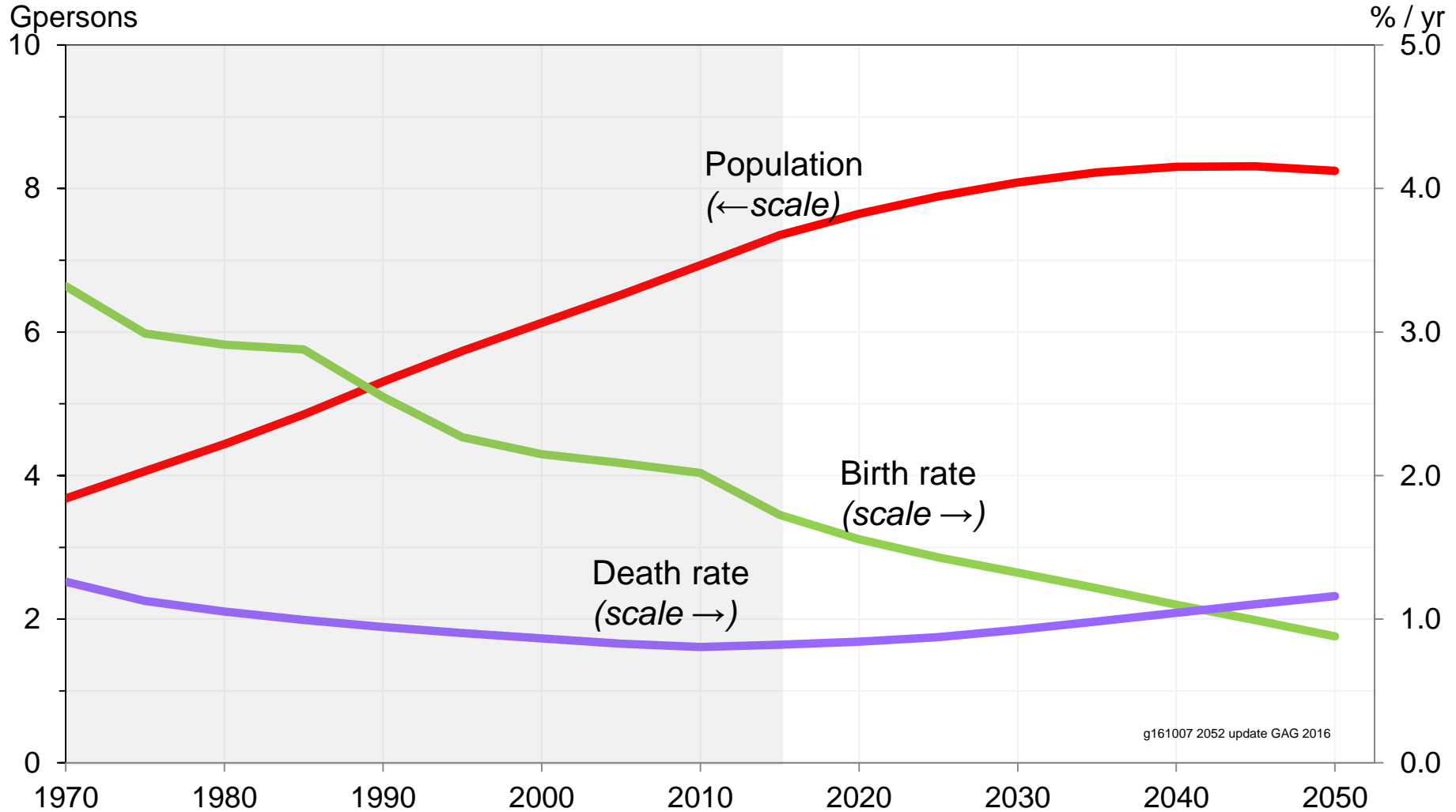
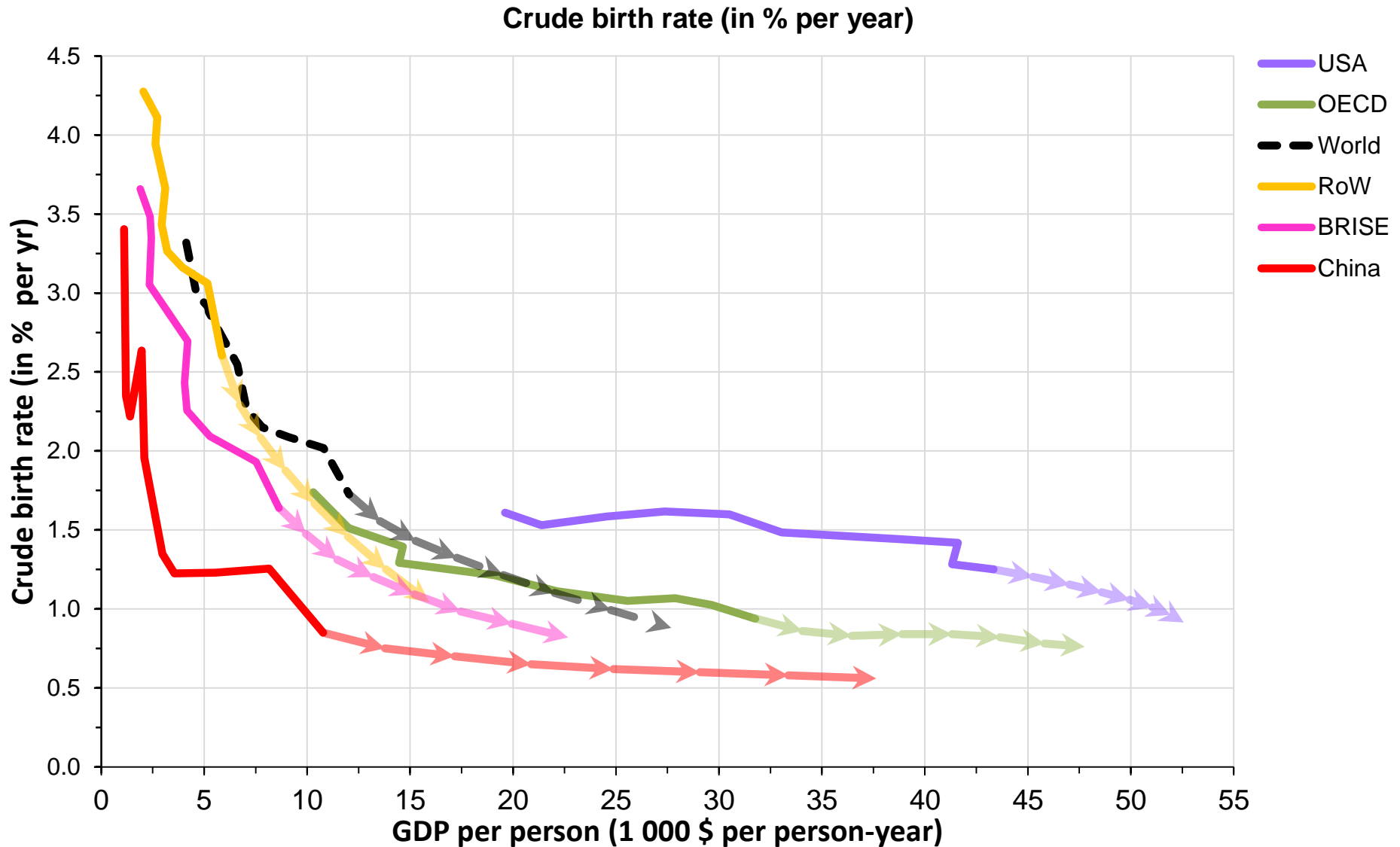


Figure 4-1 Population – World 1970 to 2050

g161007 2052 update GAG 2016

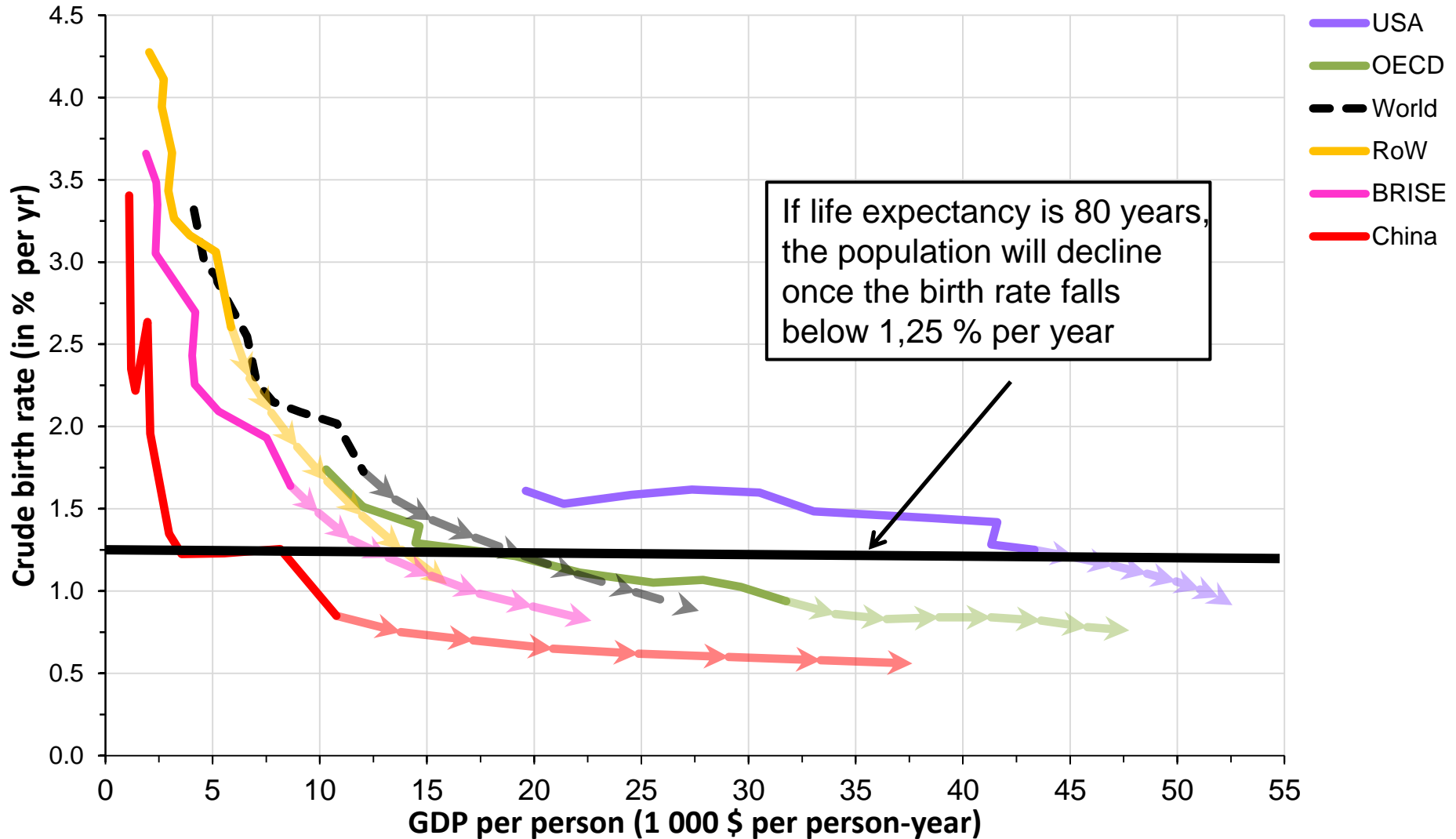
# Fertility will continue to decline



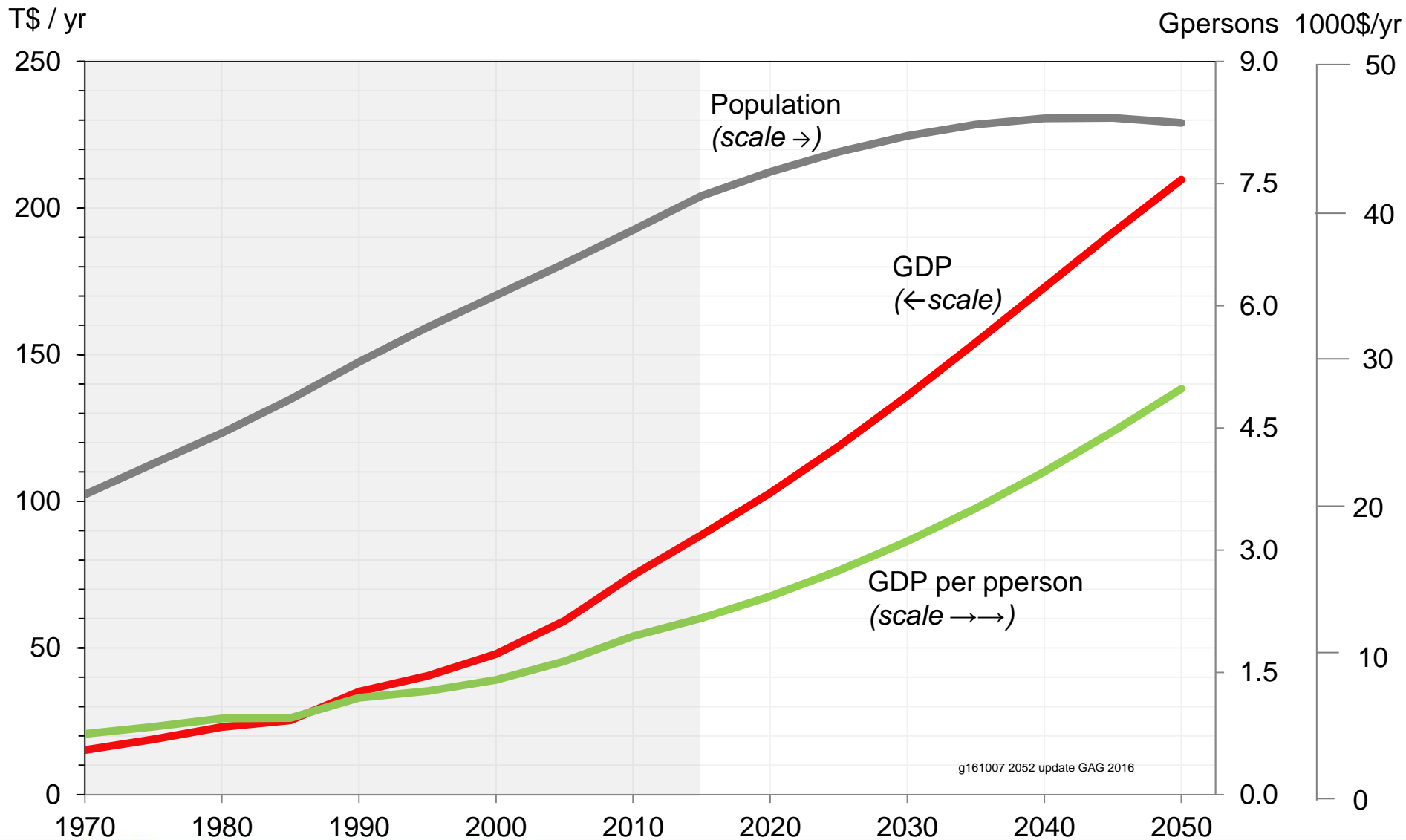


# Fertility will continue to decline

Crude birth rate (in % per year)

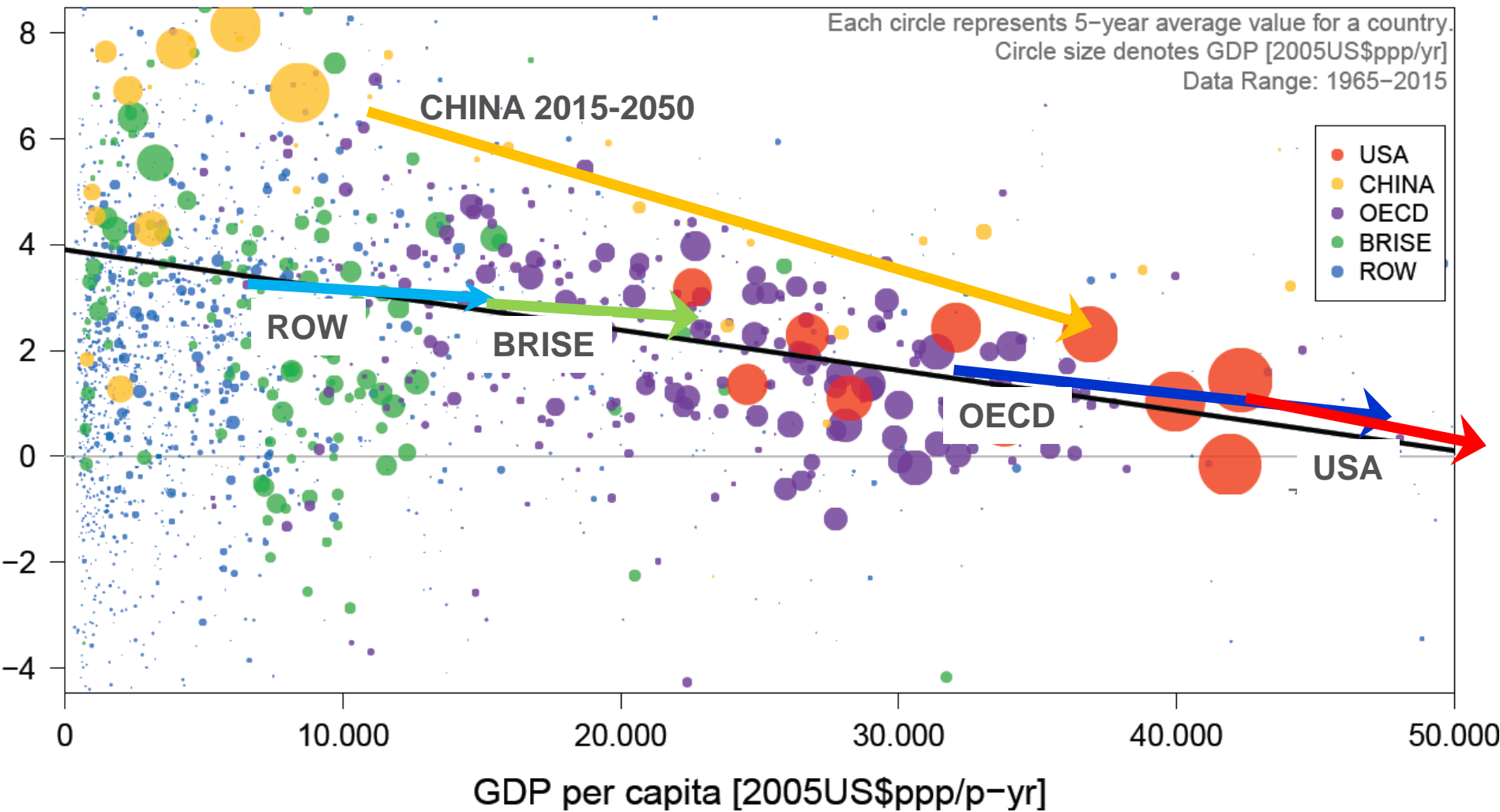


# World GDP will grow more slowly than in past



# The shift of 5 world regions from 2015 to 2050

Rate of growth in GDP per person per year (in % / yr)





# Total energy use will grow, but more slowly

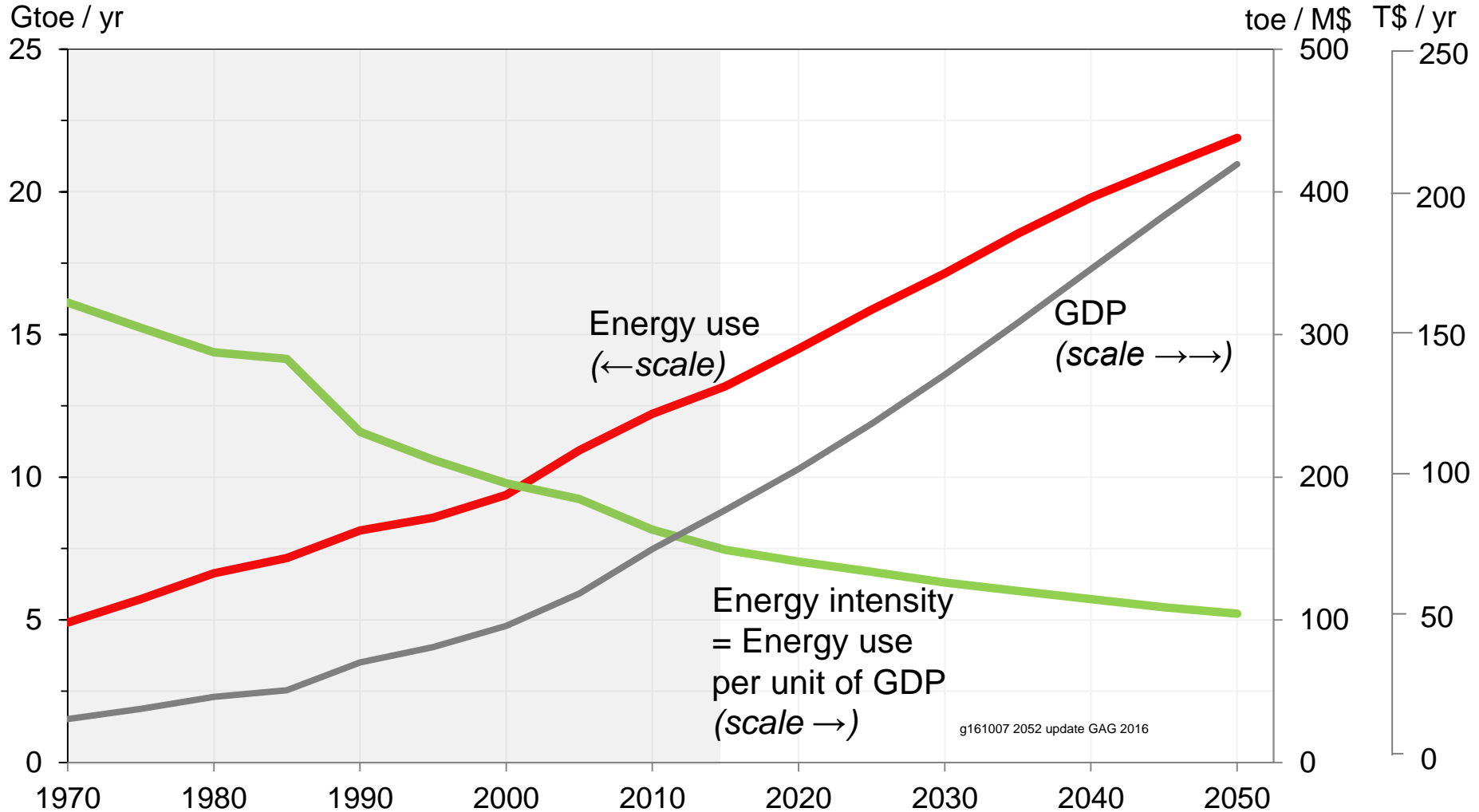


Figure 5-1: Energy Use – World 1970 to 2050

# World use of fossil fuels will peak before 2040

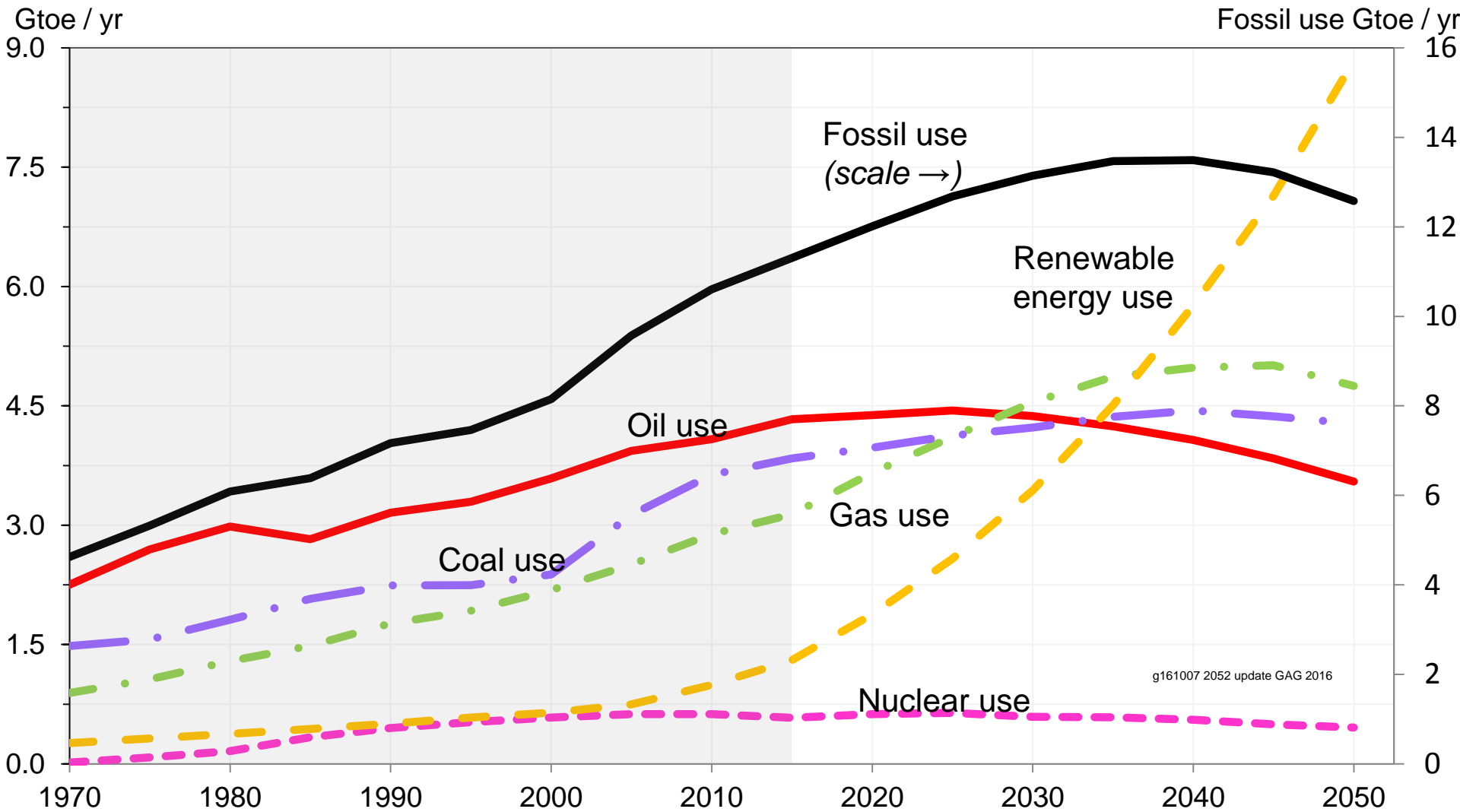


Figure 5-2: Energy Uses – World 1970 to 2052

# CO<sub>2</sub> emissions from energy will peak in 2040

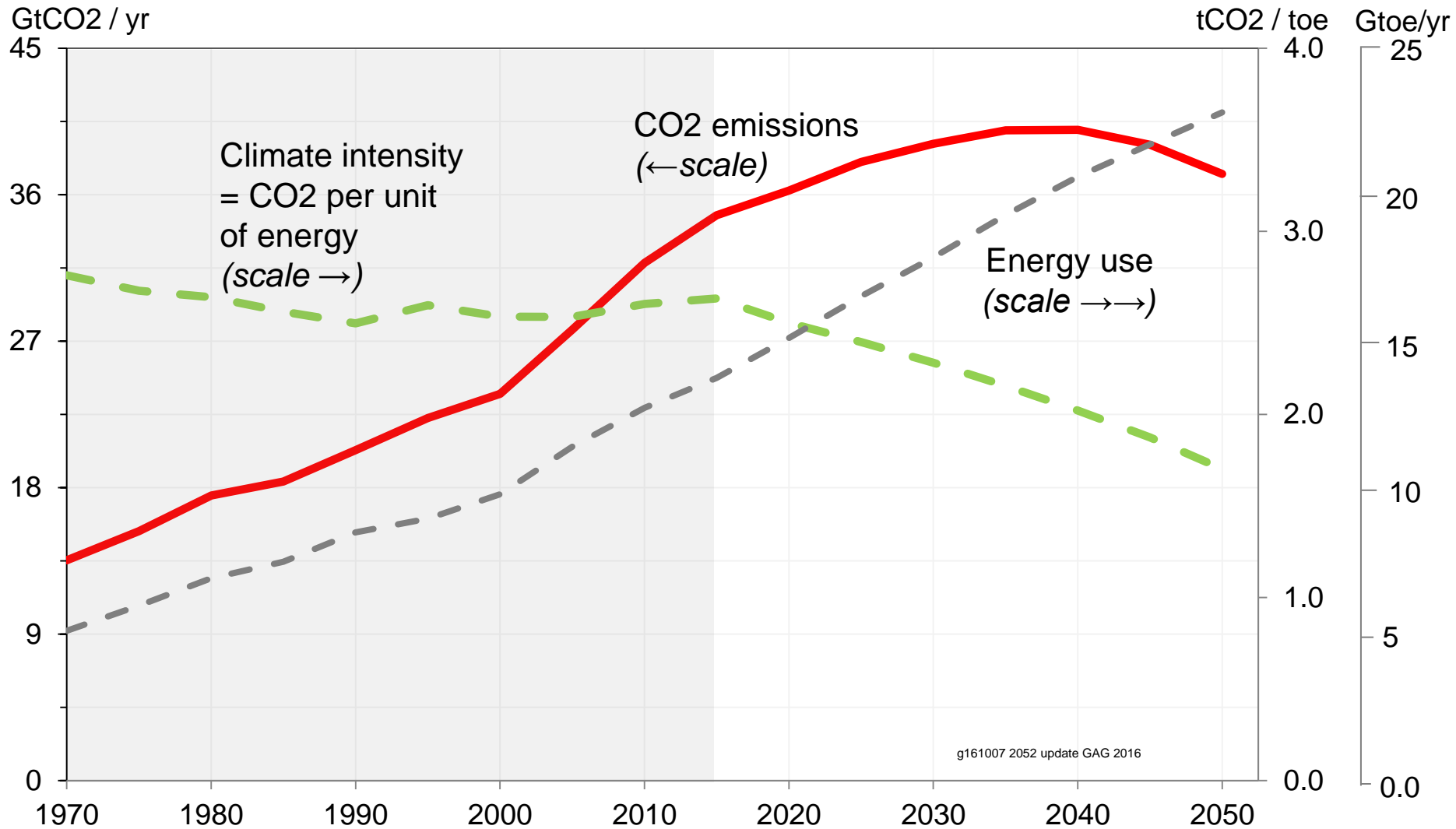


Figure 5-3: CO<sub>2</sub> Emissions from Energy Use – World 1970 to 2050.

# Temperature will pass +2 deg C before 2050

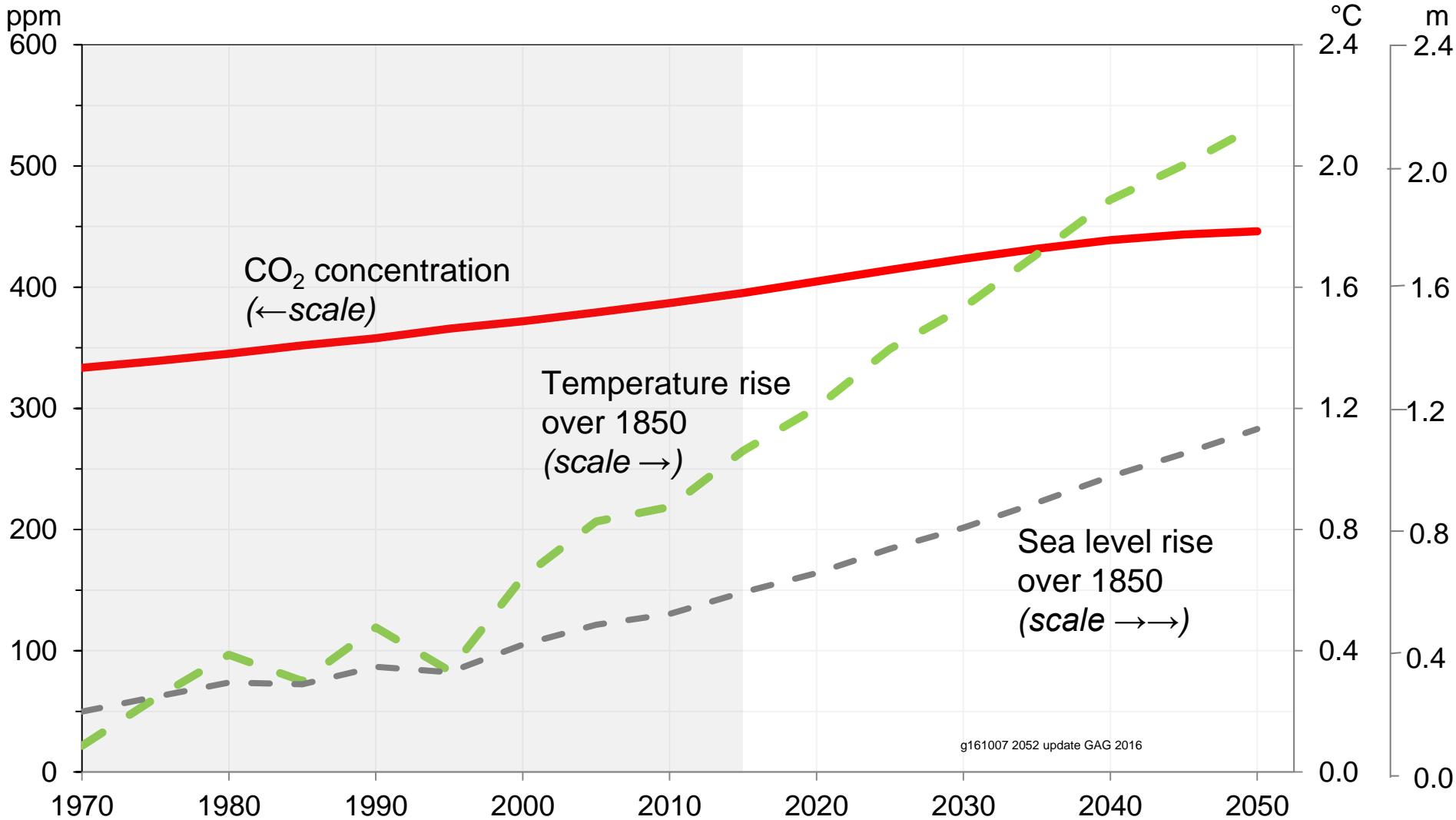
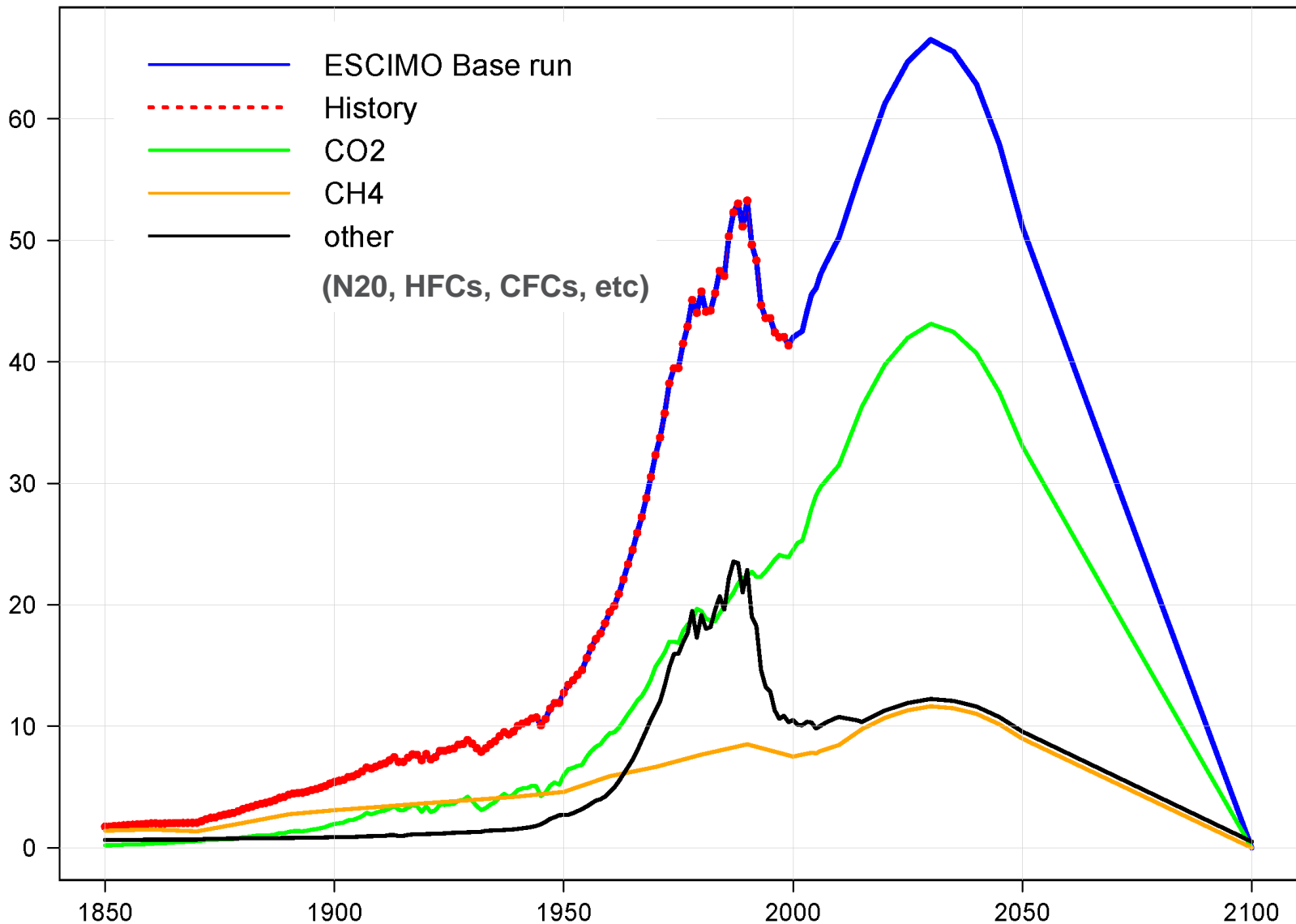
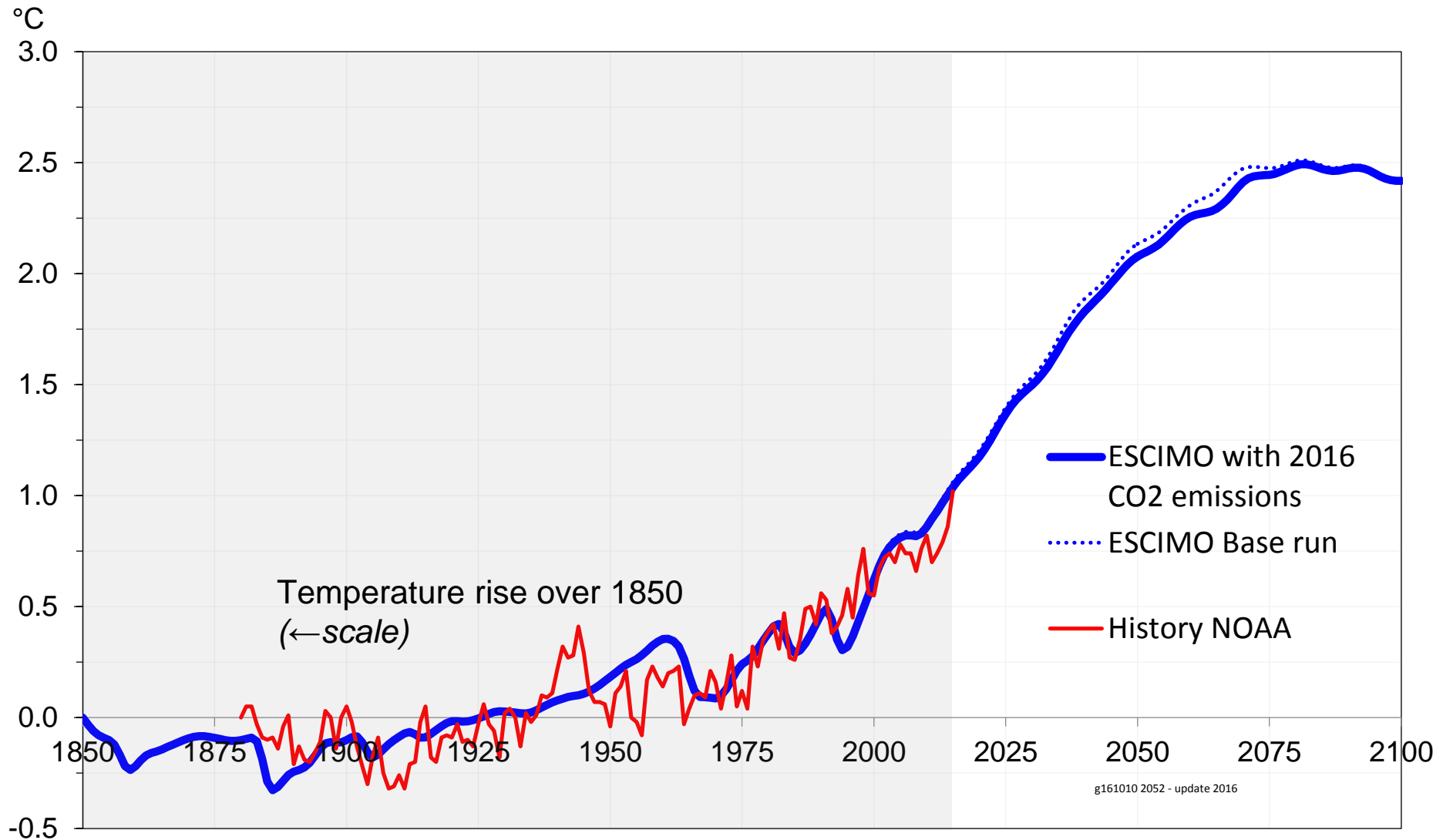


Figure 5-4: Climate Change – World 1970 to 2050

# Man-made emissions (in GtCO<sub>2</sub>e/yr)

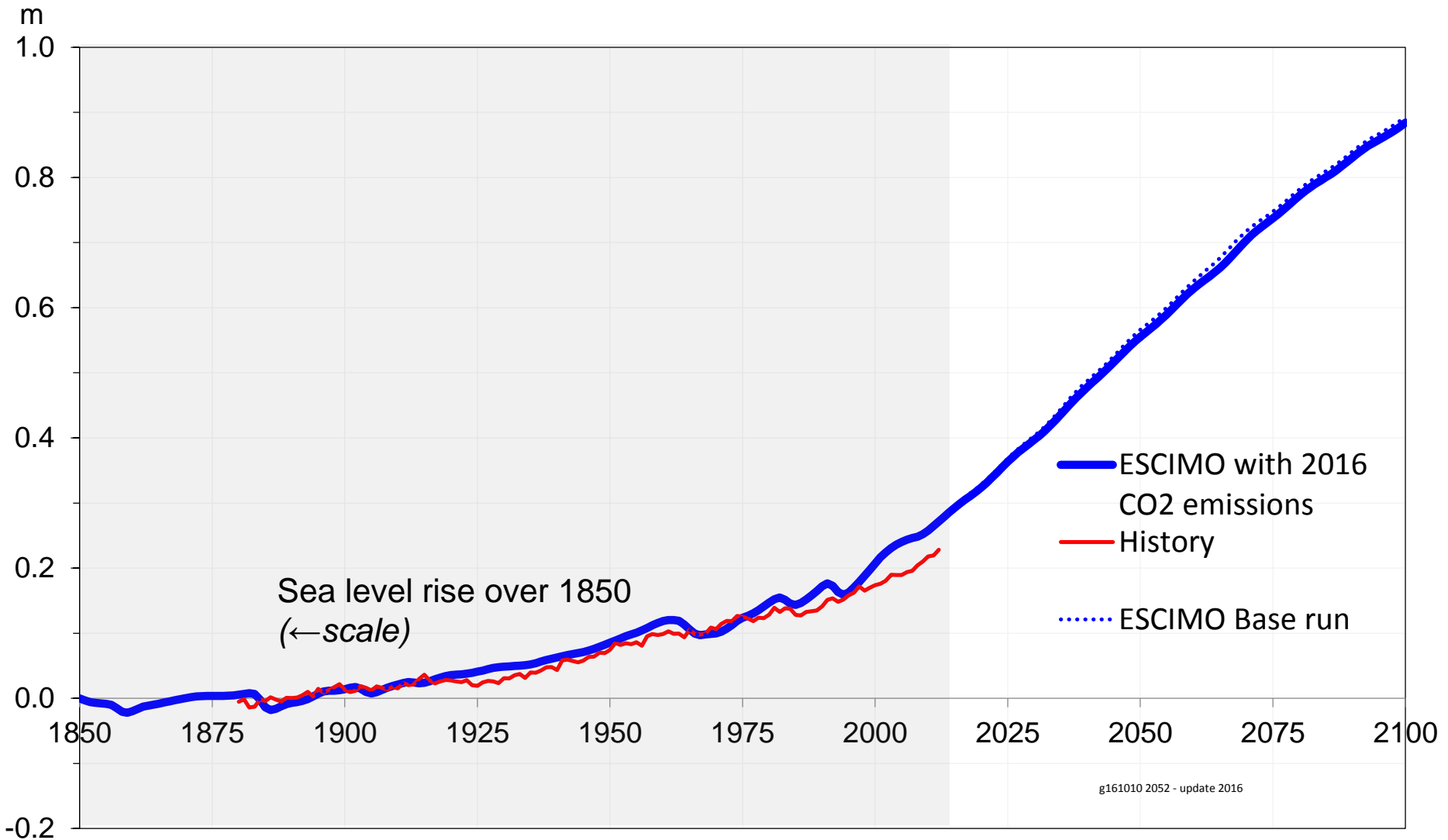


# Temperature rise (in °C over 1850)

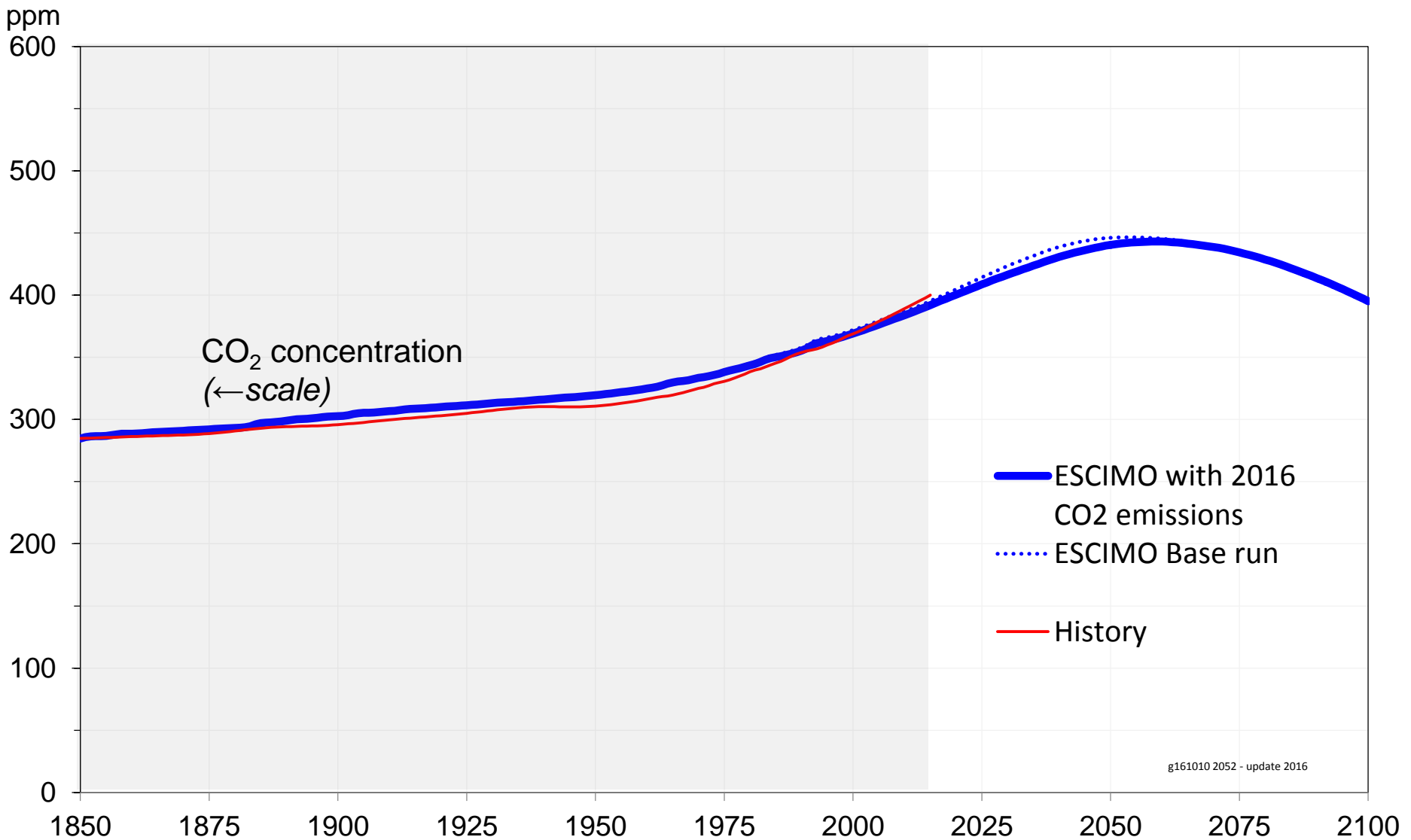




# Sea level rise (in meters over 1850 level)

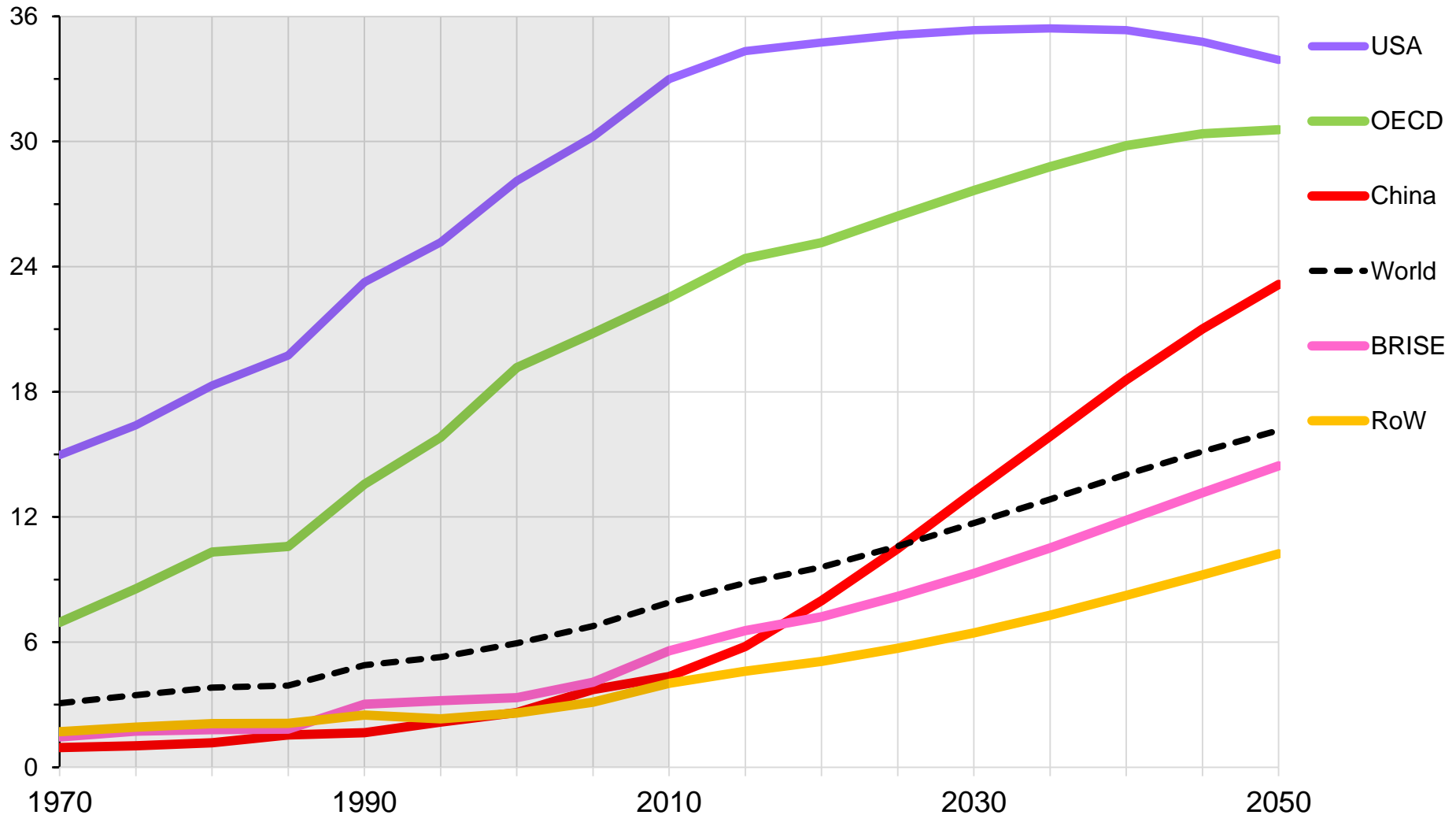


# The concentration of CO<sub>2</sub> will peak in 2075



# There will be huge regional differences

Consumption per person (in 1000 PPP US\$ per person per year)



# Main conclusions from the 2052 forecast

♣ World population and economy will grow more slowly towards 2052 than most people expect  
- but still fast enough to trigger a climate crisis

♣ Consumption growth will slow because society will have to spend ever more labour and capital on repair and adaptation

♣ The short-term nature of man  
- reflected in the short term focus of democracy and capitalism -  
is the root cause of this development

# What should be done?

To stop global warming it is enough to do a few things:

- 1. *Replace all fossil generation of electricity with renewable (solar, wind and hydro) capacity***
- 2. *Replace all fossil based transport (cars, trucks, buses) with electric vehicles***
- 3. *Insulate all buildings to gold standard***
- 4. *Shift to climate-friendly procedures in agriculture, forestry and waste handling – to get rid of the last 20 % of man-made emissions***
- 5. *Retrofit carbon capture and storage (CCS) on remaining point sources (cement, steel, etc)***

If done over next 35 years, the cost will be around 500 US\$ per person per year. The funds could be obtained through green taxes (very unpopular) or by printing new money (very unconventional).

# A much better future is indeed possible

- 1.** Solving the climate challenge is technically feasible, and not very costly
- 2.** It requires a shift of less than 2 % of the world's labor and capital from “dirty” to “clean” sectors
- 3.** This solution will be resisted by the incumbent workers and owners in the dirty sectors
- 4.** And by those who dislike higher taxes and more regulation
- 5.** The challenge is purely political. It amounts to finding ways to do the shift which is supported by a majority of the voters.

The dream are climate policies that provide a short term benefit to a majority of the voters.



# The EU carbon price has remained low



# Simpler to use regulation than the market

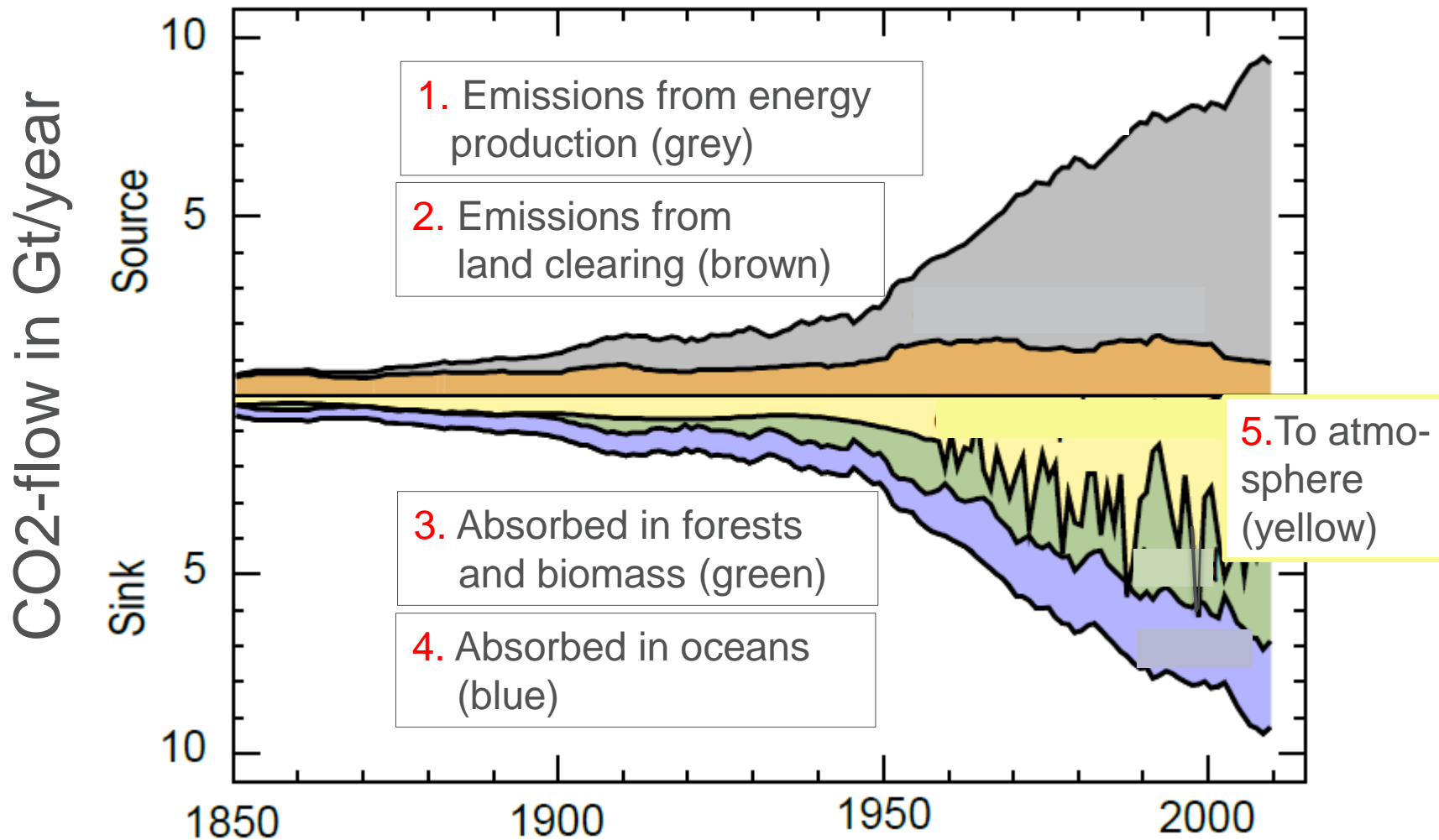
Many good examples exist:

- a.** *The subsidy paid for solar and wind power in Germany (financing the energy transition)*
- b.** *The exemption of electric cars in Norway from 100% import tax*
- c.** *The ban of incandescent light bulbs in the EU (making low energy bulbs competitive)*
- d.** *The ban of the use of heating oil in Oslo from 2020 (passed 10 years earlier)*
- e.** *The green stimulus packages in Korea (paying workers to make the country more energy efficient)*

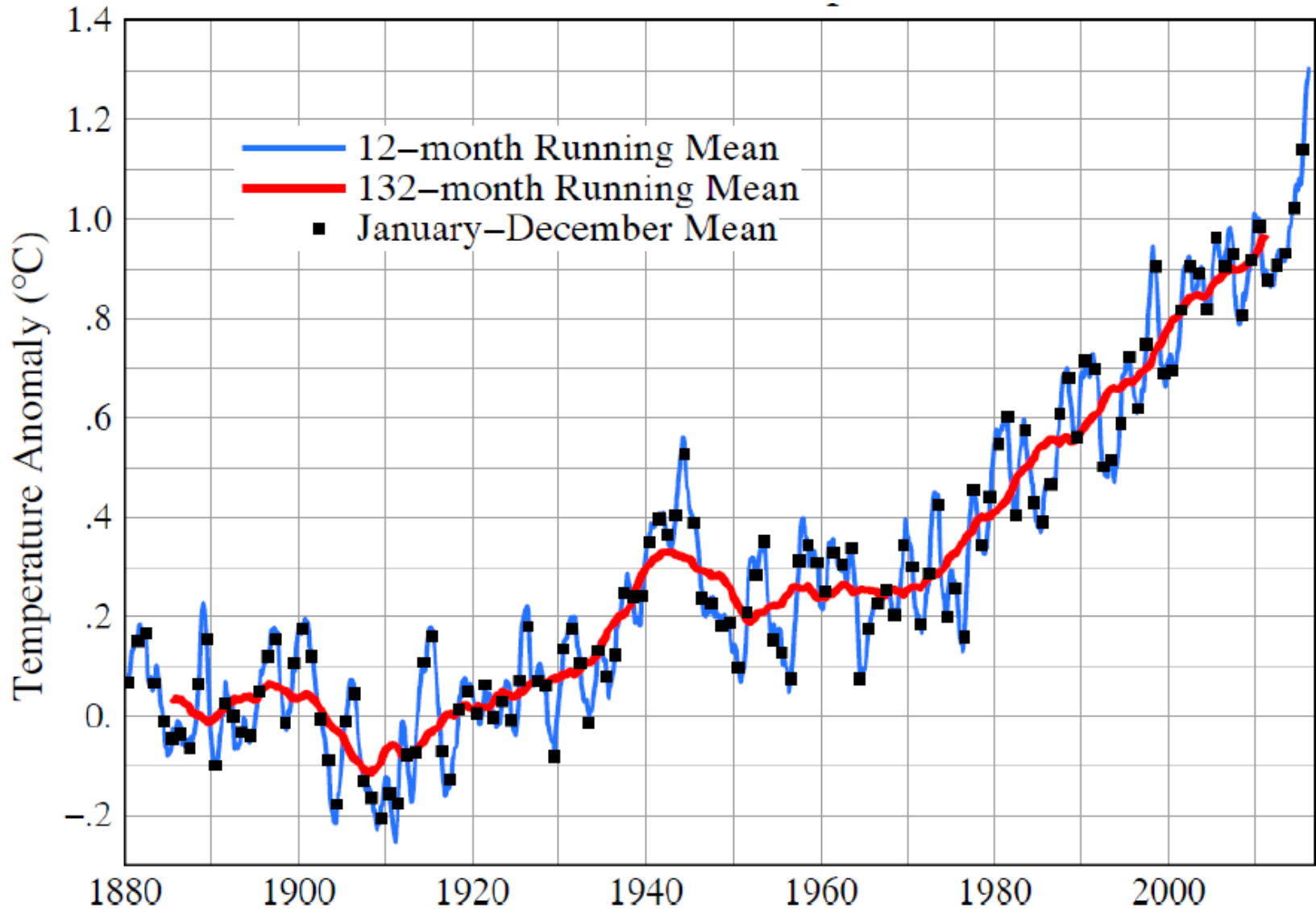
# It is time to act – decisively!



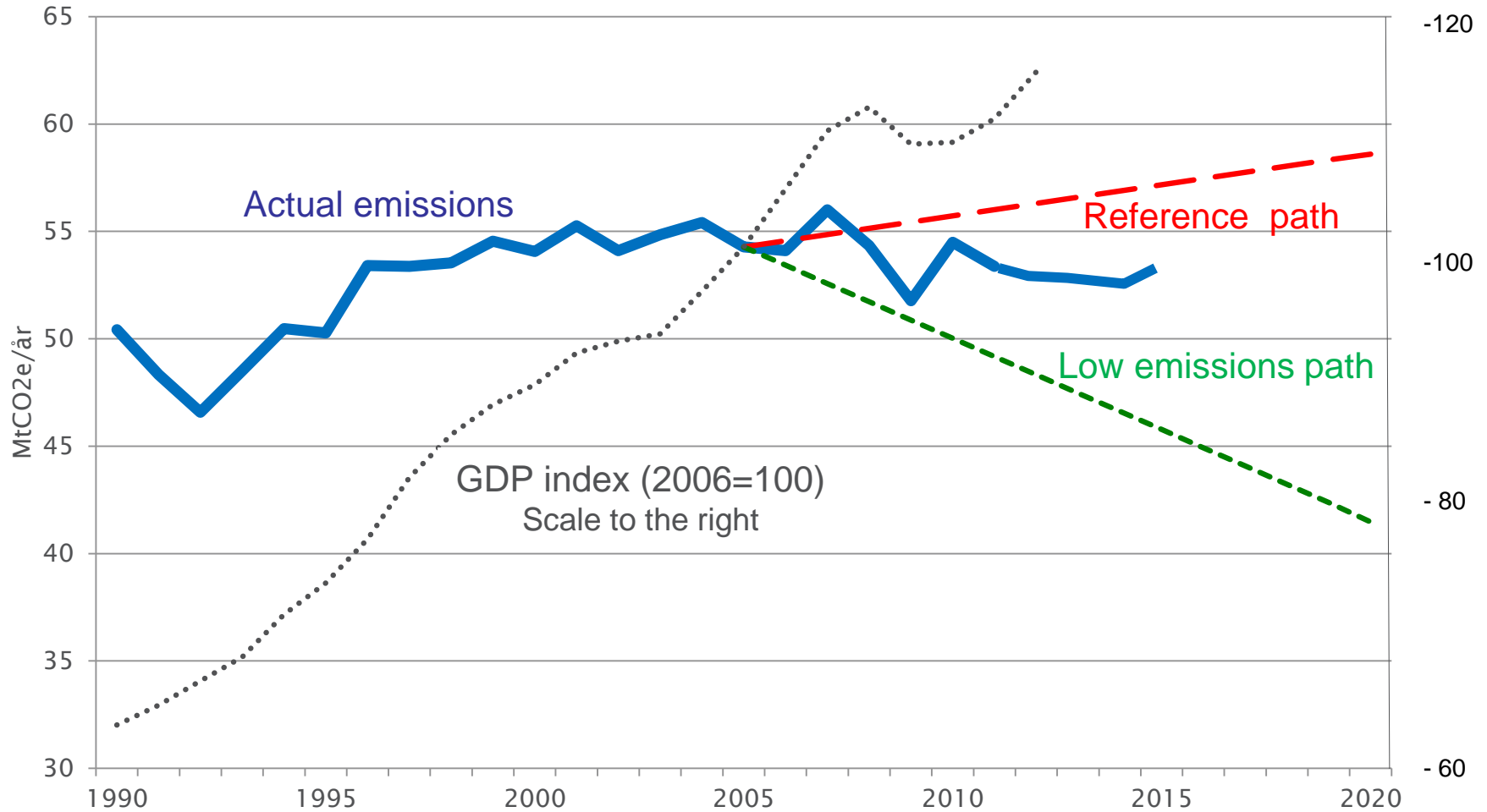
# 50 % of human CO2 ends in the atmosphere



# Global Surface Temperature (in °C over 1900)



# No decline in Norway's emissions since 2006





# Example: 1 % spent on solar capacity is enough

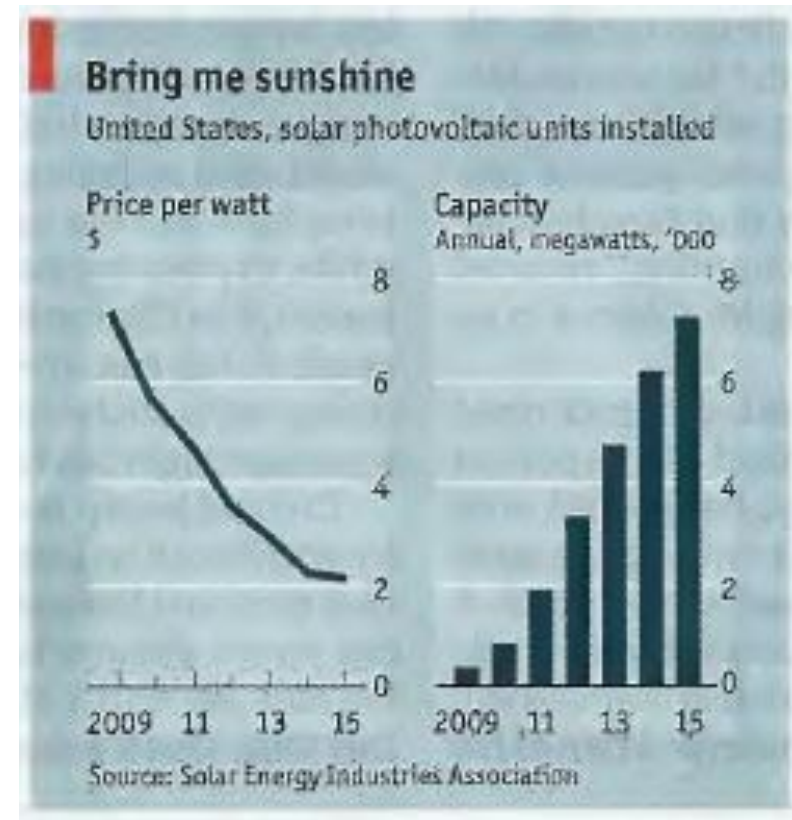
It costs 2 USD per  $W_{el}$  to install solar panels  
That is 2 G\$ per  $GW_{el}$

The GDP (annual output) of the richest world  
(US and EU 15, some 600 million people)  
is around 30.000 G\$ per year

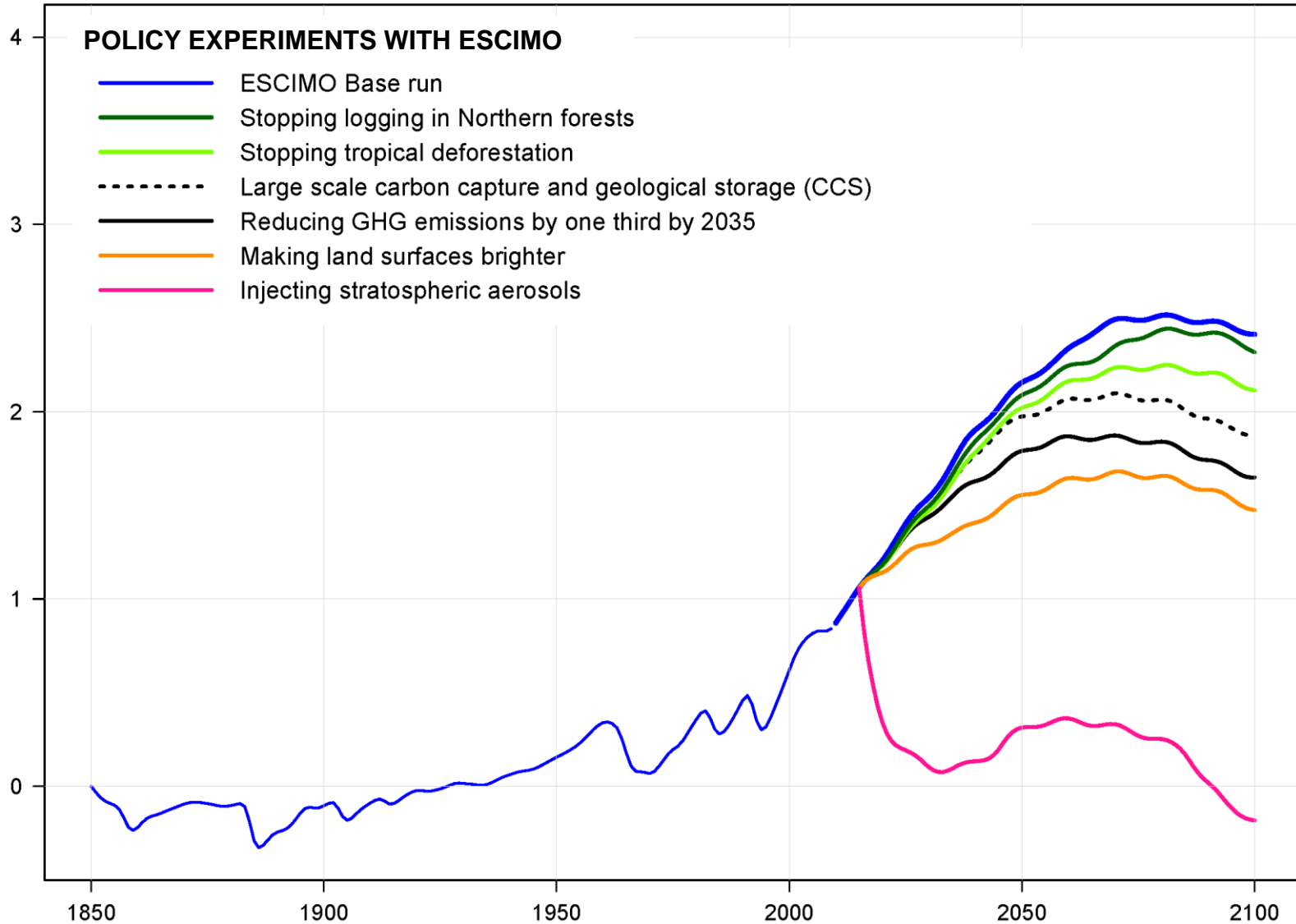
So one percent is 300 G\$ per year,  
which is enough to install 150  $Gw_{el}$  per year

Total energy use (both electricity, fuel and  
heat) in this part of the world is some  
6.000 GW (around 10 kW per person)

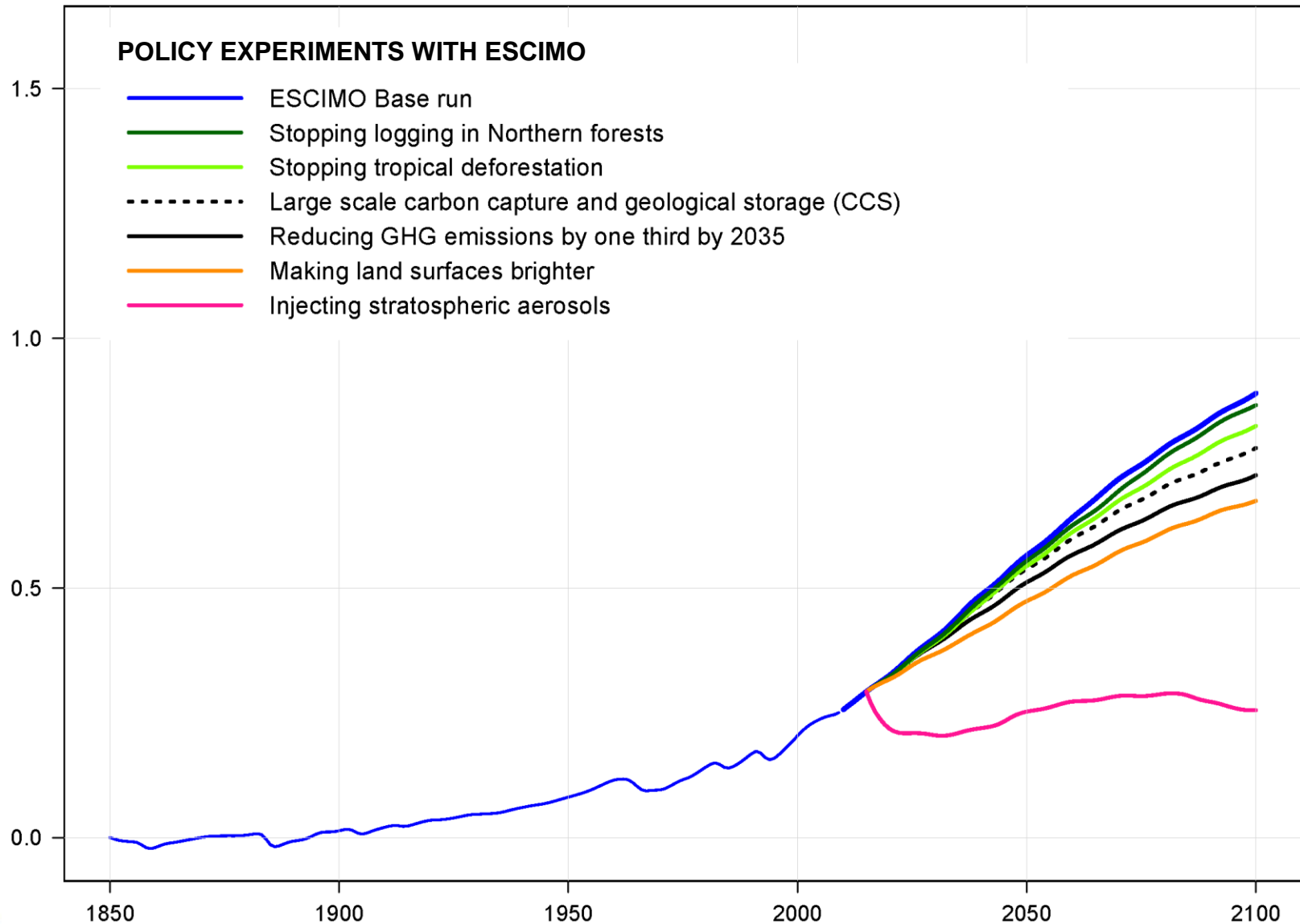
So by shifting 1 % of rich world GDP into building of solar capacity,  
one can replace all capacity in 40 years ( $= 6.000 / 150$ ) – i.e. by mid-century



# Temperature rise from various policies (in °C)



# Sea level rise from various policies (in m)



# Q&A

Professor Jorgen Randers &  
Dame Polly Courtice, Director, CISL

For business briefings, research, and information on all our activities, visit [www.cisl.cam.ac.uk](http://www.cisl.cam.ac.uk)