

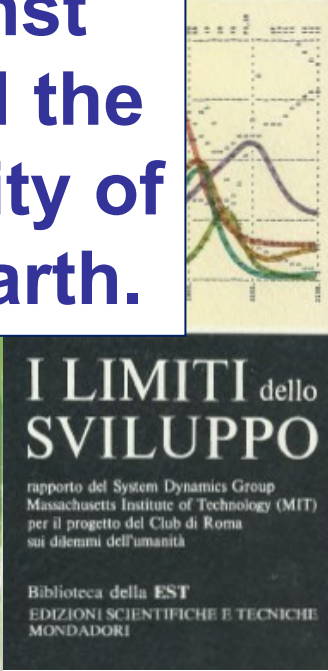
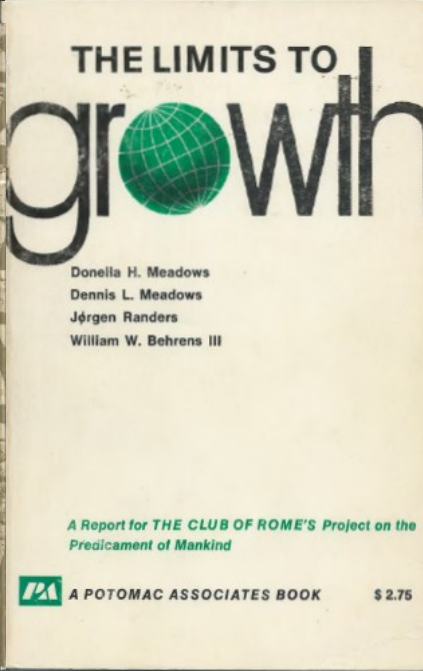
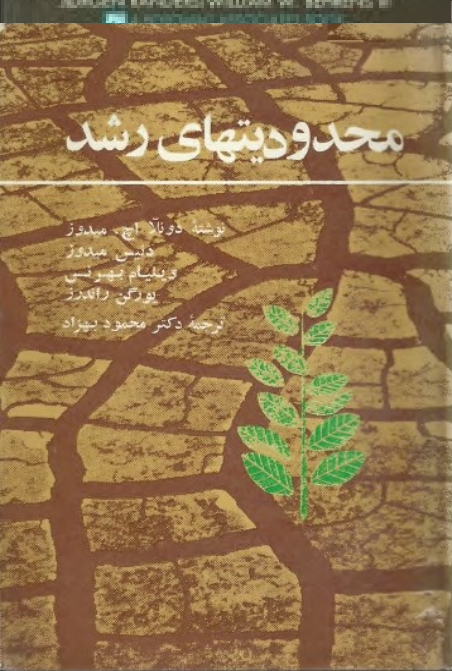
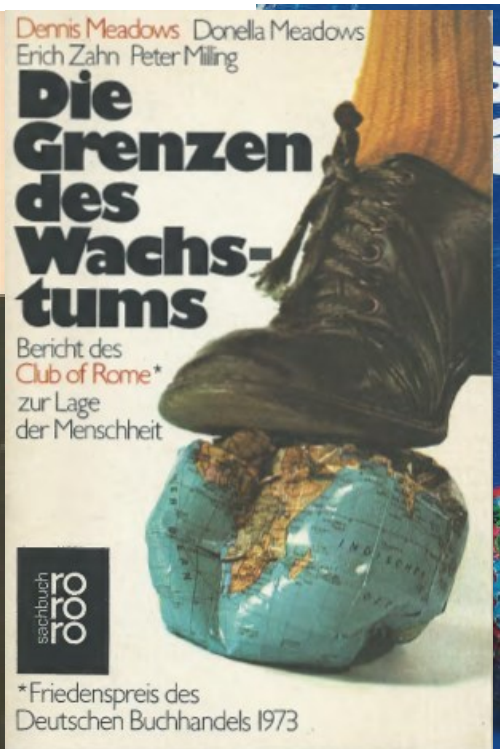
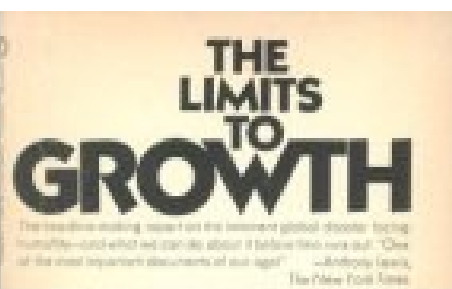


CENTER FOR
CLIMATE STRATEGY

2052 – A Global Forecast for the Next Forty Years Implications for AQPER

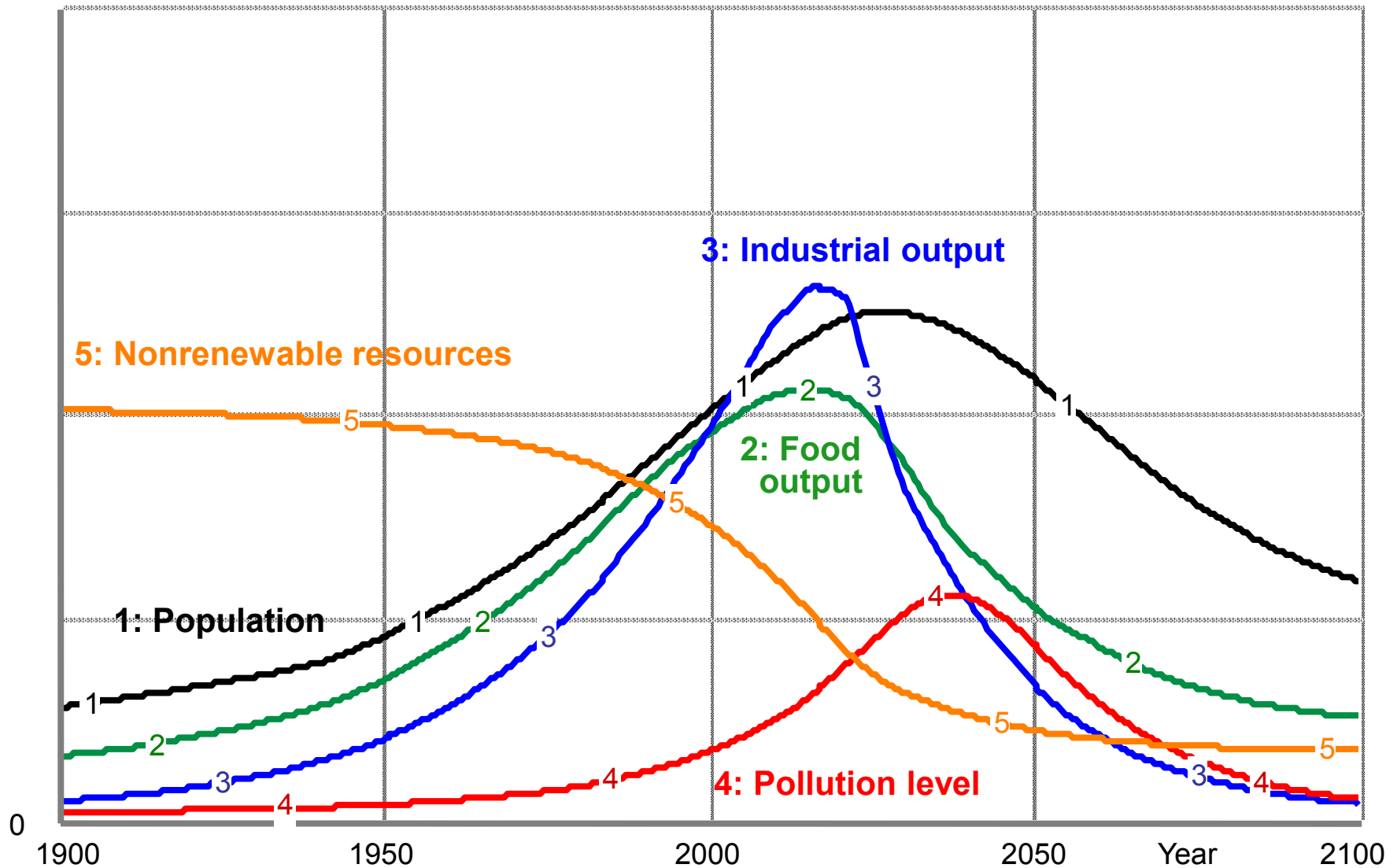
Jorgen Randers
Professor
Center for Climate Strategy
Norwegian Business School BI

Association Quebécoise de la Production d'Énergie Renouvelable
Montreal, March 11th, 2015

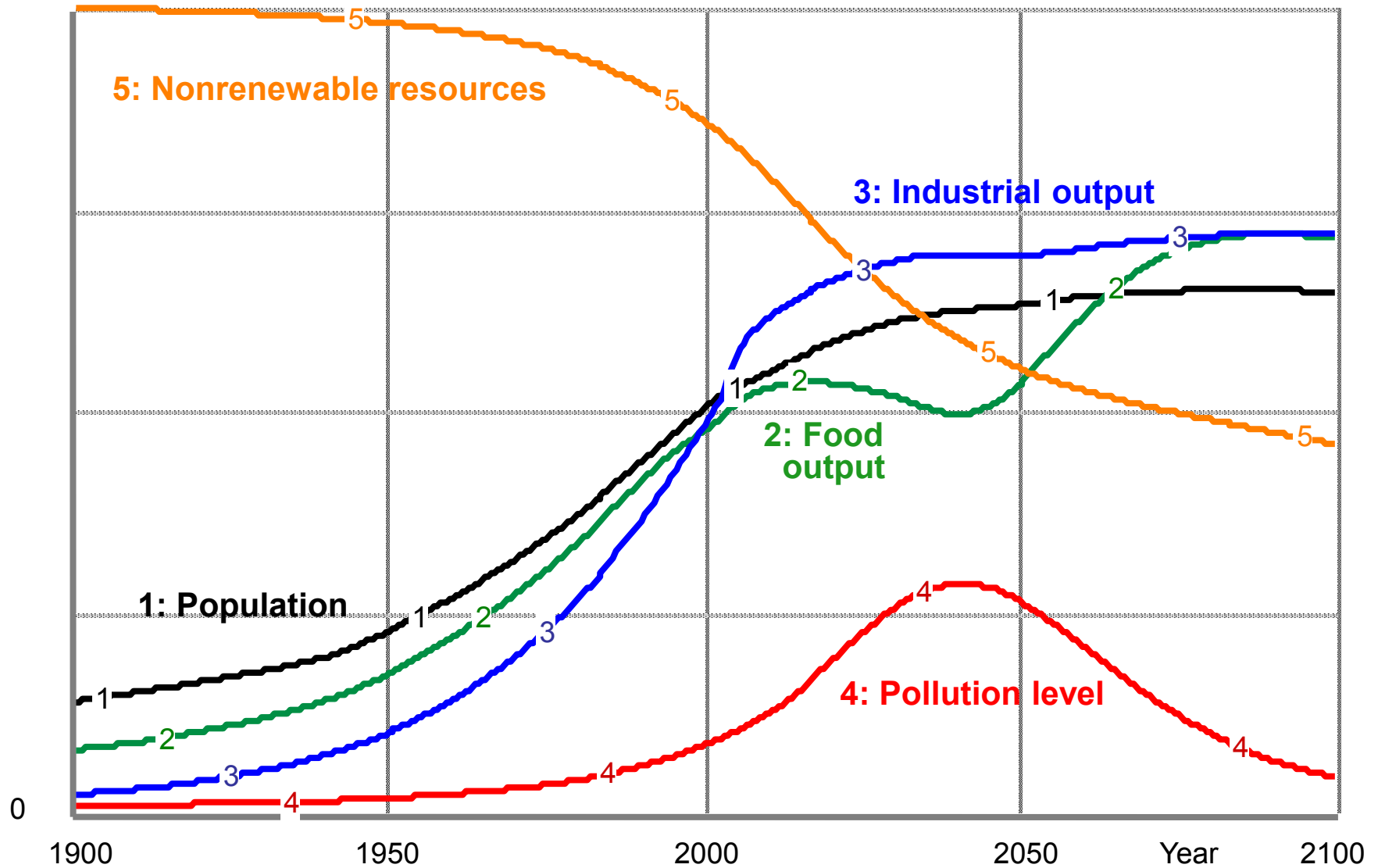


Twelve scenarios for the 21st century. Warned against growth beyond the carrying capacity of small planet Earth.

Limits Scenario 1: Resource crisis



Limits Scenario 9: Sustainability



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

EINE GLOBALE PROGNOSE
FÜR DIE NÄCHSTEN 40 JAHRE



나은 미래는
계 오지 않는다

A Global Forecast for the Next Forty Years
멈춘 세계, 나와 내 아이는 어떤 하루를 살고 있을까

요르겐 란더스 지음 | 김태훈 옮김

A forecast of global
development to 2052.
Predicts that the world will
follow the pollution
scenario in *The Limits to
Growth*, somewhat delayed.
See www.2052.info

未来四十年的中国与世界
A Global Forecast for the Next Forty Years

〔编著〕 兰德斯 · 俱乐部 · 著
译者 张其成



清华大学出版社

A GLOBAL FORECAST FOR
THE NEXT FORTY YEARS

2052

今後40年のグローバル予測

ヨルゲン・ランダース著
野中浩吉訳
1997年出版

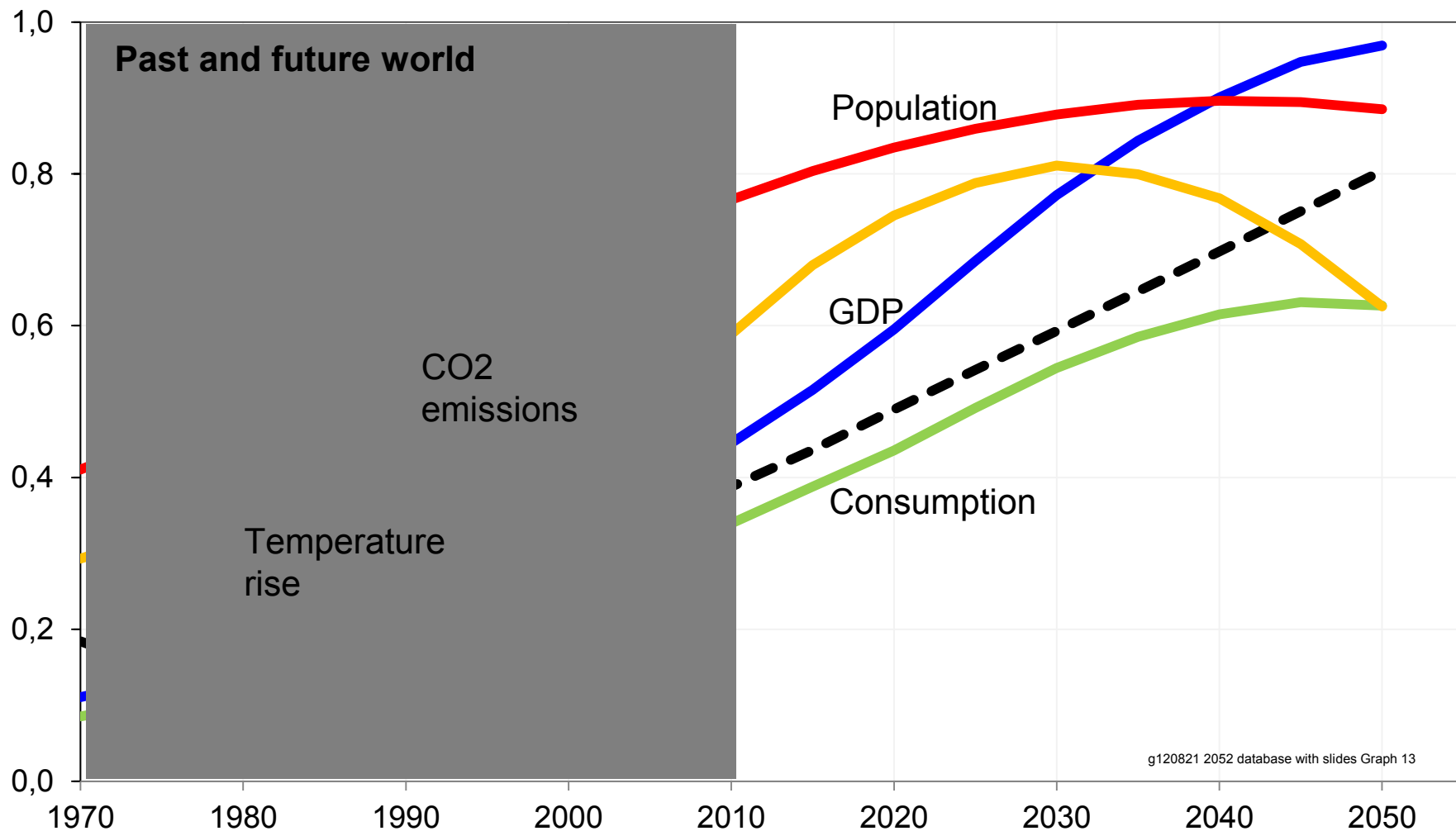
A REPORT TO THE CLUB OF ROME
COMMEMORATING THE 40TH ANNIVERSARY OF
THE LIMITS TO GROWTH

朝日新聞社

Main trends towards 2052

- 1. Slower growth – both in population and GDP**
- 2. Gradual shift towards renewable energy**
- 3. Continued growth in man-made greenhouse gas emissions**
- 4. Steadily deteriorating climate**

Central elements of the 2052 forecast

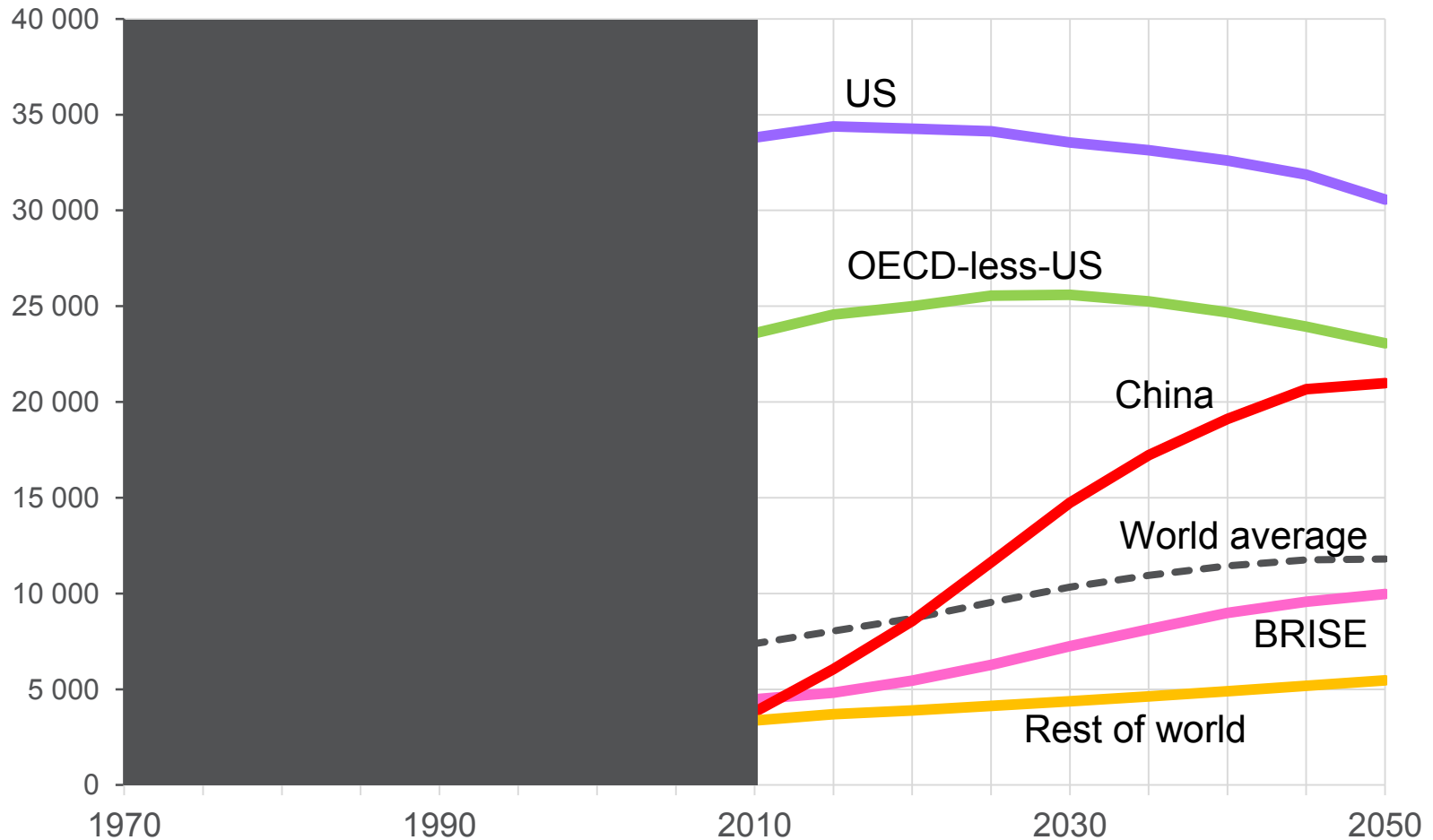


Max values **9 Gp**, **150 G\$/yr**, **50 GtCO₂/yr**, **150 G\$/yr**, **2.5 deg C**

Figure 9-1a: Past and future World - State of Affairs -1970 to 2050

There will be huge regional differences

After-tax income per person (in 2005 PPP \$ per person-year)



A much better future is possible

- 1.** It is not impossibly costly
- 2.** Requires a shift of 2 % of the world's labor and capital from dirty to clean sectors
- 3.** Is fiercely resisted by those who dislike higher taxes and more regulation, plus by the incumbent workers and owners in the dirty sectors

World energy use will peak in 2040

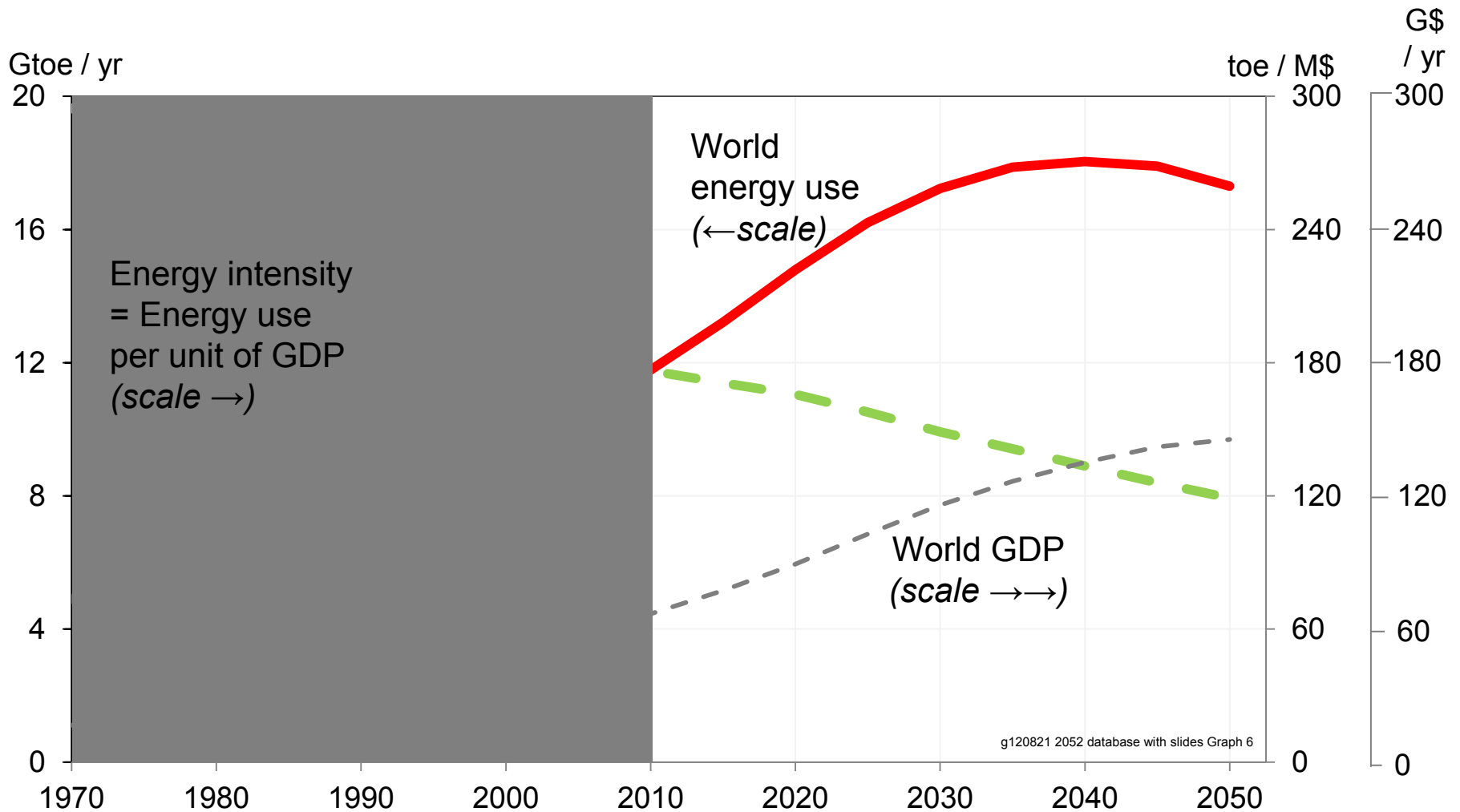


Figure 5-1: Energy Use – World 1970 to 2050

World use of fossil fuels will peak around 2030

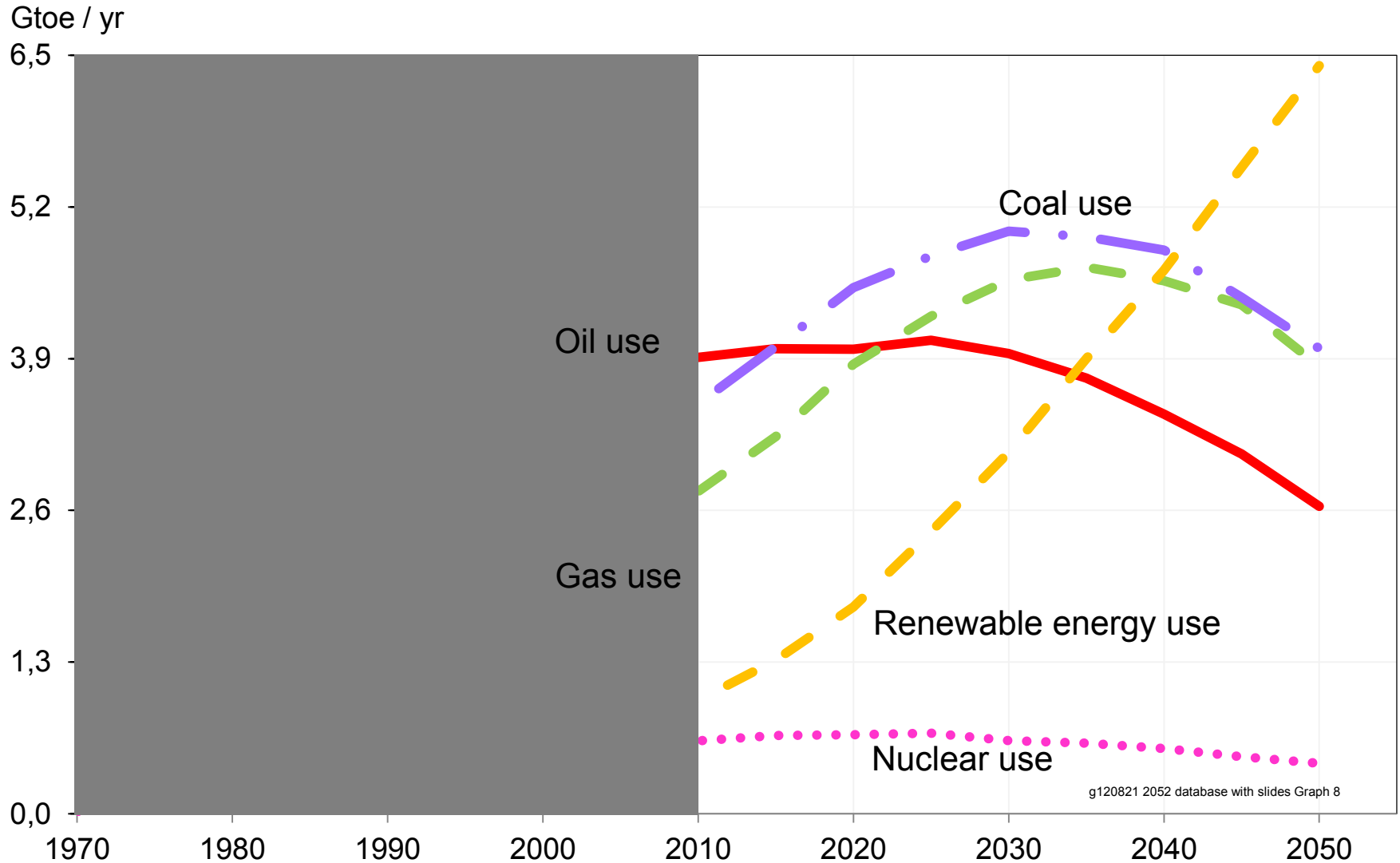


Figure 5-2: Energy Uses – World 1970 to 2052

World CO₂ emissions will peak in 2030

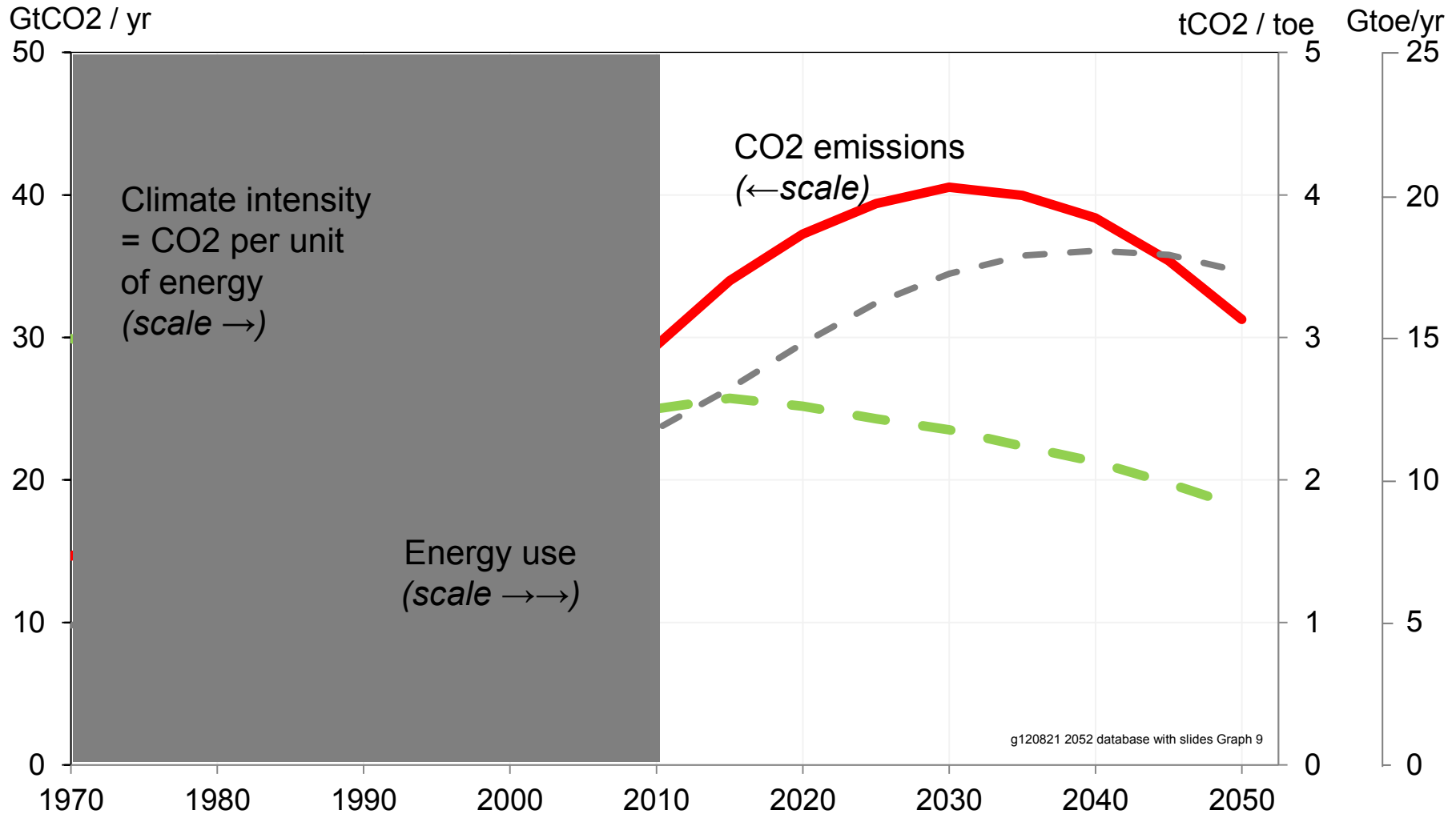


Figure 5-3: CO₂ Emissions from Energy Use – World 1970 to 2050.

Temperature will pass +2 degrees C in 2052

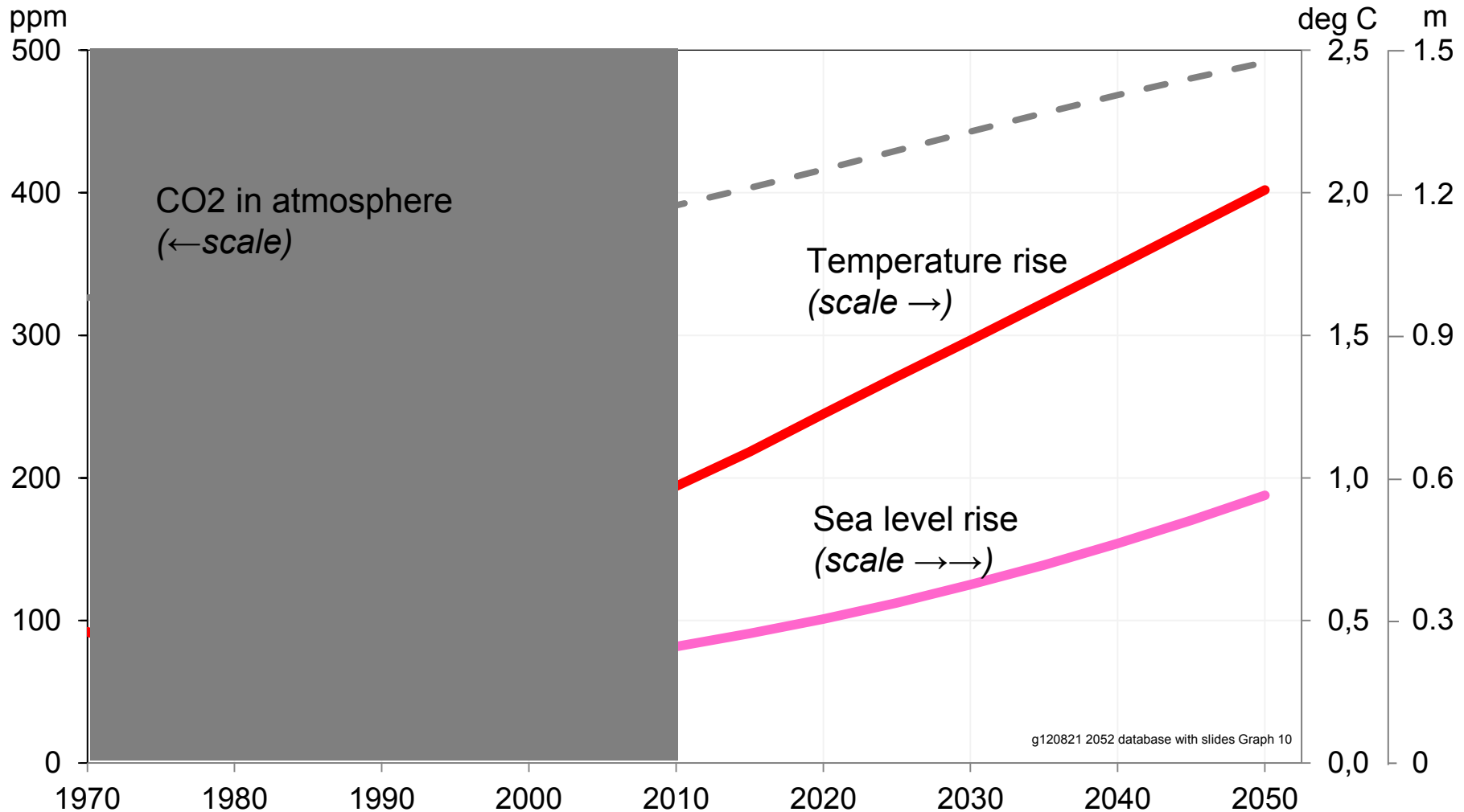


Figure 5-4: Climate Change – World 1970 to 2050

What should be done?

- 1. Stop the use of fossil fuels in transport**
- 2. Make buildings much more energy efficient**
- 3. Make manufacturing more energy efficient**
- 4. Build enough renewable energy capacity (hydro, wind, solar for power; solar and biomass for heat)**
- 5. Build enough CCS to keep us below +2 deg Centigrade**

The long-term energy solution is obvious

- 1.** Mainly electric, from climate friendly sources. No coal, oil and gas
- 2.** Most heat replaced by electricity (in buildings, manufacturing, transport)
- 3.** Cheap solar power, cheaper wind power, some solar heat
- 4.** Some gas and CCS in the transition
- 5.** Some biomass, but not from slow-growing species – they are more useful for carbon storage

What should you do?

- 1. Understand that the transition won't happen on its own – not fast enough**
- 2. Exploit every opportunity that arise for more renewables**
- 3. Get into the energy efficiency business**
- 4. Argue hard for more regulation:**
 - ban (or tax) on cheap fossil solutions
 - subsidies to renewable solutions
 - tax-financed construction of clean capacity, including R&D
- 5. Must be done while demand stagnates**

Sell it as a positive challenge!

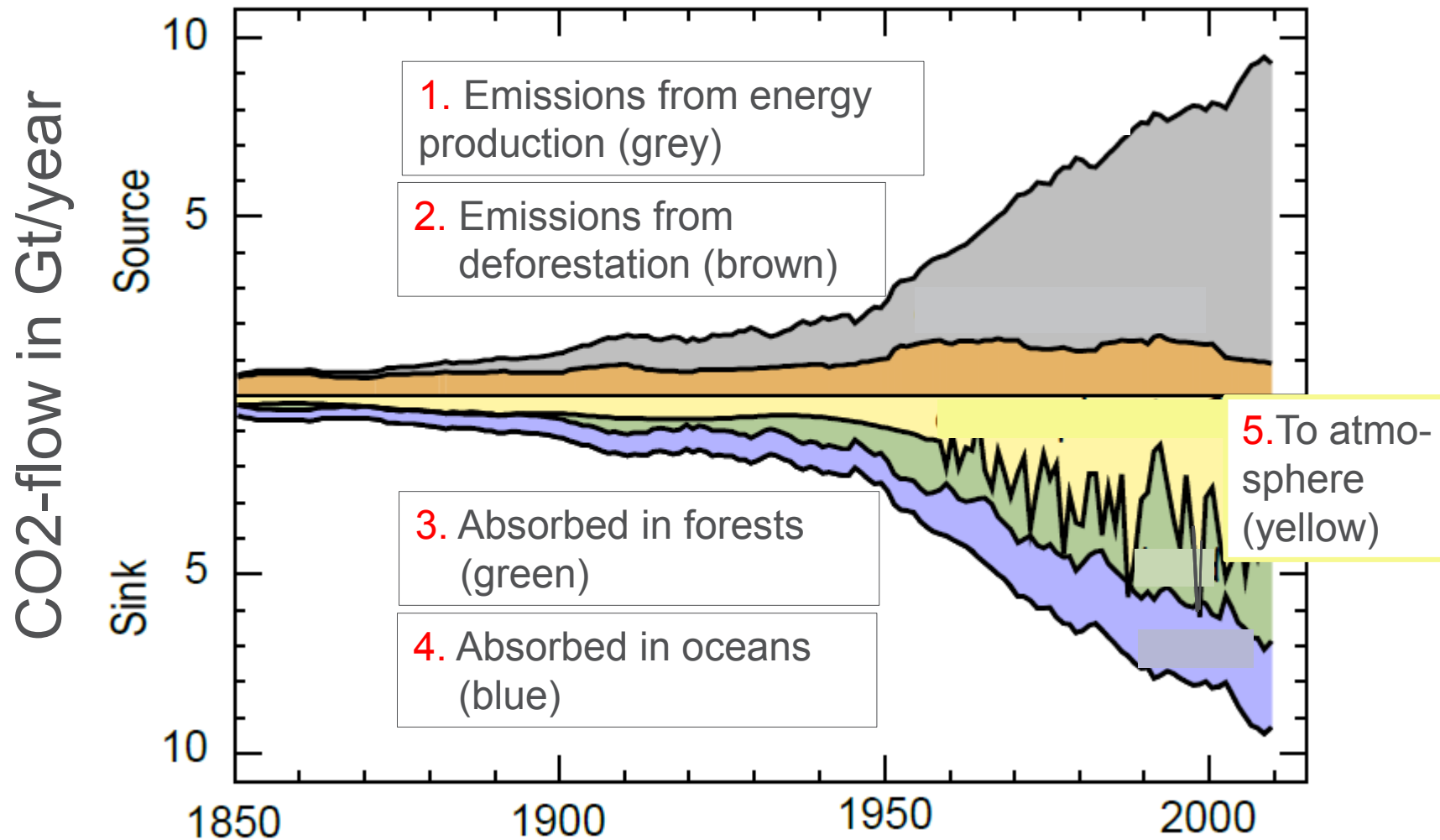
Green electricity to save the world!

Remind voters that failure will mean higher adaptation costs, that inevitably will be paid for by the tax-payer

It is time to act



50 % of human CO2 ends in the atmosphere



The five regions used in the 2052 forecast

Region	Population 2010 (billion people)	GDP 2010 (trillion \$ pr year)	GDP per person 2010 (1000 \$ pr person-year)
US	0,3	13	41
China	1,3	10	7
OECD-less-US (1)	0,7	22	30
BRISE (2)	2,4	14	6
ROW (3)	2,1	8	4
Sum world	6,9	67	10

(1) Old industrial world, including EU, Japan, Canada, Australia, New Zealand etc

(2) Brazil, Russia, India, South Africa and the ten biggest emerging economies

(3) The remaining ca 140 countries of the world

World population will peak in 2040

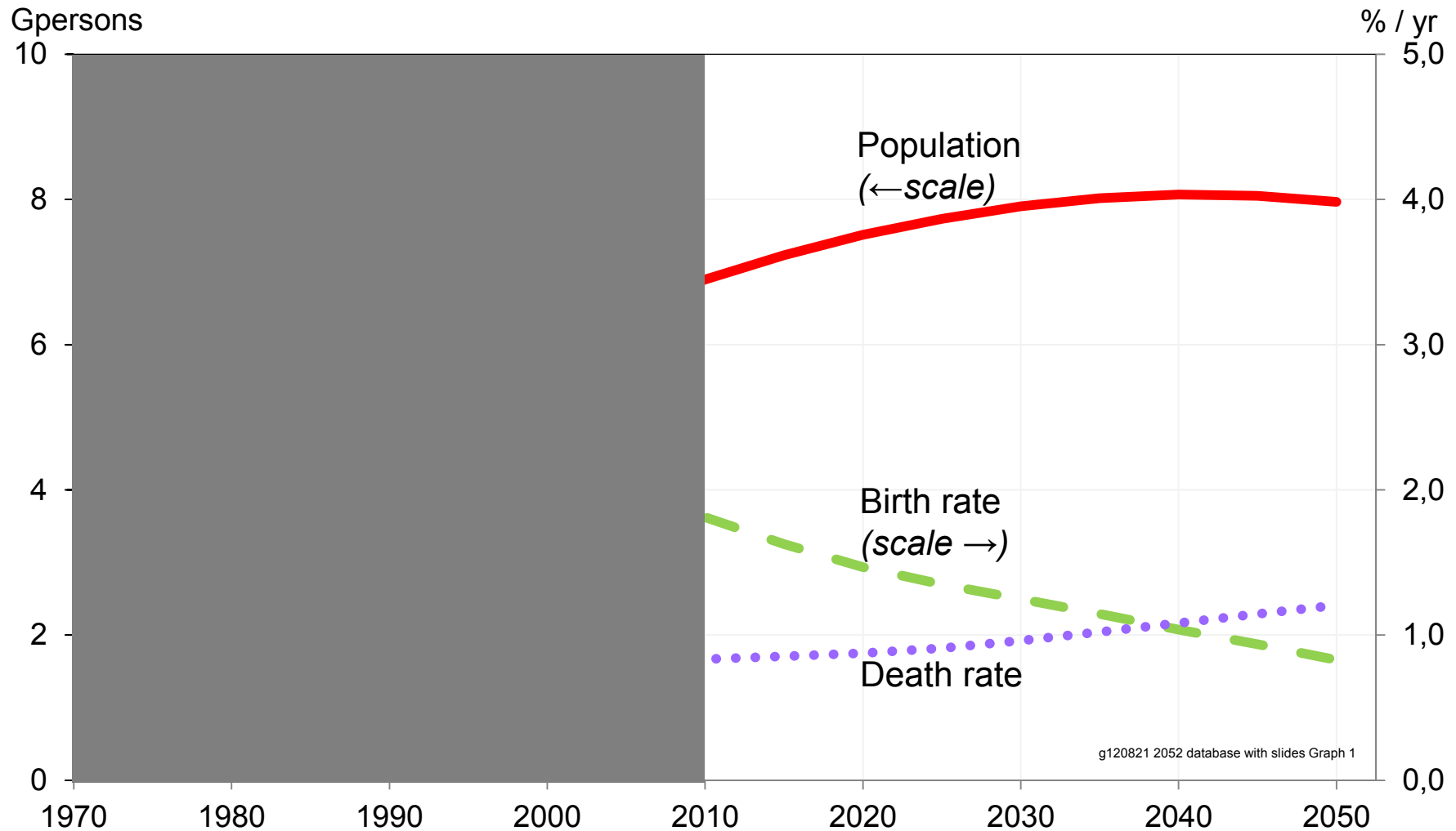


Figure 4-1 Population – World 1970 to 2050

World GDP growth will slow down

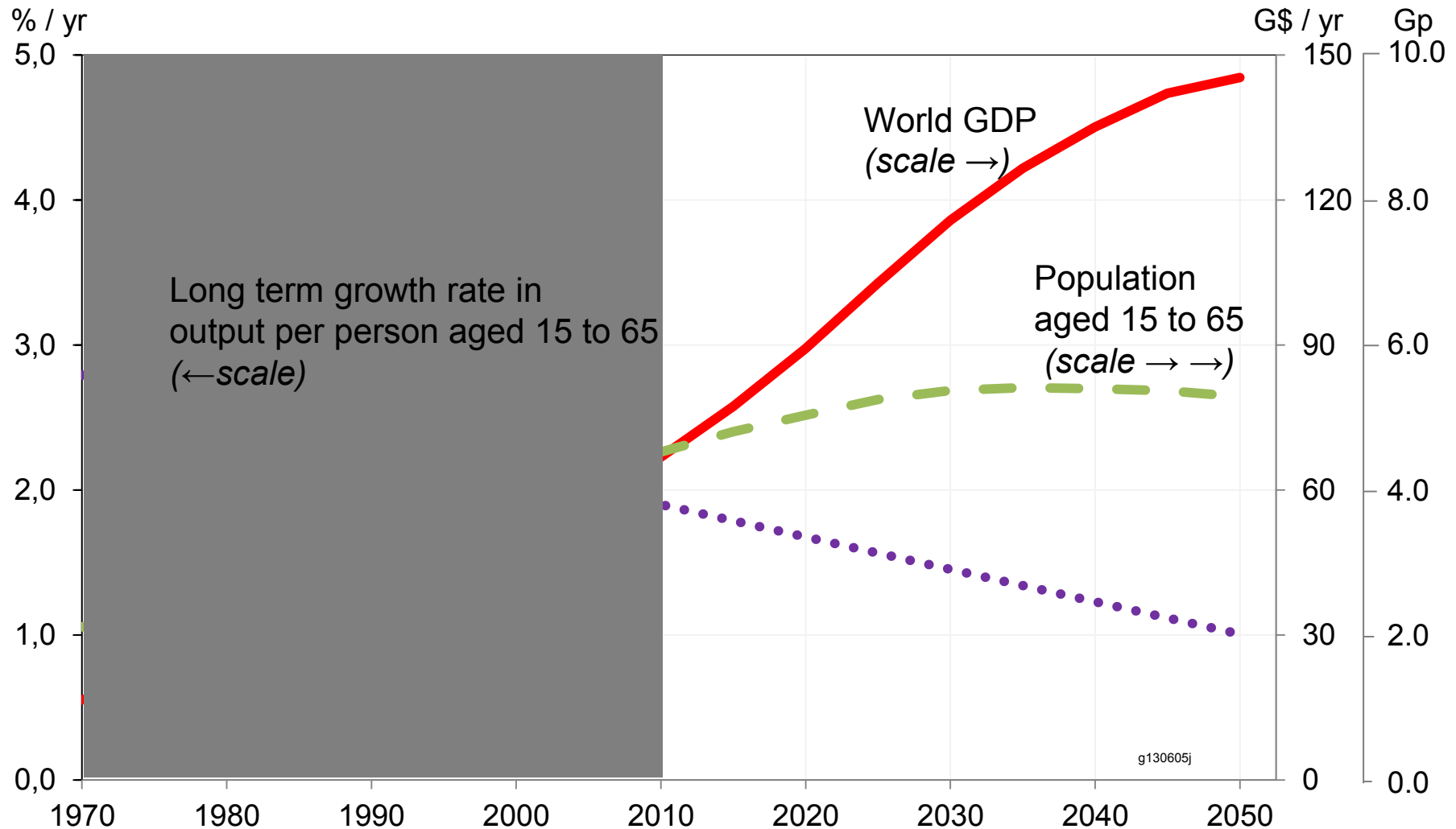


Figure 4-3b: Gross Domestic product – World 1970 to 2050

Definition: GDP = Population aged 15 to 65 years multiplied with Output per member of potential workforce

More unavoidable repair and adaptation work

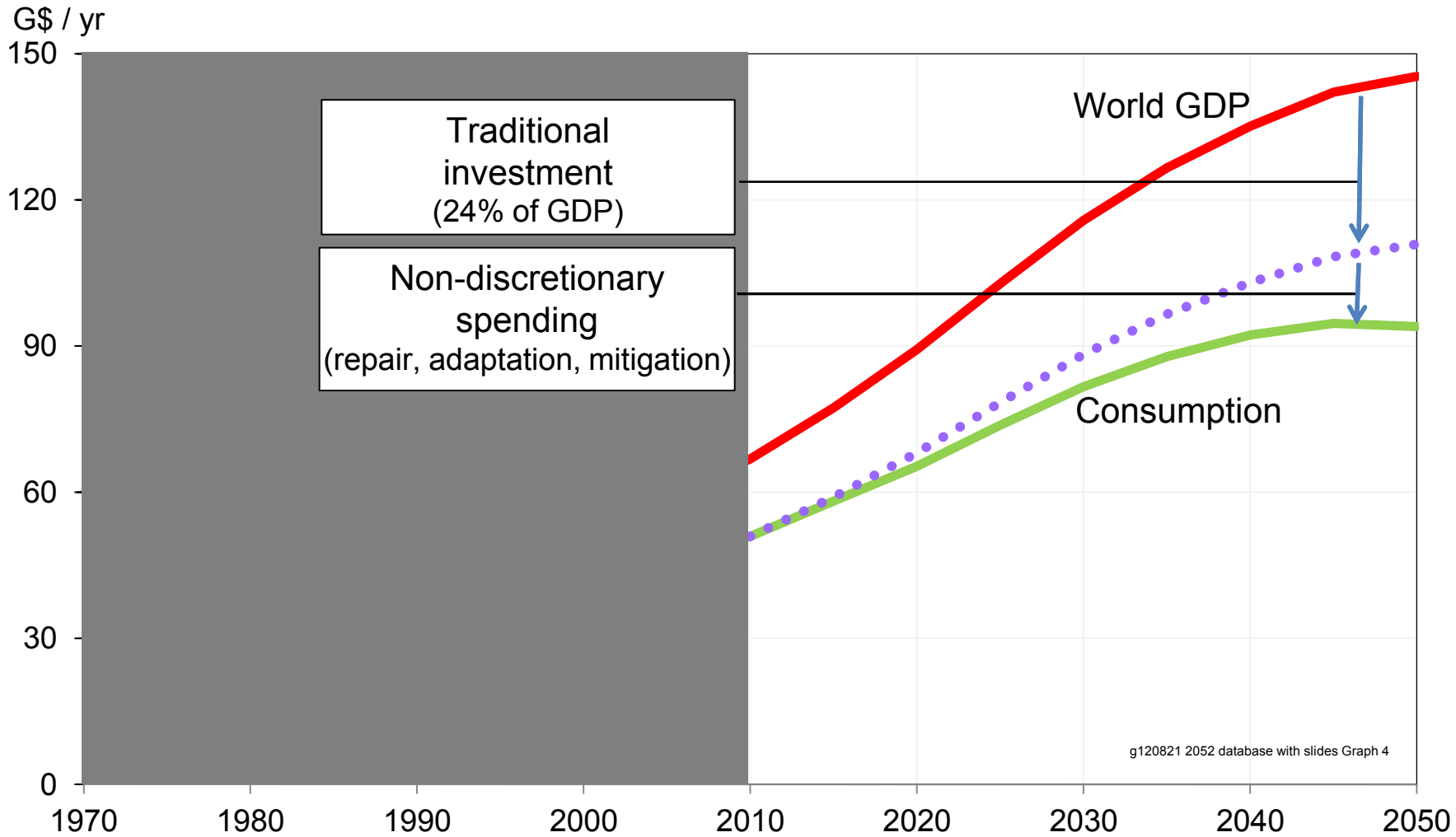


Figure 4-4: Production, Consumption and Investment – World 1970 to 2050

Enough food to satisfy demand – but not need

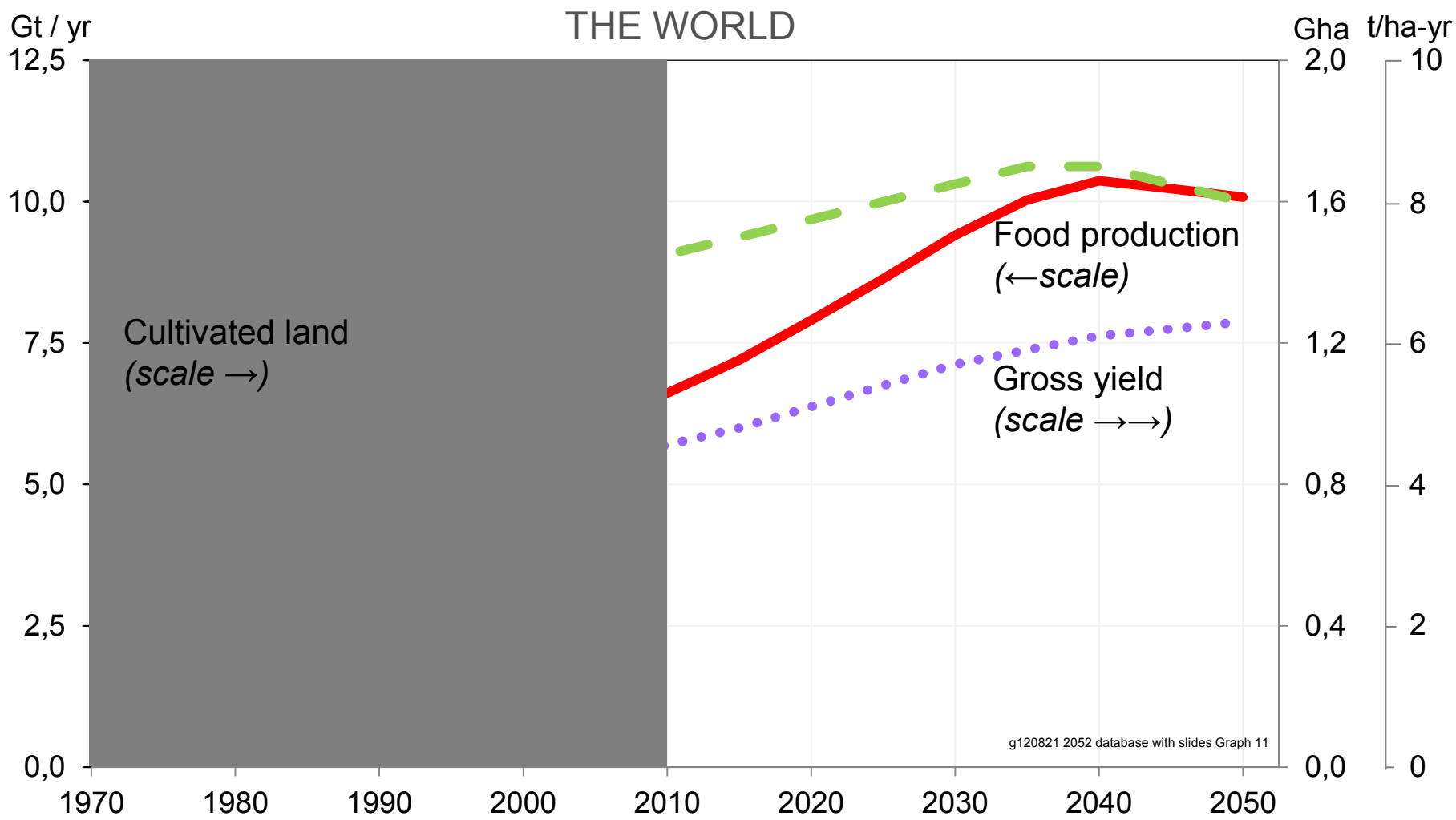


Figure 6-1: Food Production – World 1970 to 2050

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 will stagnate 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

Discussion of the 2052 forecast

- 1.** World population and GDP growth will slow
Because of human choice, not planetary constraints
- 2.** There will be enough resources – energy, water & food
Because middle class will be smaller than expected
But unsatisfied needs among those who can't pay
- 3.** There will still be significant poverty
Because of growing inequity in the rich world
and low GDP growth in the poor world
- 4.** The world will be well on its way towards a climate catastrophe in the second half of the 21st century

Simple to make a better world. In principle!



What should be done? - Ideally

- 1.** Further slow population growth
Introduce 1-child policy – first in rich world
- 2.** Cut CO2 emissions – first in the rich world
Ban the use of coal, oil and gas from 2024
- 3.** Reduce poverty in the poor world
Give a climate-friendly energy system to the poor
- 4.** Reduce the ecological footprint of the rich world
Legislate more compulsory vacation
- 5.** Temper national short termism
Establish supra-national institutions
- 6.** Reduce the focus on income growth
Establish “increased well-being” as the new goal

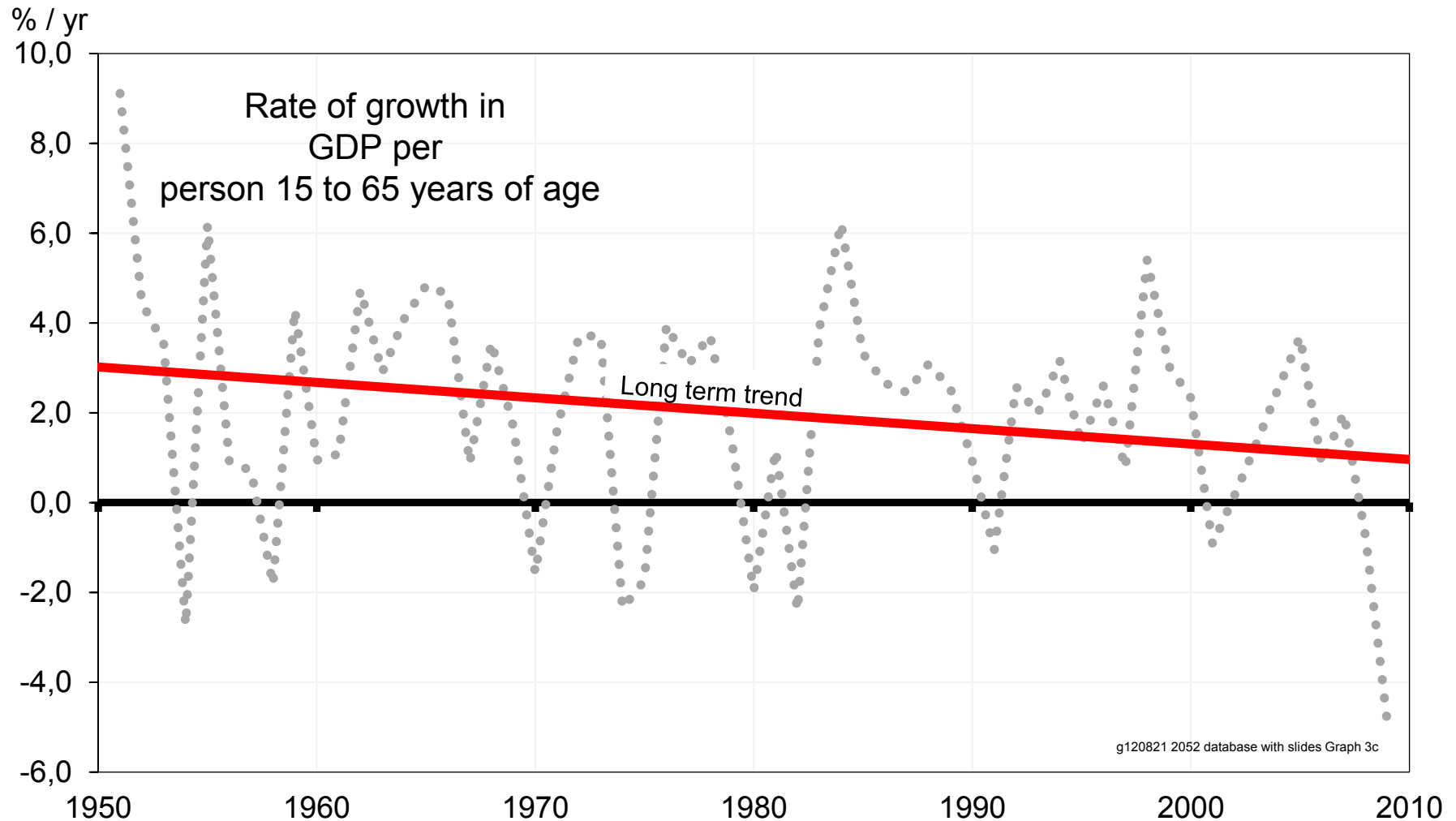
What can be done? – Realistically (1 of 2)

1. Further slow population growth
 - ◆ *Give moral support to women with < 2.1 children*
 - ◆ *Increase the pension age*
 - ◆ *Explain that the “support burden” will not grow*
2. Cut CO2 emissions – first in the rich world
 - ◆ *Subsidize energy efficiency in all sectors*
 - ◆ *Build no new coal capacity in the rich world*
 - ◆ *Tax coal and oil and distribute the money evenly*
3. Reduce poverty in the poor world
 - ◆ *Use most development aid to build renewable energy capacity in the developing world*
 - ◆ *Copy the planned rise of Japan, South Korea and China – and their use of “strong government”*

What can be done? – Realistically (2 of 2)

4. Reduce the ecological footprint of the rich world
 - ◆ *Simplify shift from dirty to clean production*
= *provide income security in transition*
 - ◆ *Reduce production growth*
= *reduce length of the work year, i.e. more leisure*
4. Temper national short termism
 - ◆ *Establish a global agreement where all nations promise to emit less CO2 per person than the US*
 - ◆ *Evolve IPCC to “IPCC 3” (a supernational org. with funding to pay for the most effective cuts)*
5. Reduce the focus on income growth
 - ◆ *Start measuring “growth in well-being” alongside “growth in GDP”*

Slowing growth in total productivity - USA



Fertility decline in EU-15 – 1950 to 2010

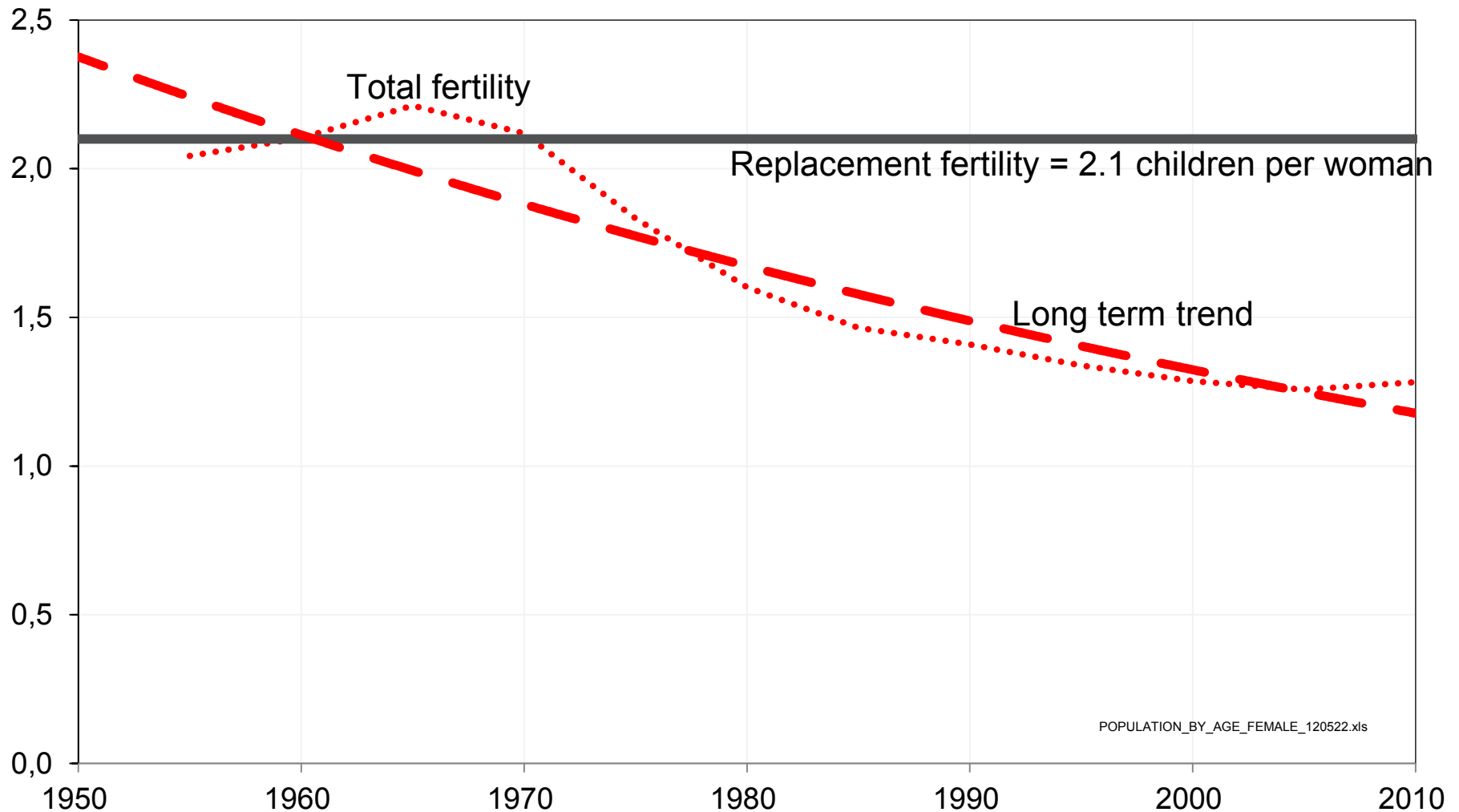


Figure A4-1 Total Fertility – EU15 1950 to 2010

Definition: Total fertility = Number of children per woman during reproductive age