SUSTAINABLE DEVELOPMENT : WHY ? WHEN ? HOW ?

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Joseph-Simon **SMITZ**
Environnement Centre & HEC-ULG
University of Liege

j.smitz@ulg.ac.be

SUSTAINABLE DEVELOPMENT : WHAT ?

Development of mankind can be seen as three successive waves :

1) Agricultural wave (10.000 BC)
2) Industrial wave (1.800)
3) Knowledge wave (2.000)

Historical evolution of human population

Date		Population (Millions)	Density (Inhab/km2)
- 25.000	The Paleolitic Age	3	0,03
- 2.000	The Iron Age	26	1
1650		545	3,7
1800	Industrial Revolution	906	6,2
1950	Nuclear energy	2.400	16,4
1985	Exploration of space	4.900	32
2000	Internet	6.100	50
2010 March 31		6.835 (+200.000 inhab/day)	

See www.worldometers.info

SUSTAINABLE DEVELOPMENT : WHAT ?

DEVELOPMENT is directly linked to **INNOVATION** :
Innovation → Improvement of technology → Specialization → Market
→ Increase in production of goods / services

INNOVATION and MARKET :
proved to be the most efficient instruments to generate goods and welfare

But

INNOVATION and MARKET :

- Short term horizons → difficulties to take long term issues into account
- Difficulties in recognizing values other than linked to money (eg : natural capital)
- Externalities → need to establish 'internalization' mechanisms
- Instabilities → need to establish mechanisms to reduce discrepancies

SUSTAINABLE DEVELOPMENT : WHAT ?

OUTCOME of the rapid
TECHNOLOGICAL, INDUSTRIAL and SOCIAL DEVELOPMENT
of mankind :

a tremendous **increase** in

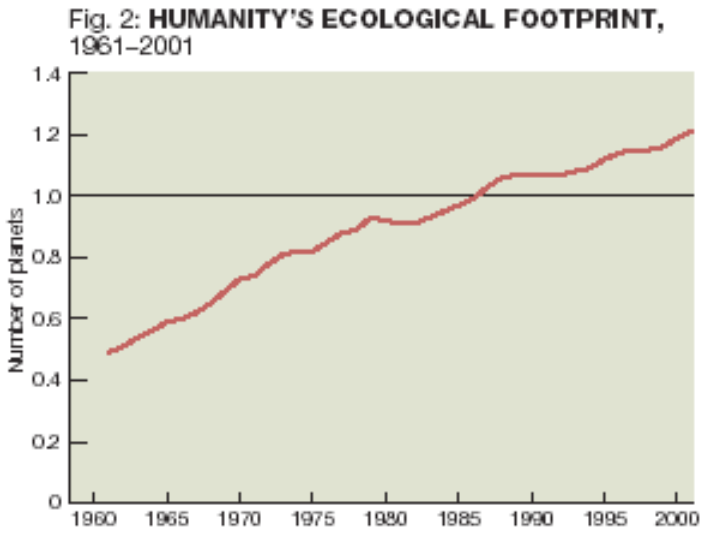
- consumption of natural resources
- energy use (energy used today by 1 European = 100 slaves 24h/24h)
- pollution and waste

SUSTAINABLE DEVELOPMENT : WHAT ?

1990 : The analysis of the situation reveals worrying figures :

1) As regards the **ENVIRONMENT** :

- Ecological footprint of mankind exceeds the capacity of the Earth
- Annual costs of the environmental impacts = Annual growth of GDP
- Rapid exhaust of non renewable resources
- Biodiversity : decreasing at a rapid pace
- Global impacts (eg increase in GHG concentrations → climate effect)
- Negative effects due to several present activities will occur later on → burden on the next generations



SUSTAINABLE DEVELOPMENT : WHAT ?

1990 : The analysis of the situation reveals worrying figures :

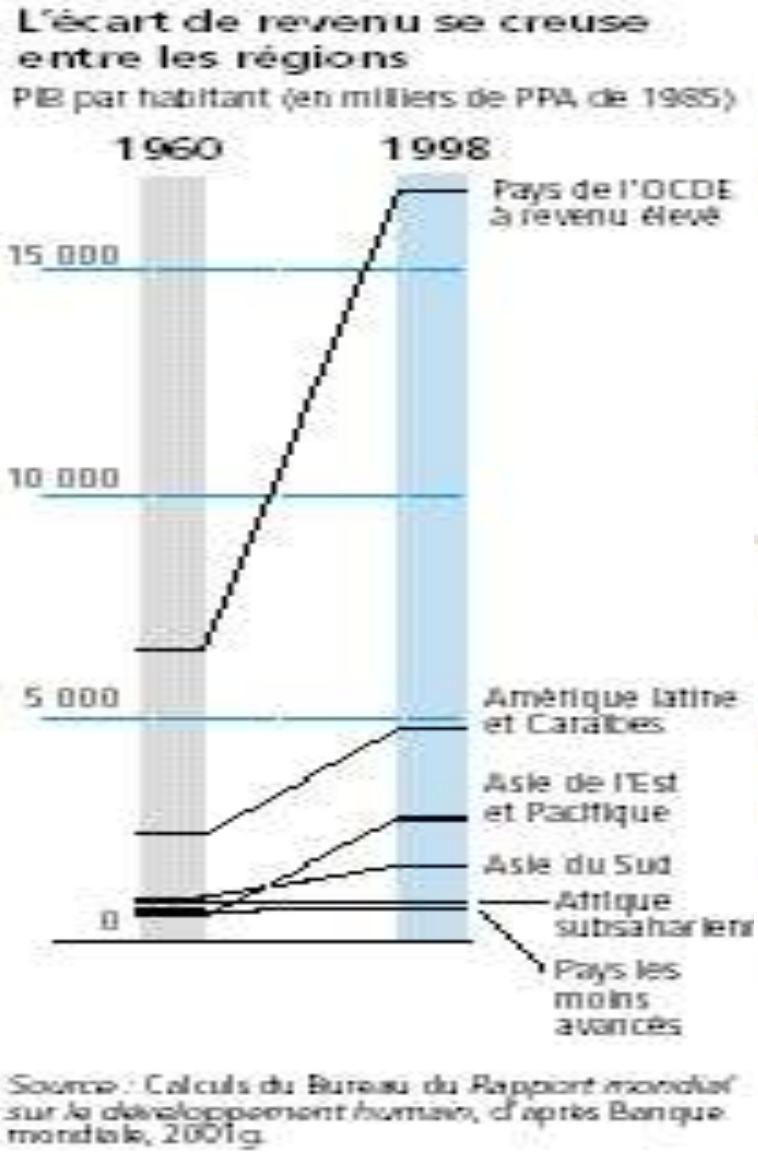
2) As regards **SOCIETY** :

The present development has increased the discrepancies

- between rich countries and poor countries
- between rich and poor in each of the countries
  (including in countries where a strong social system does exist)

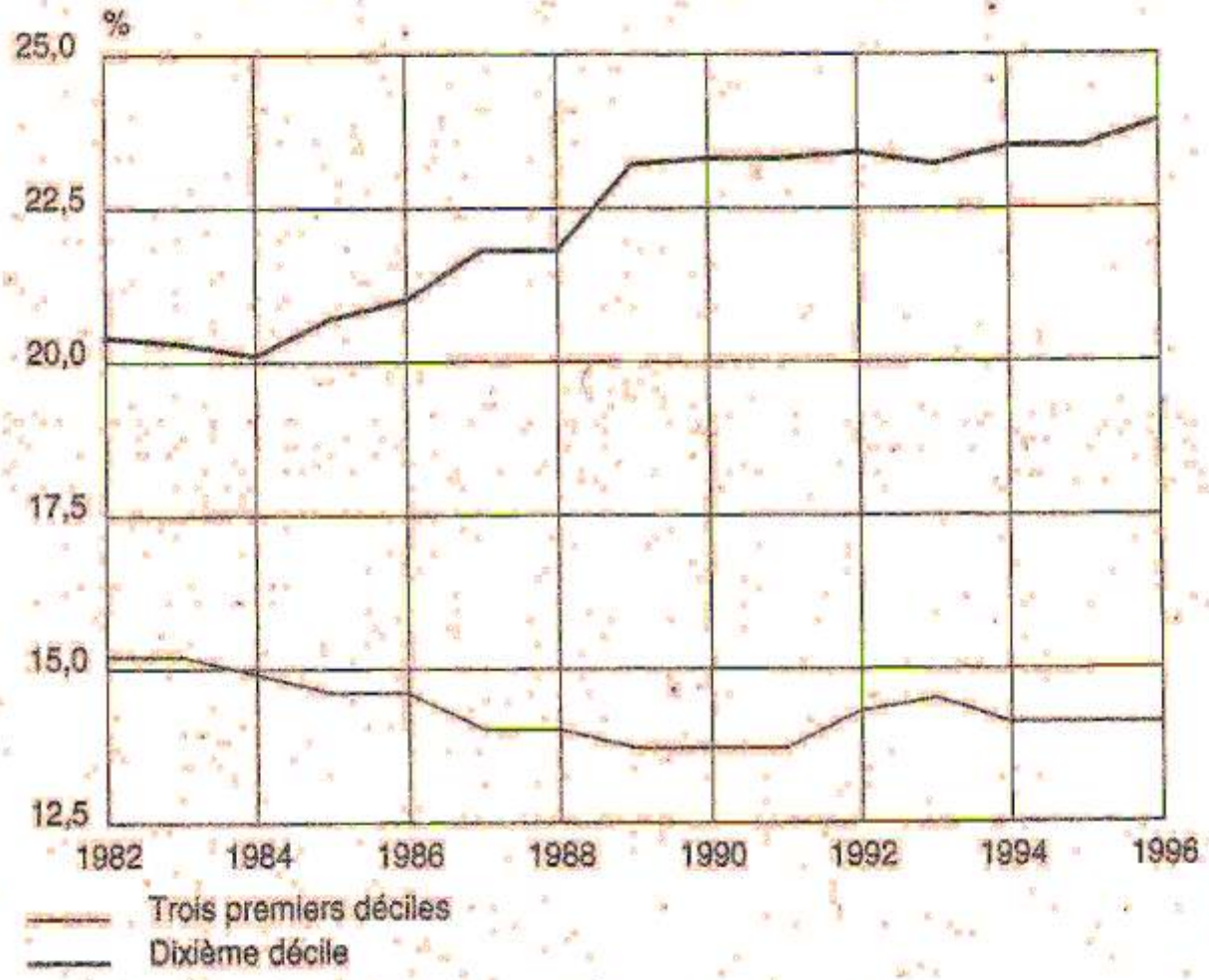
SUSTAINABLE DEVELOPMENT : WHAT ?

World : parity of purchasing power



Source : Calculs du Bureau du *Rapport mondial sur le développement humain*, d'après Banque mondiale, 2001g.

Belgium : deciles of the net income (households)



SUSTAINABLE DEVELOPMENT : WHAT ?

CONCLUSION of this twofold analysis :

The present way of development :
- CANNOT BE ACCEPTED (ethical point of view)
- CANNOT LAST LONGER (too many negative effects / high costs)

➔ WE MUST CHANGE THE WAY WE DEVELOP

➔ Concept of **SUSTAINABLE DEVELOPMENT** :

« A development that meets the needs of the present
without compromising the ability of future generations
to meet their own needs »

SUSTAINABLE DEVELOPMENT implies continuous long term improvement along 3 axes :

ECONOMY
ENVIRONMENT
SOCIETY

SUSTAINABLE DEVELOPMENT : WHAT ?

1992 : **EARTH SUMMIT** (Rio de Janeiro) :

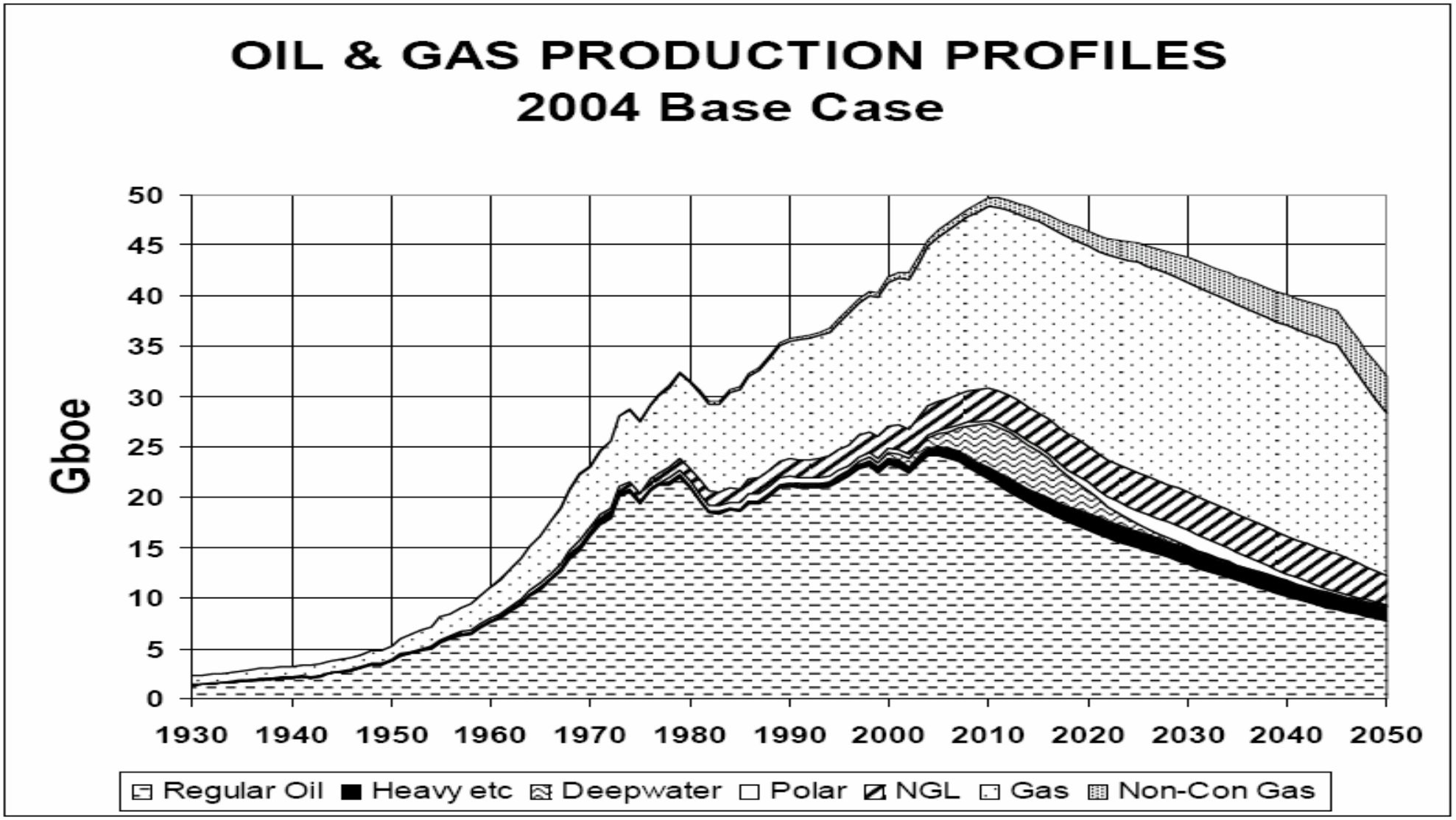
All countries approved :

- The principle of SUSTAINABLE DEVELOPMENT
- A convention on CLIMATE : to « achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous interference with the climate system »
  → list of developed countries ('Annex I') : major emitters who have special responsability in GHG emission reduction
- A convention on protection of BIOLOGICAL DIVERSITY
- A convention on protection of FORESTS

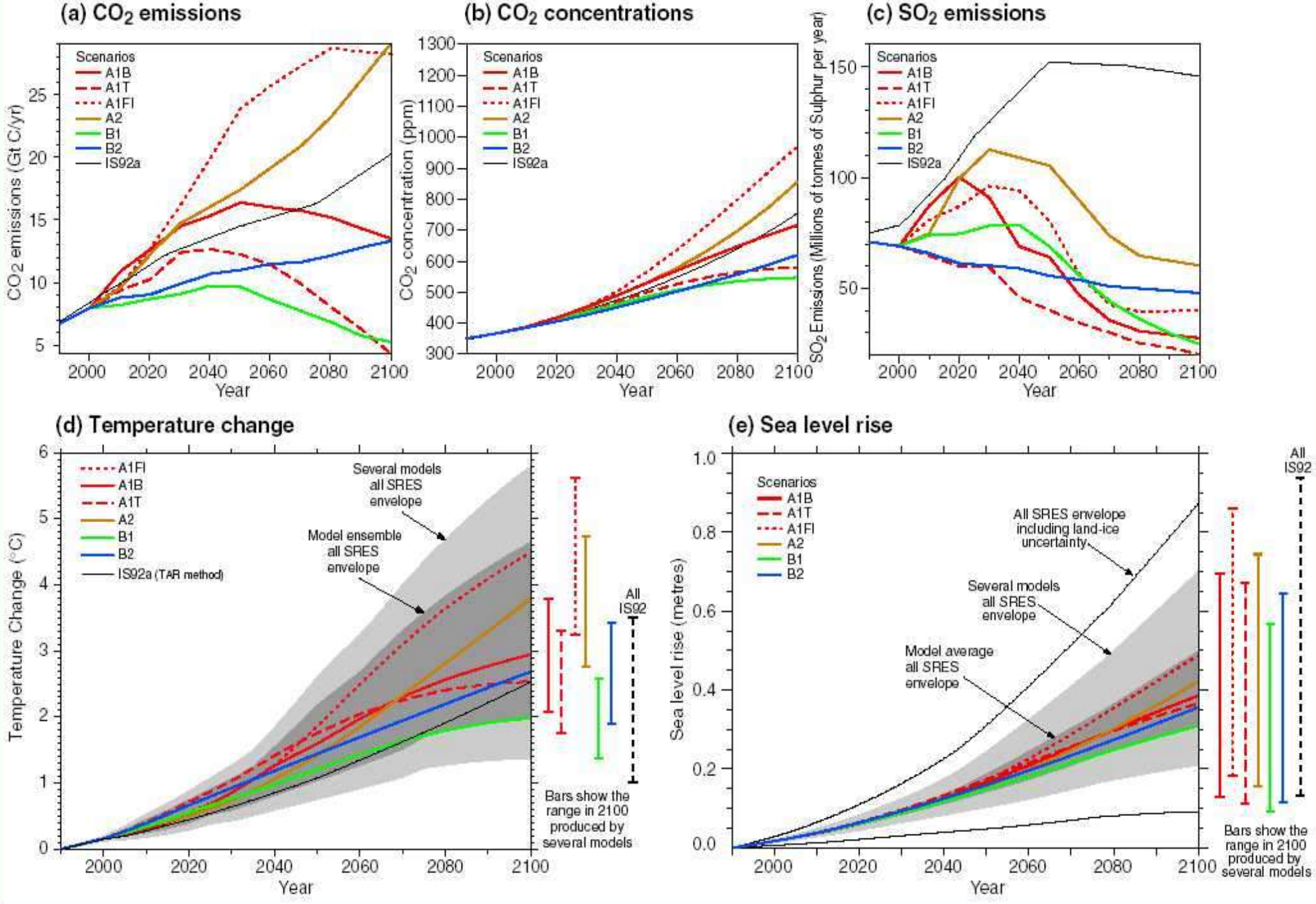
21st century : MAJOR THREATS EXPECTED

Under a Business As Usual scenario

- Depletion of non renewable resources : raw materials, fossil fuels

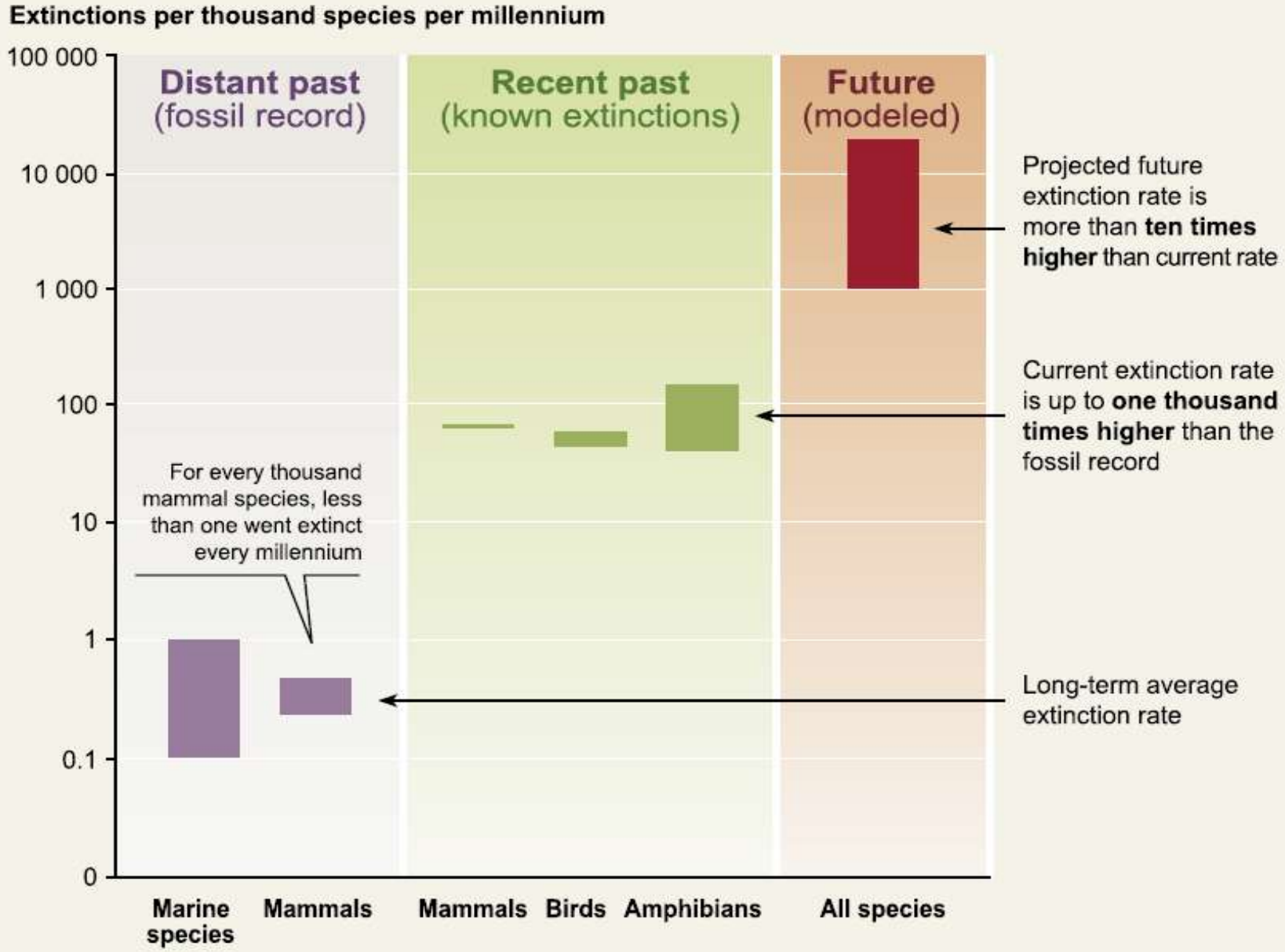


The global climate of the 21st century



21st century : MAJOR THREATS EXPECTED

Under a Business As Usual scenario : significant loss of biodiversity



21st century : MAJOR THREATS EXPECTED

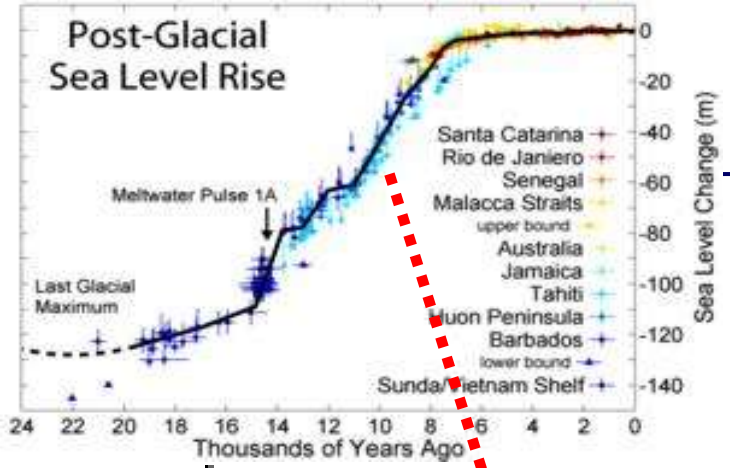
SCIENTIFIC CONFIRMATION of the THREATS ? **YES !**

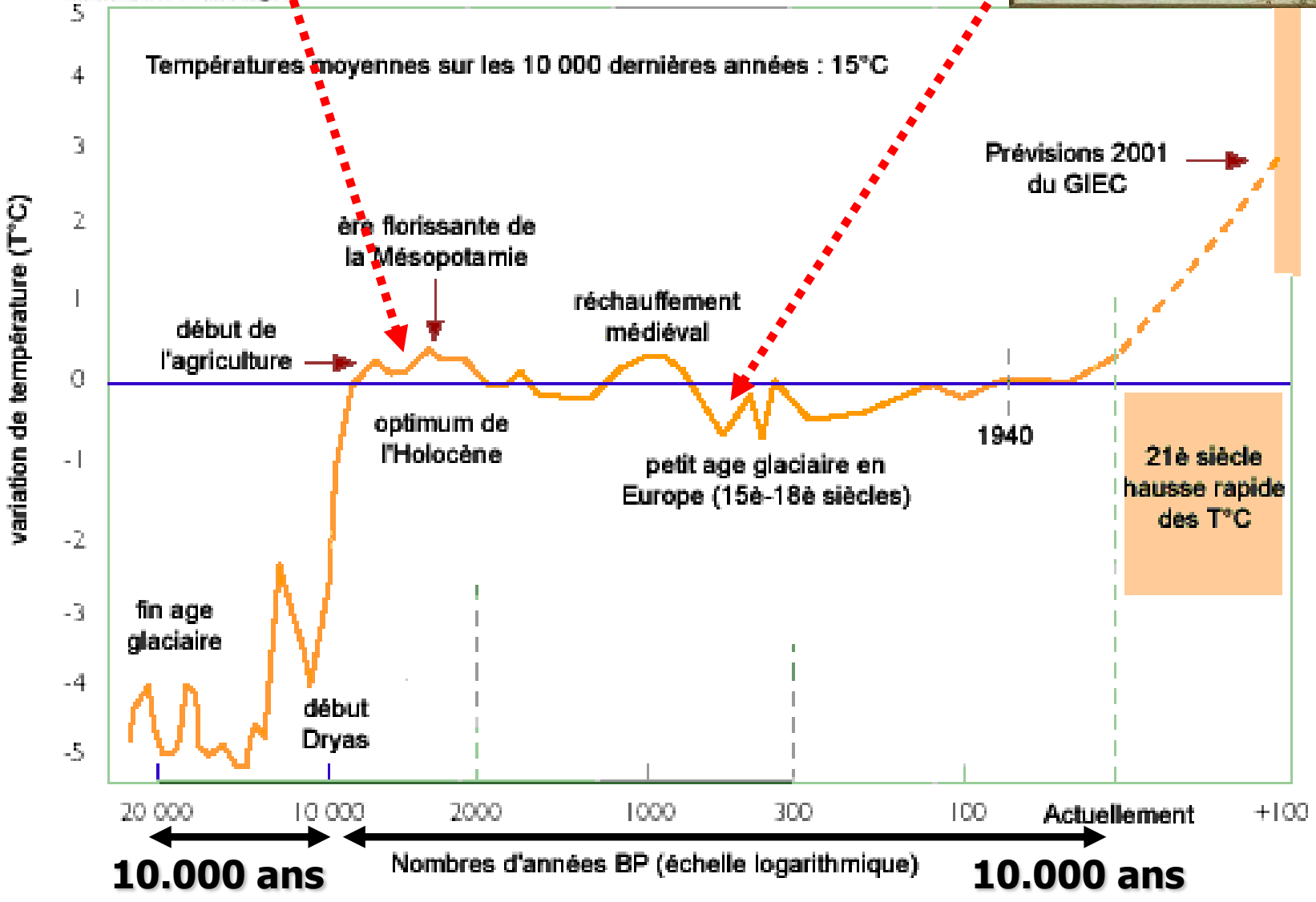
Arguments of the **skeptics** :

- Scientific arguments : do not resist a thorough analysis
- Non scientific arguments : poor

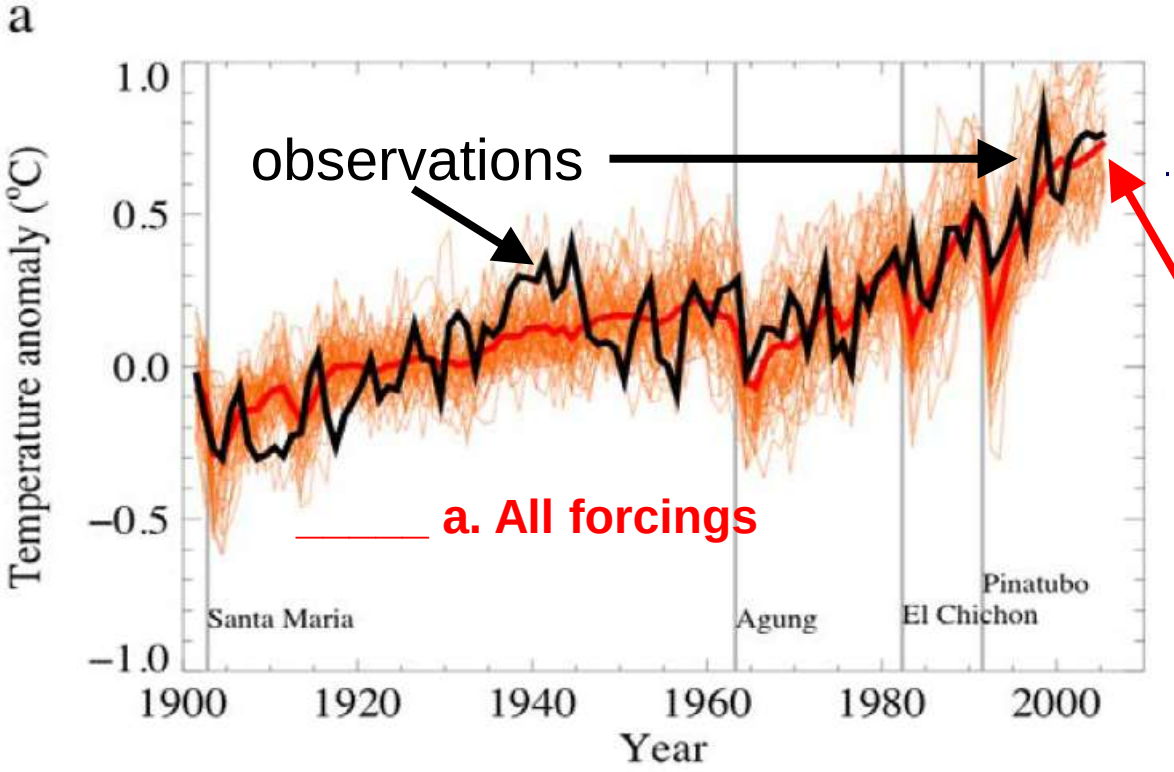
IPCC :

- High scientific level and very few errors
- When a mistake occurs, the correction follows
- Mistakes nor corrections DO NOT MODIFY
  the general trends and conclusions

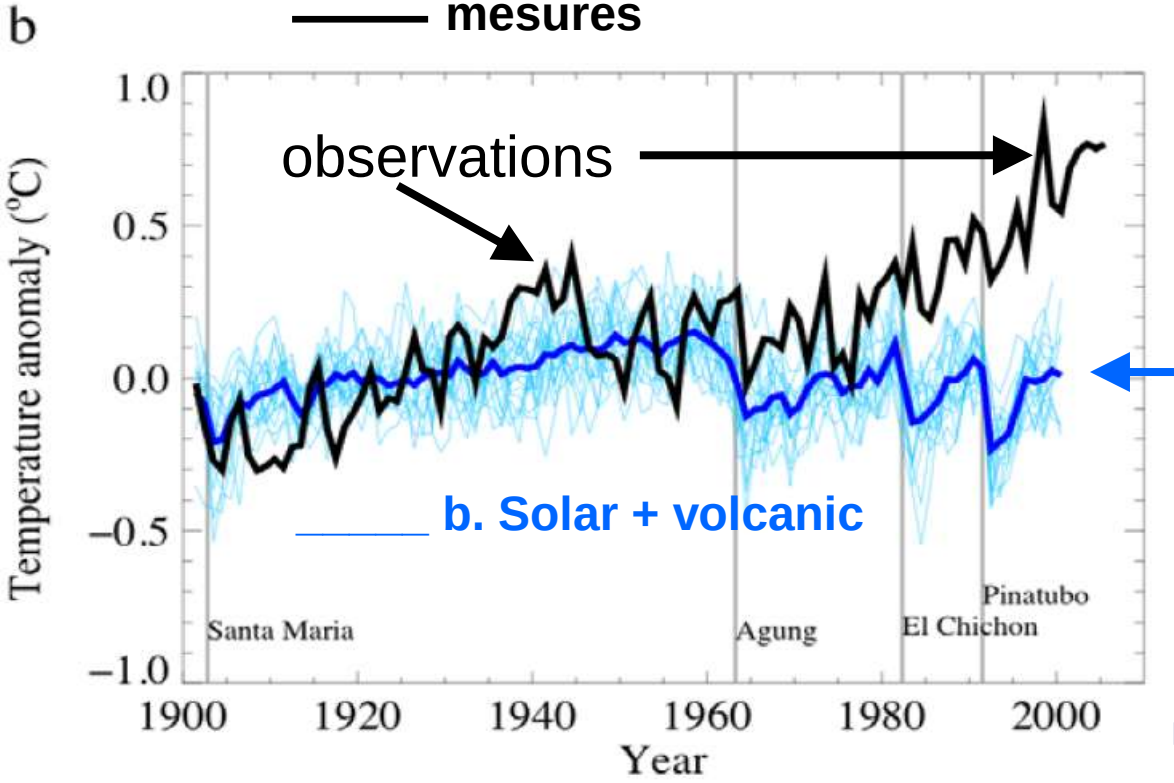

Post-Glacial
Sea Level Rise
Meltwater Pulse 1A
Last Glacial
Maximum
Santa Catarina
Rio de Janiero
Senegal
Malacca Straits
upper bound
Australia
Jamaica
Tahiti
Huon Peninsula
Barbados
lower bound
Sunda/Vietnam Shelf
Sea Level Change (m)
Thousands of Years Ago


Températures moyennes sur les 10 000 dernières années : 15°C
variation de température (T°C)
Prévisions 2001
du GIEC
ère florissante de
la Mésopotamie
réchauffement
médiéval
début de
l'agriculture
optimum de
l'Holocène
petit age glaciaire en
Europe (15è-18è siècles)
1940
21è siècle
hausse rapide
des T°C
fin age
glaciaire
début
Dryas
20 000
10 000
2000
1000
300
100
Actuellement
+100
10.000 ans
Nombres d'années BP (échelle logarithmique)
10.000 ans

Comparisons observations – models 1900 – 2000



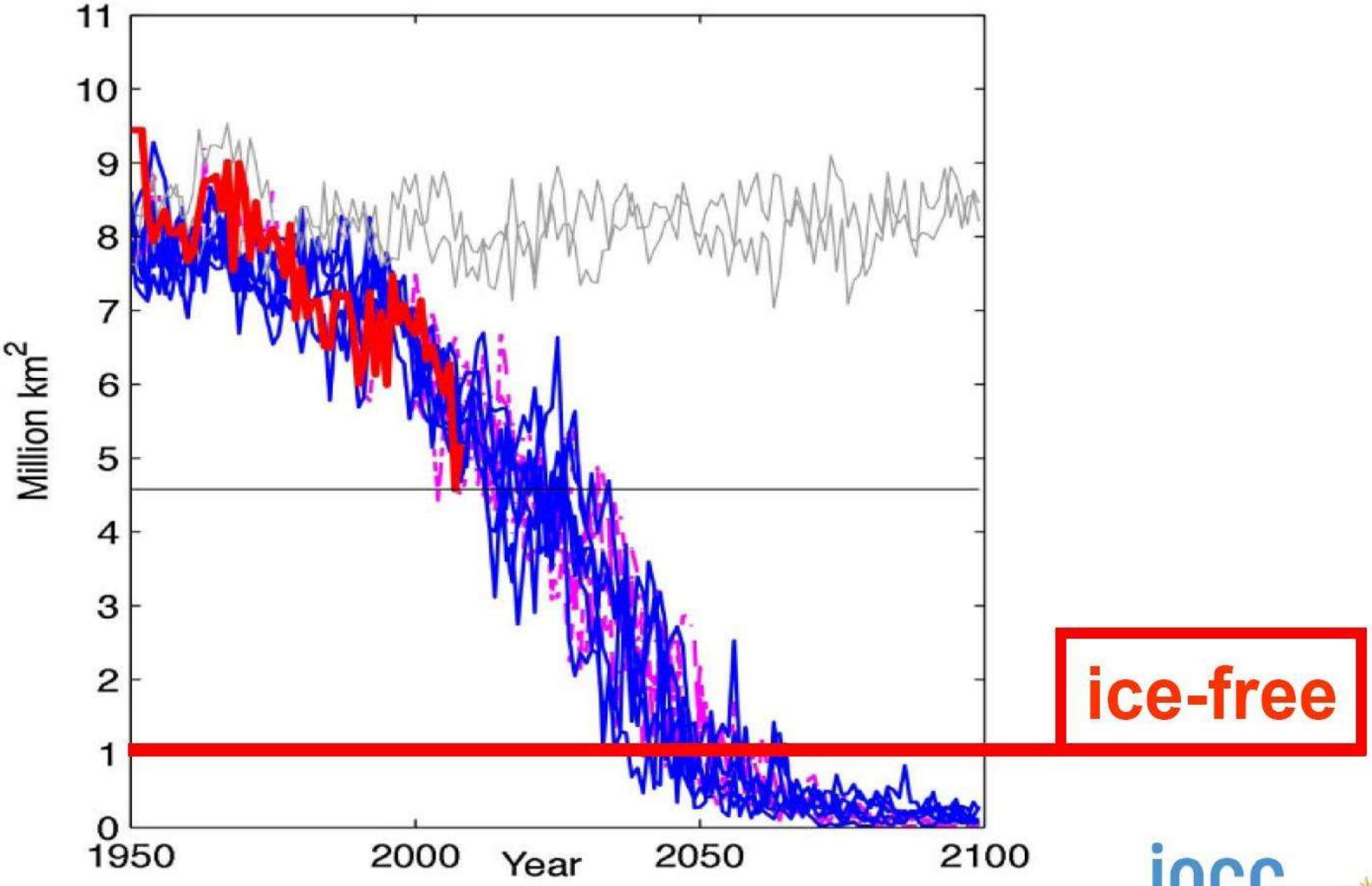
a. <u>all forcings</u>
(solar + volcanos
+ human-induced GHG)



b. <u>Only natural forcings</u>
(solar + volcanos)

Source : IPCC, 2007

21st century : MAJOR THREATS EXPECTED



(Wang and Overland, 2009)

ipcc
INTERGOVERNMENTAL PANEL ON climate change

WMO UNEP

WHAT CAN WE DO to reduce the THREATS ?

The formula is quite simple :
Eliminate non sustainable behaviour
& move rapidly towards a sustainable way :

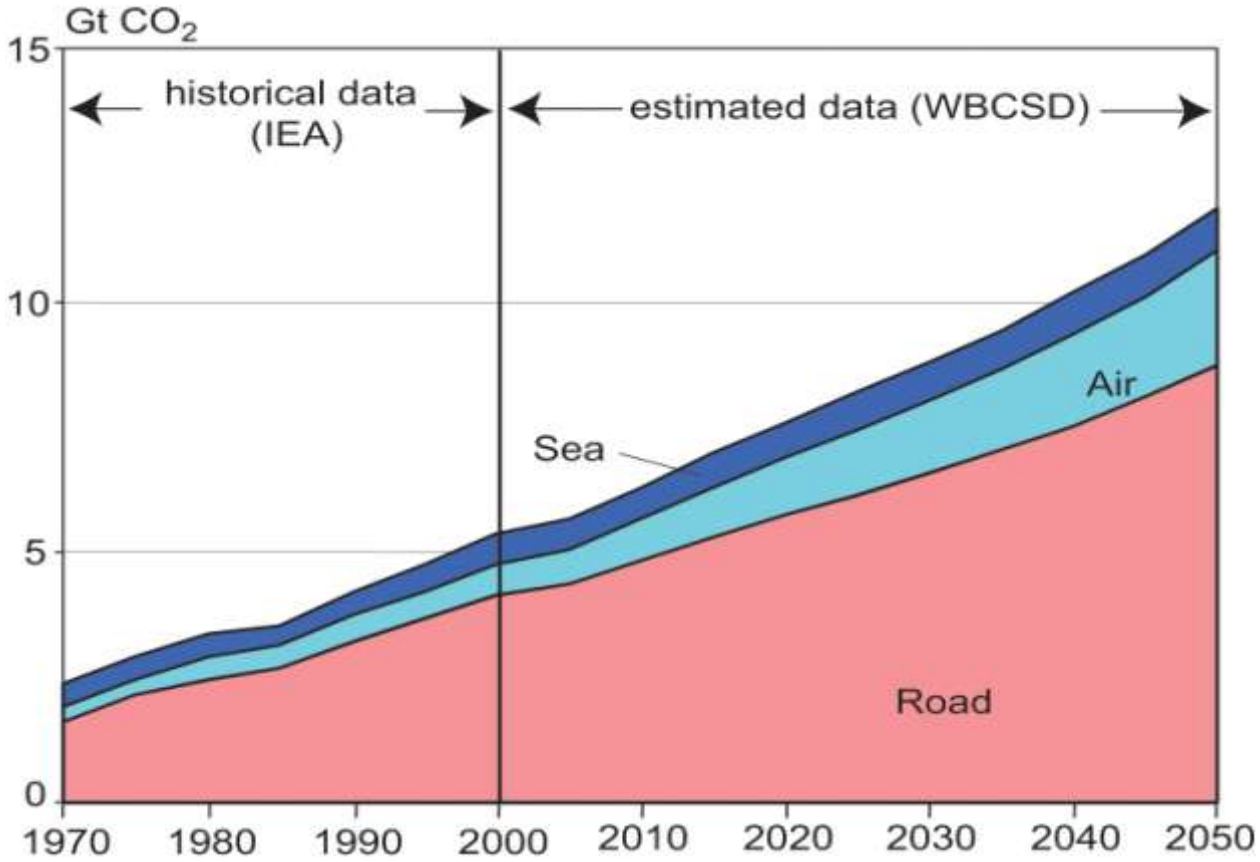
- Stabilize human population
- Reduce consumption of energy
- Eliminate fossil fuels / Use only renewable energies
- Reduce use of raw materials / Close the loop
- Stop decrease biodiversity / Enhance ecosystems services
- Reduce social discrepancies / Improve social cohesion

21st century : MAJOR THREATS EXPECTED

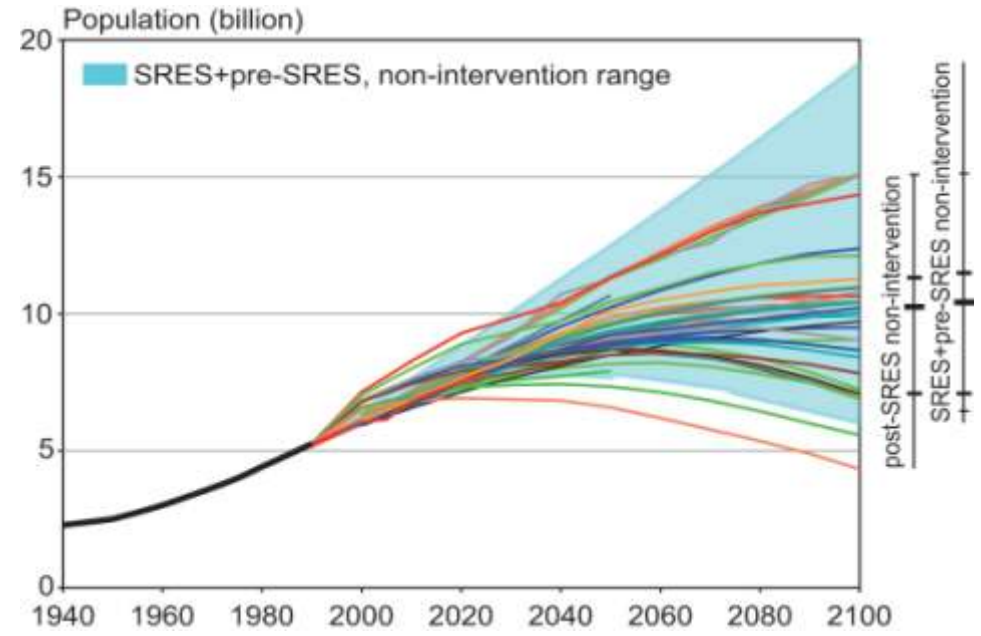
WHAT CAN WE DO to reduce the THREATS ?

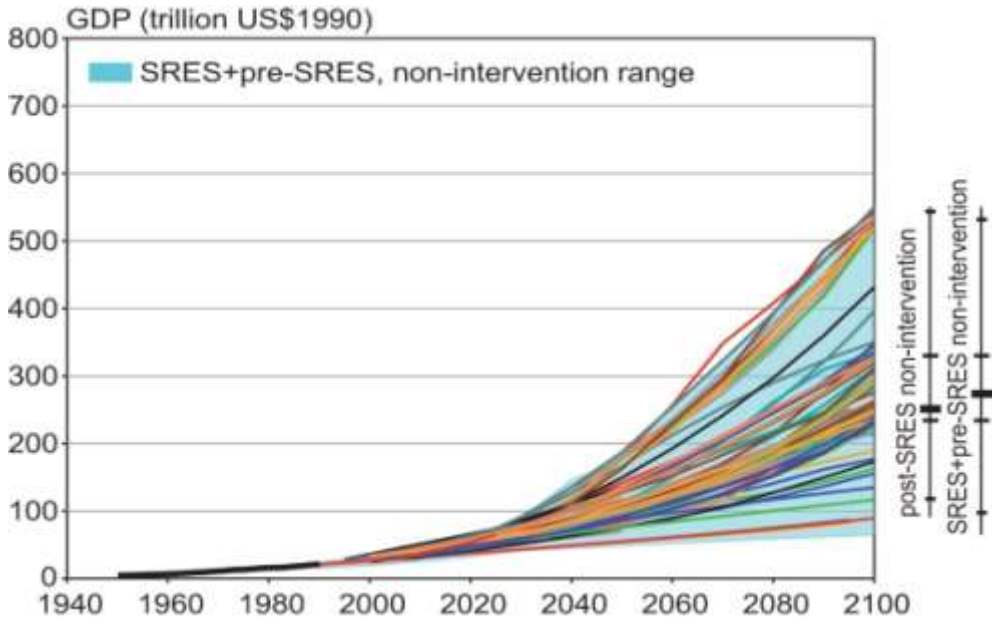
Total IMPACT = N x C x i

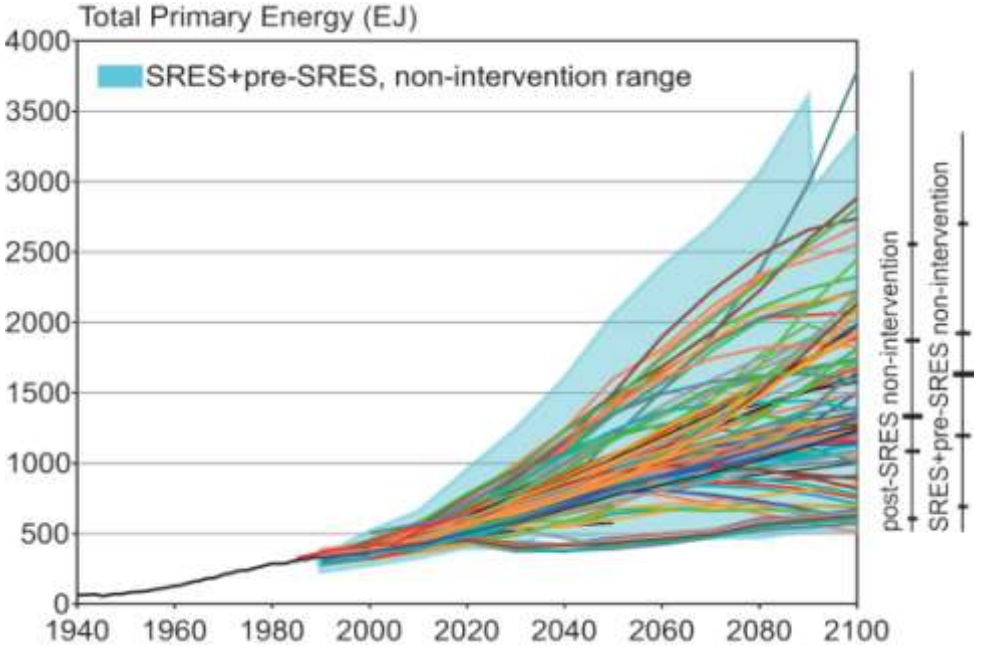
N = total population C = mean consumption / capita i = impact / unit of consumption

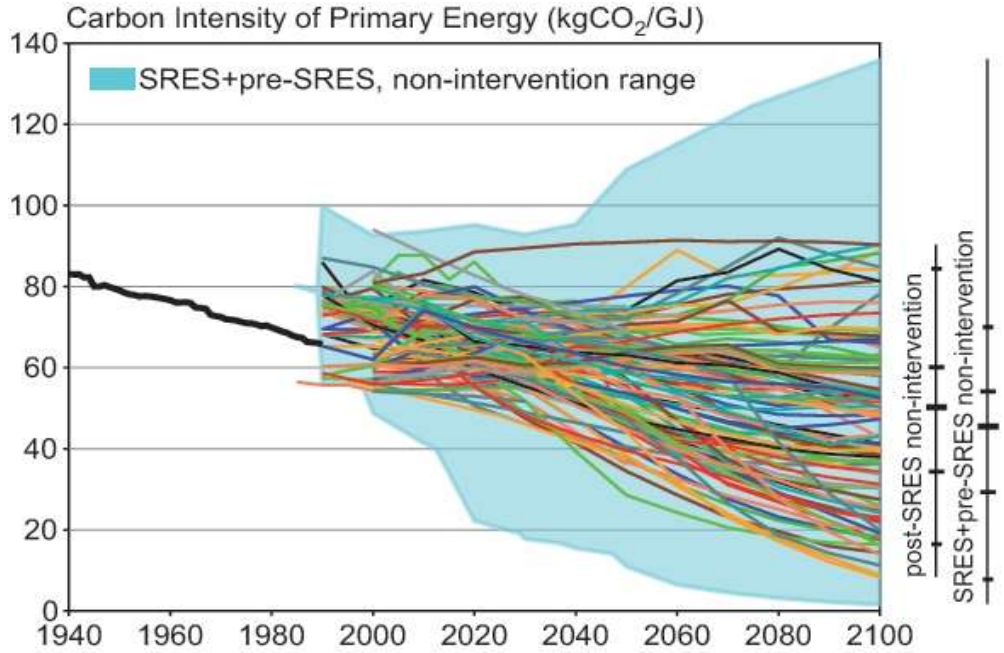


21st century : MAJOR THREATS EXPECTED



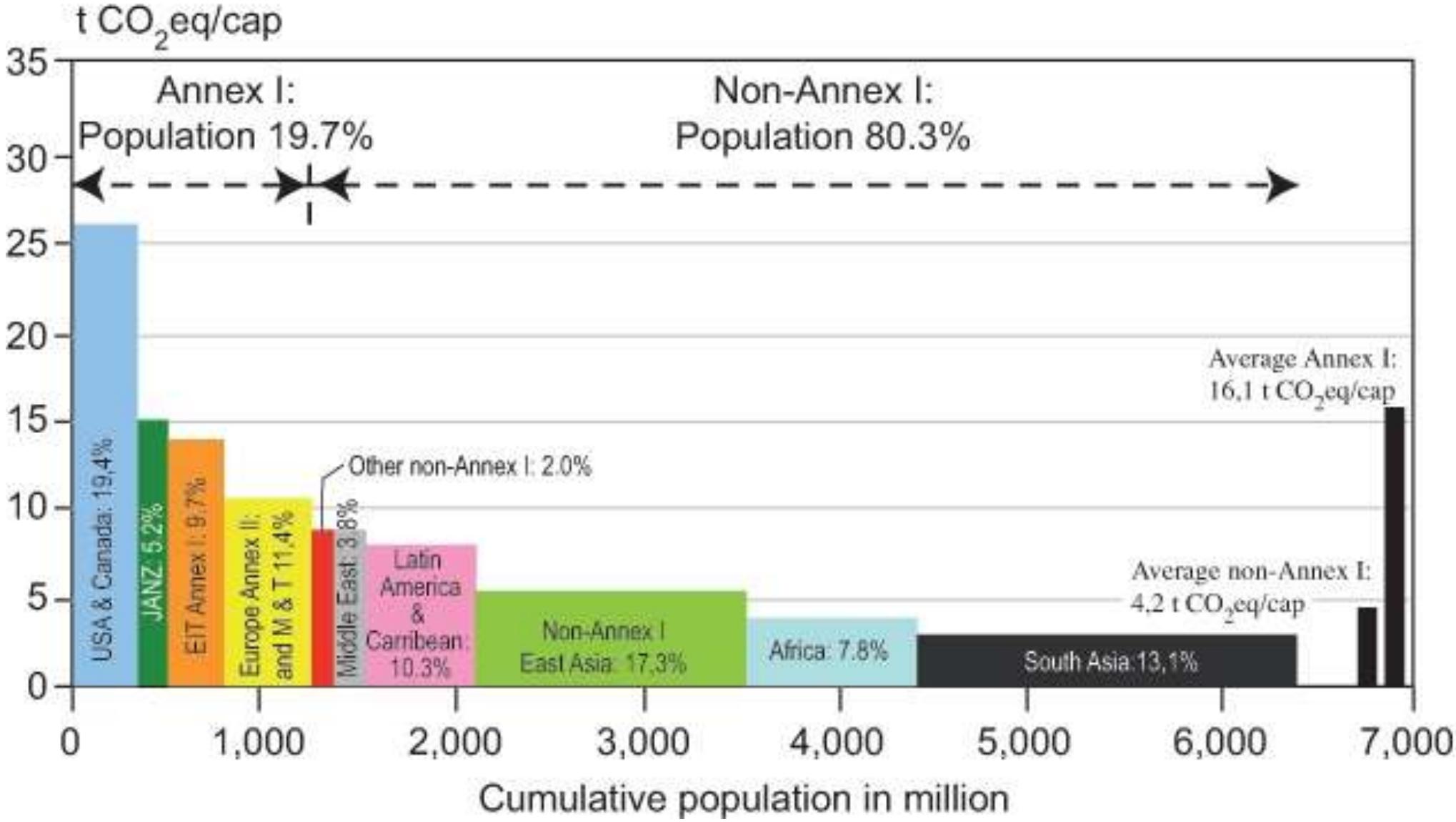






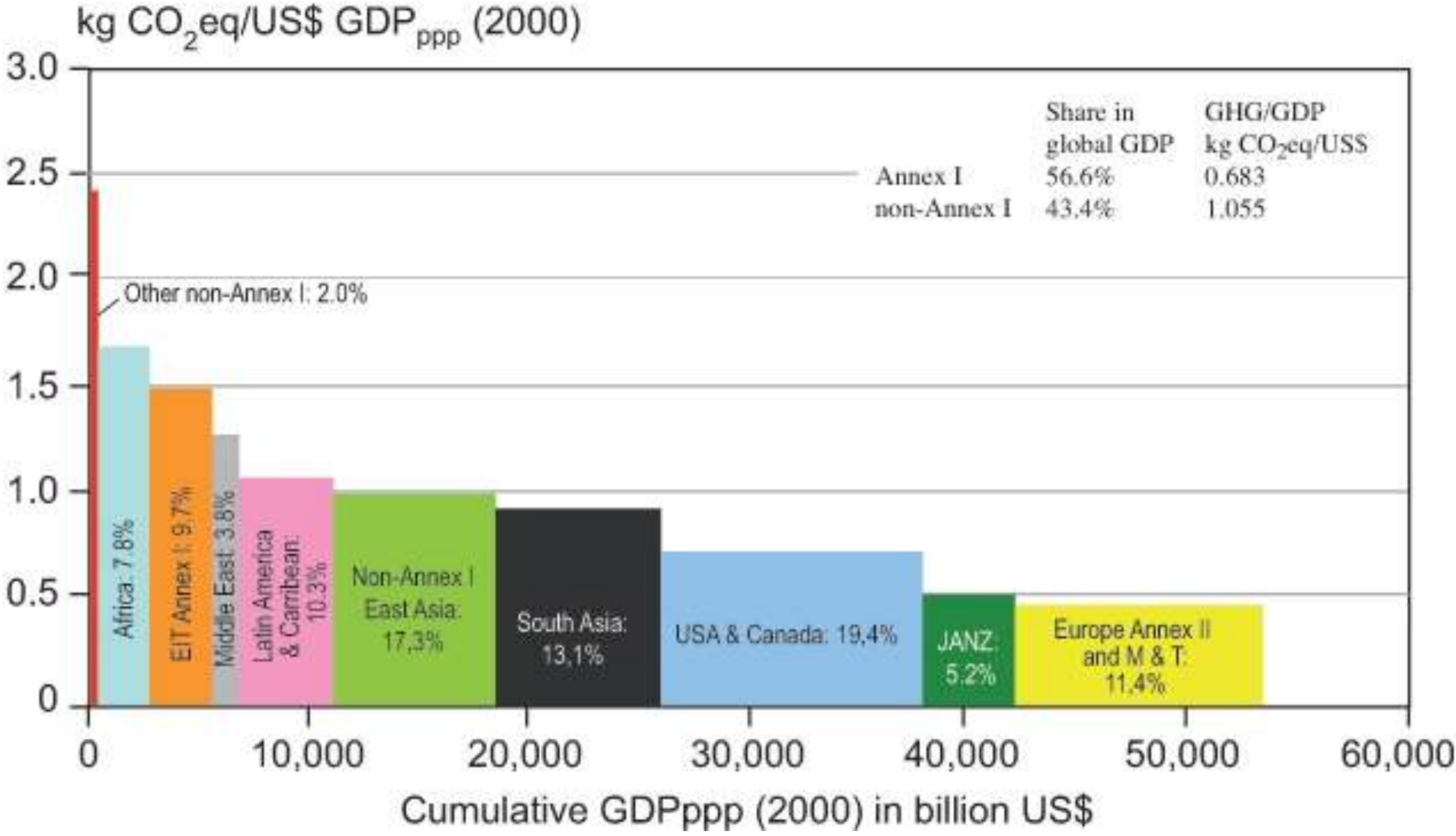
21st century : MAJOR THREATS EXPECTED

WHAT CAN WE DO to reduce the THREATS ?



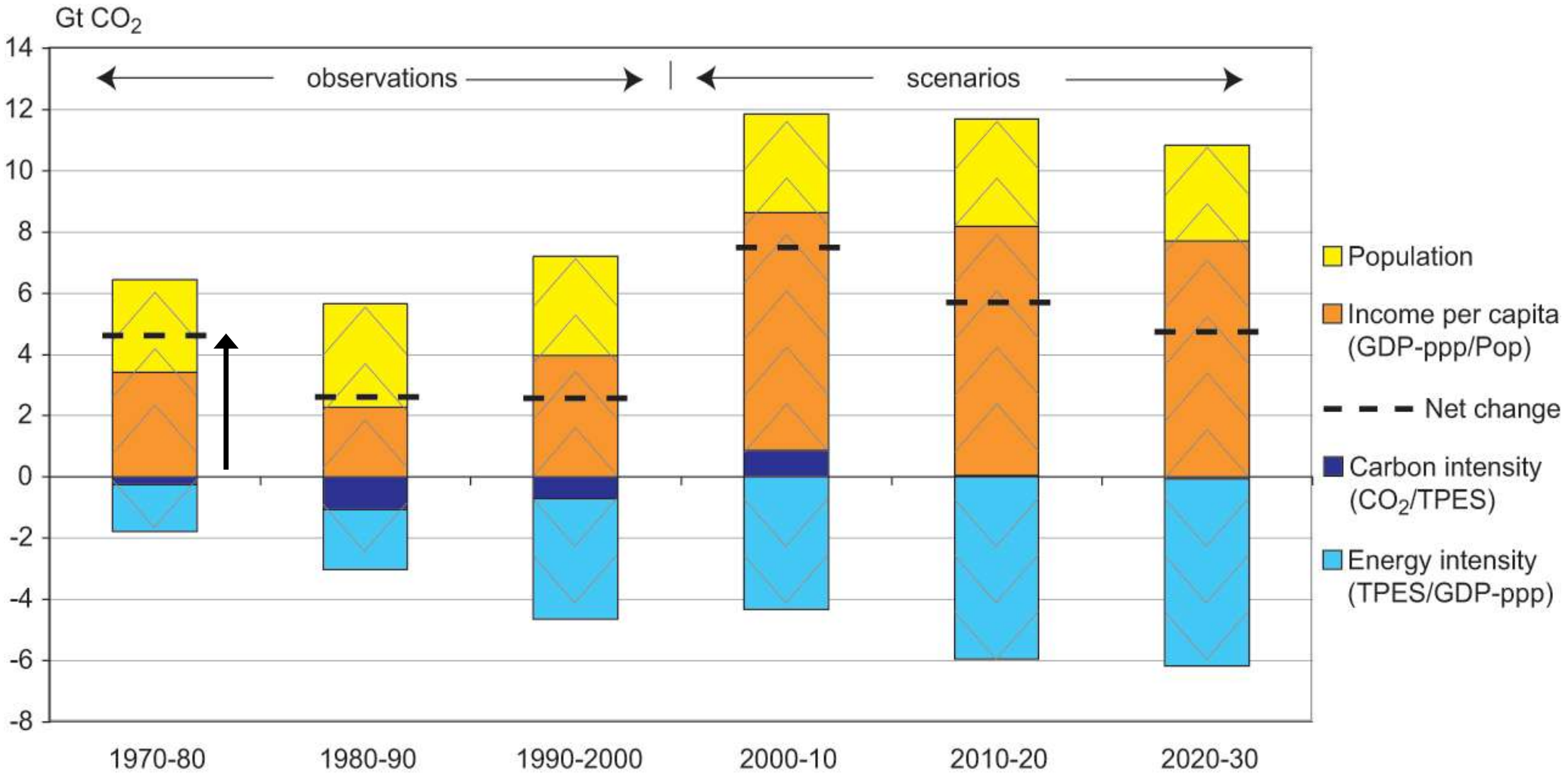
21st century : MAJOR THREATS EXPECTED

WHAT CAN WE DO to reduce the THREATS ?



21st century : MAJOR THREATS EXPECTED

WHAT CAN WE DO to reduce the THREATS ?

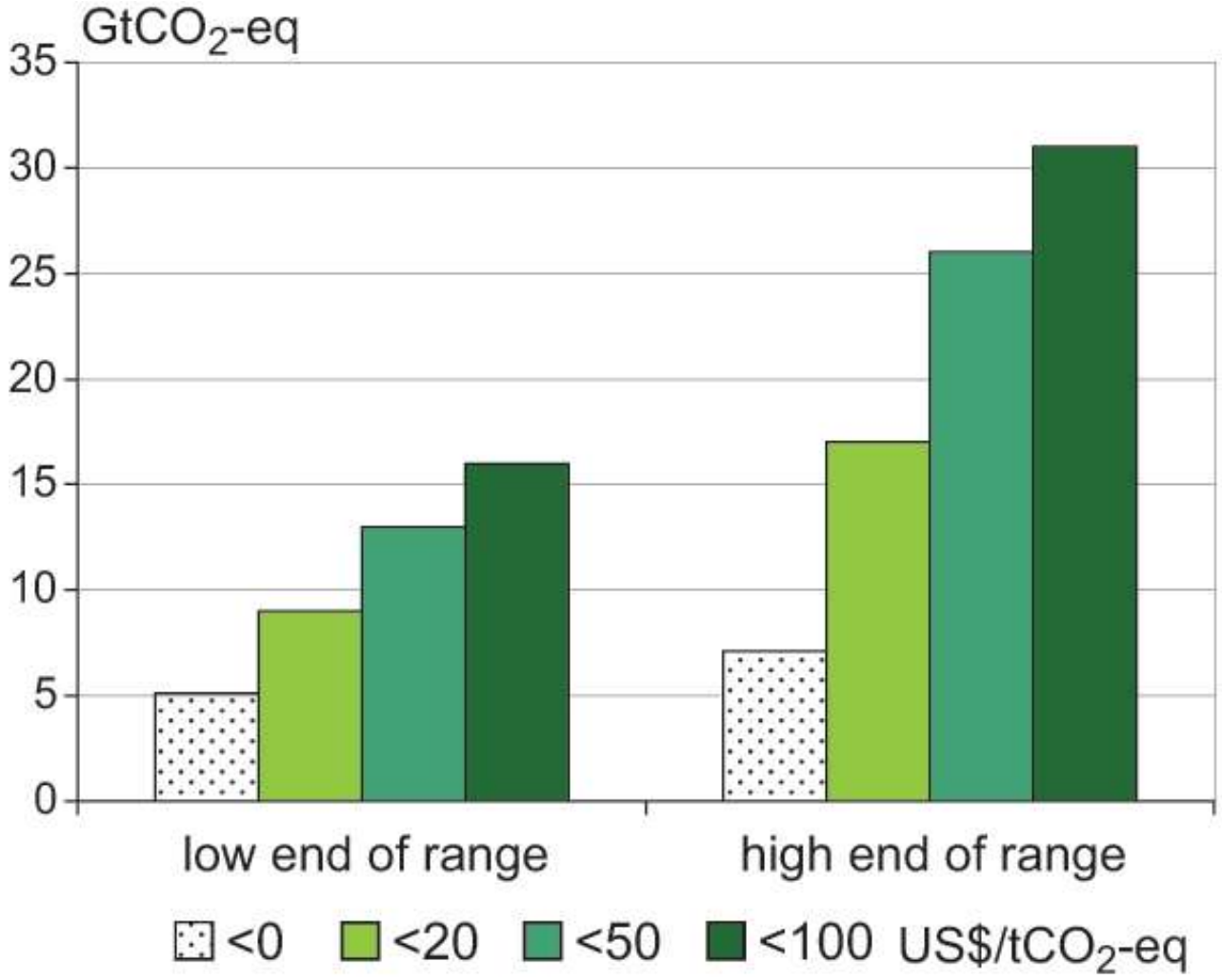


Increase in CO2 emissions / decade

Source : IPCC, AR4 WG I, 2007

21st century : MAJOR THREATS EXPECTED

WHAT CAN WE DO to reduce the THREATS ?



Potential reduction in CO2 emissions F (Price of CO2)

Source : IPCC, AR4 WG I, 2007

Why should States act ?

ETHICAL REASONS :

- Biodiversity, climate change protection : ethical aspects
- Responsability

ENVIRONMENTAL REASONS :

- Biodiversity, climate : part of our ‘common heritage’
- Protection of health and living conditions

Why should States act ?

ECONOMIC REASONS :

- Financial responsability
- Limit direct and indirect costs of climate change
- Decarbonization of the economy → avoid costly mistakes eg in energy infrastructures → push innovation
- To shift taxation from labor to carbon → creation of jobs
- Economy less dependent on world energy markets and more resilient to increase in energy prices
- Protection of biodiversity → maintain ecosystems services

Why should States act ?

SOCIAL REASONS :

- Reduce negative impacts on population
- Reduce energy cost burden on low-income households
- Instruments (ex : carbon tax) can be designed to reduce social discrepancies
- Reduce risks of social an international conflicts

The **essential mission of governements**
is to set the rules of the game
- on the worldwide scale
- in their country

Why should <u>individuals</u> act ?

ETHICAL REASONS :

- Acting in an ethical way can make you feel happier

ENVIRONMENTAL REASONS :

- Contribute to the protection of health and living conditions

ECONOMIC REASONS :

- Actions in reducing energy consumption and improving efficiency are the most cost-effective actions and are often directly profitable
- Early action will anticipate and dampen future rise of energy prices
- For enterprises and entrepreneurs :
  energy efficiency, renewable energies, transformation of the society towards SD = fantastic opportunities and markets

WHY ?

Why should <u>individuals</u> act ?

SOCIAL REASONS :

- Reduction of social discrepancies → improvement of personal security
- Citizens convinced to act for a more prosperous and equitable world → Improvement of personal satisfaction (at work, …)

The responsability of citizens-consumers and enterprises is :

- To be responsive, to act on the ground, to make the market operate
- To put pressure on governments so that they execute fairly their mission

Report on Impacts, Risks and Costs, **N. STERN** (2006)

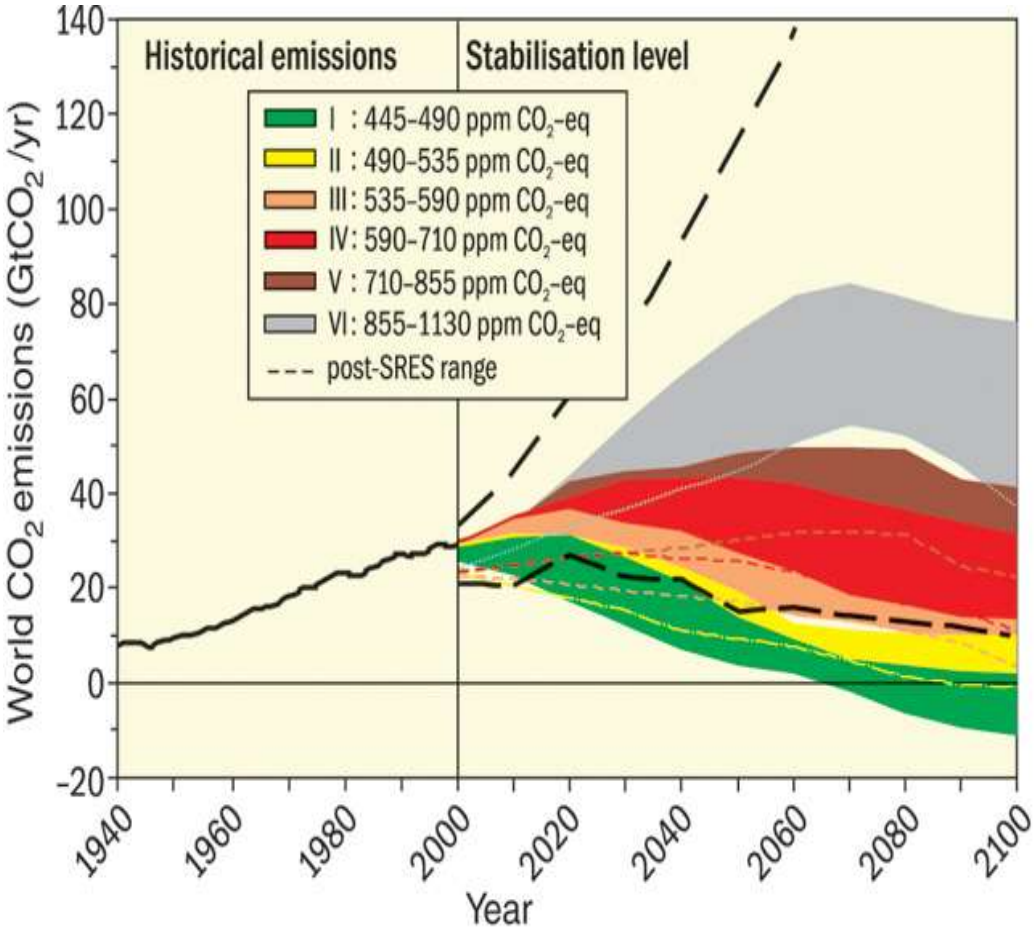
- Present concentration GHG : 430 ppm CO2eq
- Yearly increase : +2,5 ppm CO2eq / year

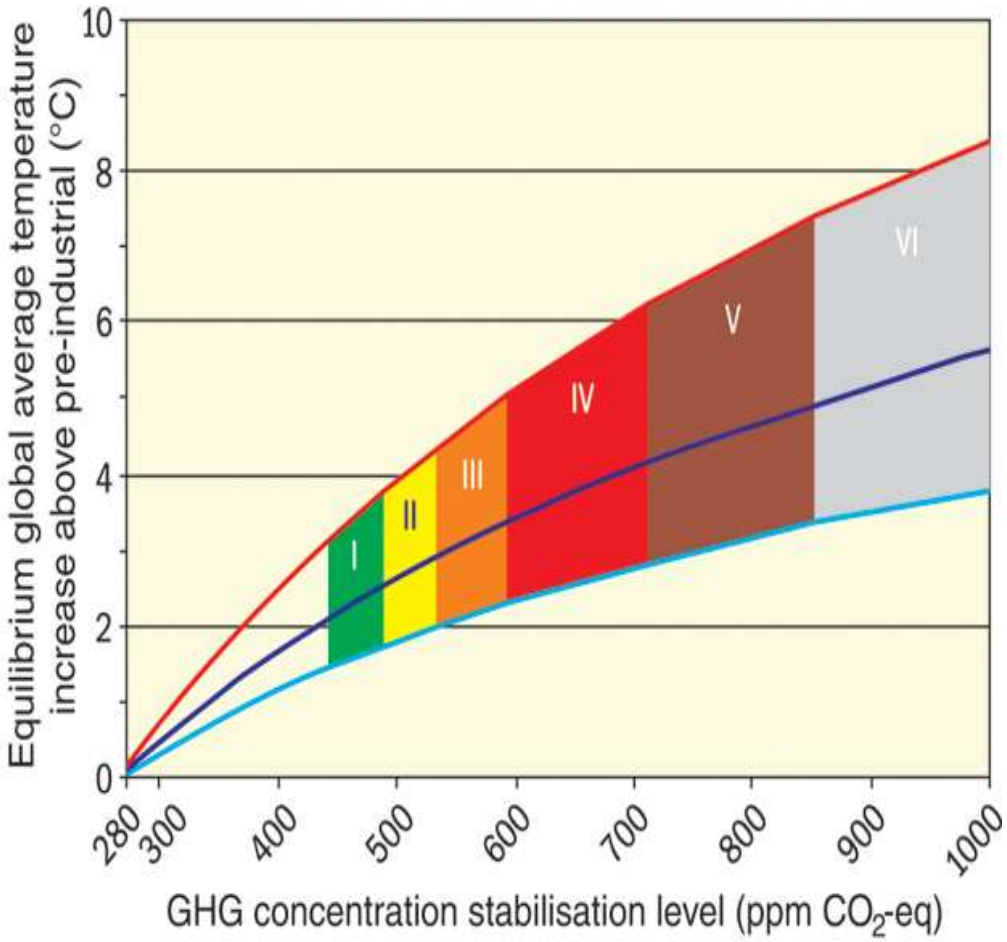
- To maintain < 450 ppm : probability 50-50 to limit temperature rise < +2°C
- To maintain < 550 ppm : probability 50-50 to limit temperature rise < +3°C
- Business-as-usual scenario ➔ +4 ou +5°C by the end of the 21st century
  → important risks of hughe climate instability

This suggests strongly that the objective must be to maintain
GHG **concentration between <u>450 and 550 ppm</u>**

- COSTS of ACTION ?
  To maintain 450-550 ppm : yearly cost = about **1% GDP**
- COSTS of INACTION ?
  Based on a rough worldwide averaged assessment :
  yearly cost = about **5 to 20% GDP**

WHY ?





Source : IPCC, 2007

WHEN ?

When do we have to act ?

Category	Radiative forcing (W/m^2)	CO_2 concentration[c] (ppm)	CO_2-eq concentration[c] (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity[b), c)] (°C)	Peaking year for CO_2 emissions[d)]	Change in global CO_2 emissions in 2050 (% of 2000 emissions)[d)]
I	2.5-3.0	350-400	445-490	2.0-2.4	2000-2015	-85 to -50
II	3.0-3.5	400-440	490-535	2.4-2.8	2000-2020	-60 to -30
III	3.5-4.0	440-485	535-590	2.8-3.2	2010-2030	-30 to +5
IV	4.0-5.0	485-570	590-710	3.2-4.0	2020-2060	+10 to +60
V	5.0-6.0	570-660	710-855	4.0-4.9	2050-2080	+25 to +85
VI	6.0-7.5	660-790	855-1130	4.9-6.1	2060-2090	+90 to +140
						Total

Source : IPCC, 2007

WHEN ?

When do we have to act ?

AS SOON and AS RAPIDLY AS POSSIBLE

From the discussions and outcome of the COPENHAGEN CONFERENCE (December 2009), it is clear that

the CLIMATE RACE has started !

What to do in practice ?

Suggestion :

1. **Feel which way the wind is blowing**

2. **Keep informed, kill pre-conceived ideas,**
   perform your own assements

3. **Be pro-active**

HOW ?

1. Feel which way the wind is blowing

Scenario 1 : Governements succeed in obtaining a worldwide agreement on GHG emission reductions

→ We will move on a 'controlled' pathway

Governments will set up specific instruments
The most efficient instruments reducing GHG emissions are ECONOMIC INSTRUMENTS :

- « Cap and Trade » : tradable quotas of emissions (instrument well suited for a limited number or large point emissions)
- « Carbon Tax » : set a price for GHG emissions (instrument well suited for numerous small dispersed emissions)

These instruments can be designed to be **progressive**

→ **smooth** the evolution of energy prices and limit climate change effects / costs

HOW ?

1. Feel which way the wind is blowing

Scenario 2 : There is NO worldwide agreement
→ We will move on a '**uncontrolled**' pathway

In a near future : peak oil + excess oil demand vs offer
➔ rise of the prices of coal, oil, natural gas

In this scenario : economists predict **succession of ups and downs** :
high prices of oil → reduction of economic activity → unemployment
→ reduction of demand → lower prices of oil → rise of activity

In this scenario, economy, environment and society will experience the worst case :

- Fluctuations of costs (→ difficulties to mobilize actors and to make investments profitable)
- Additional costs of important climate change effects

HOW ?

1. Feel which way the wind is blowing

Anyway, whatever the scenario, the conclusion is clear :

Except if a significant technological breakthrough occur,

PRICES OF ENERGY WILL RISE SIGNIFICANTLY

CARBON HAS or WILL HAVE A COST

HOW ?

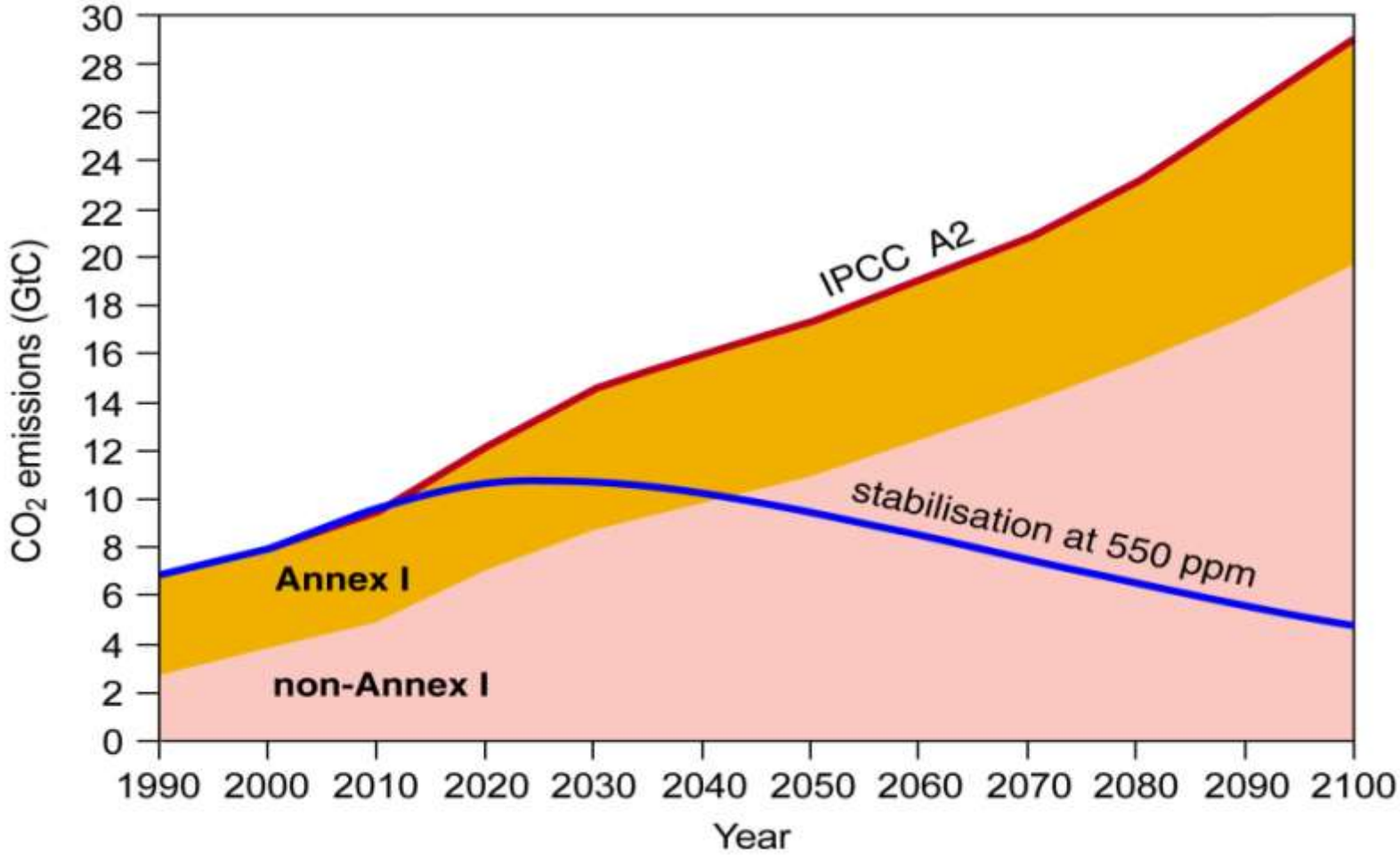
2. Keep informed, kill pre-conceived ideas, perform your own assessments

- Climate convention (Rio de Janeiro, 1992) ?
  Kyoto protocol (Kyoto, 1997) ?
  Copenhagen agreement (Copenhagen, 2009) ?
- Renewable energies are THE solution ?
- Nuclear energy is THE solution ?
- Carbon Capture and Storage is A solution ?
- Electric cars are A solution ?
- Fair Trade is A solution ?

MAX HAVELAAR
Fairtrade Garantie

2. Keep informed, kill pre-conceived ideas, perform your own assessments

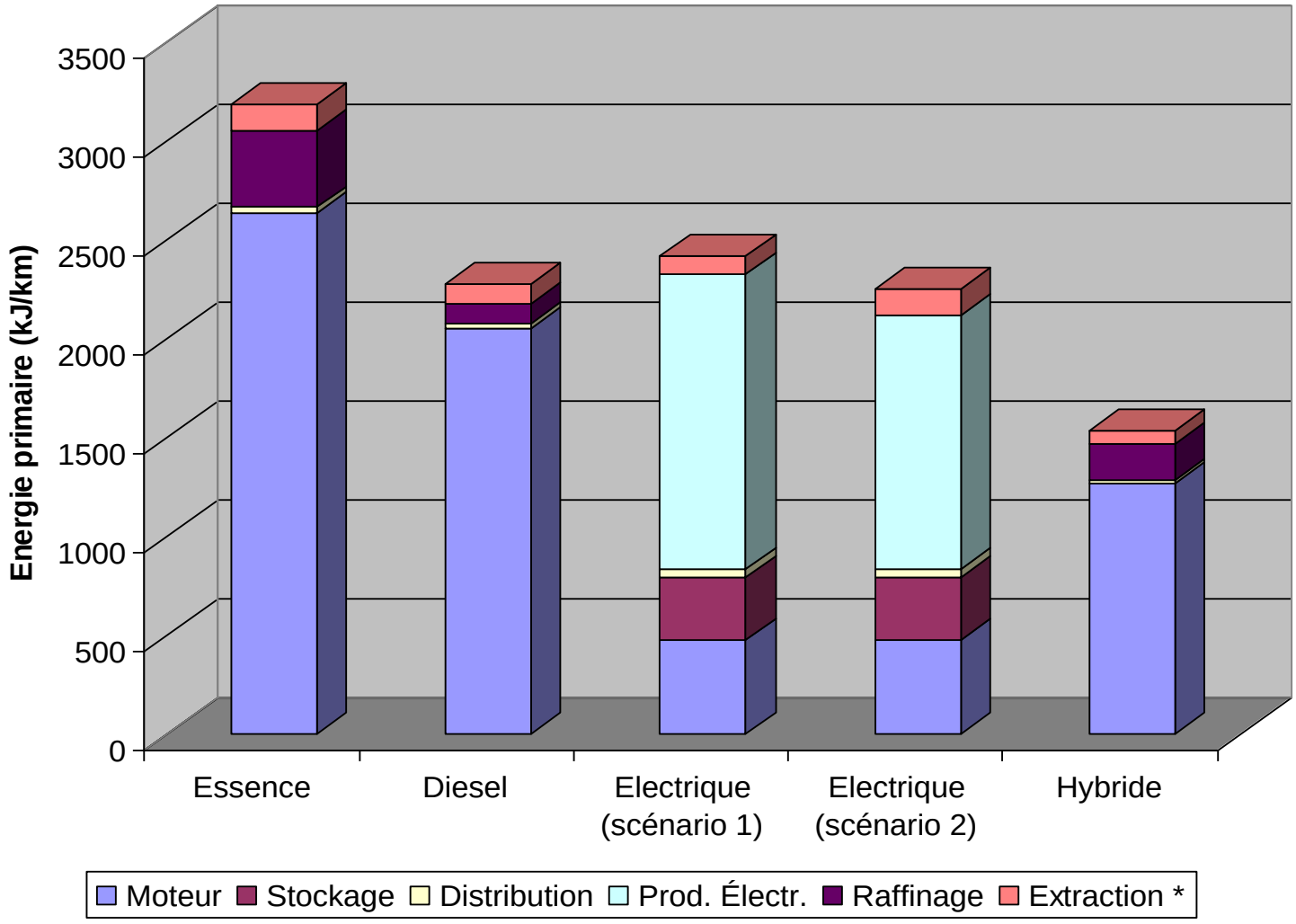
- Climate convention (Rio de Janeiro, 1992) ?
  Kyoto protocol (Kyoto, 1997) ?
  Copenhagen agreement (Copenhagen, 2009) ?



2. Keep informed, kill pre-conceived ideas, perform your own assessments :

- Electric cars ?

Primary energy use kJ/ km

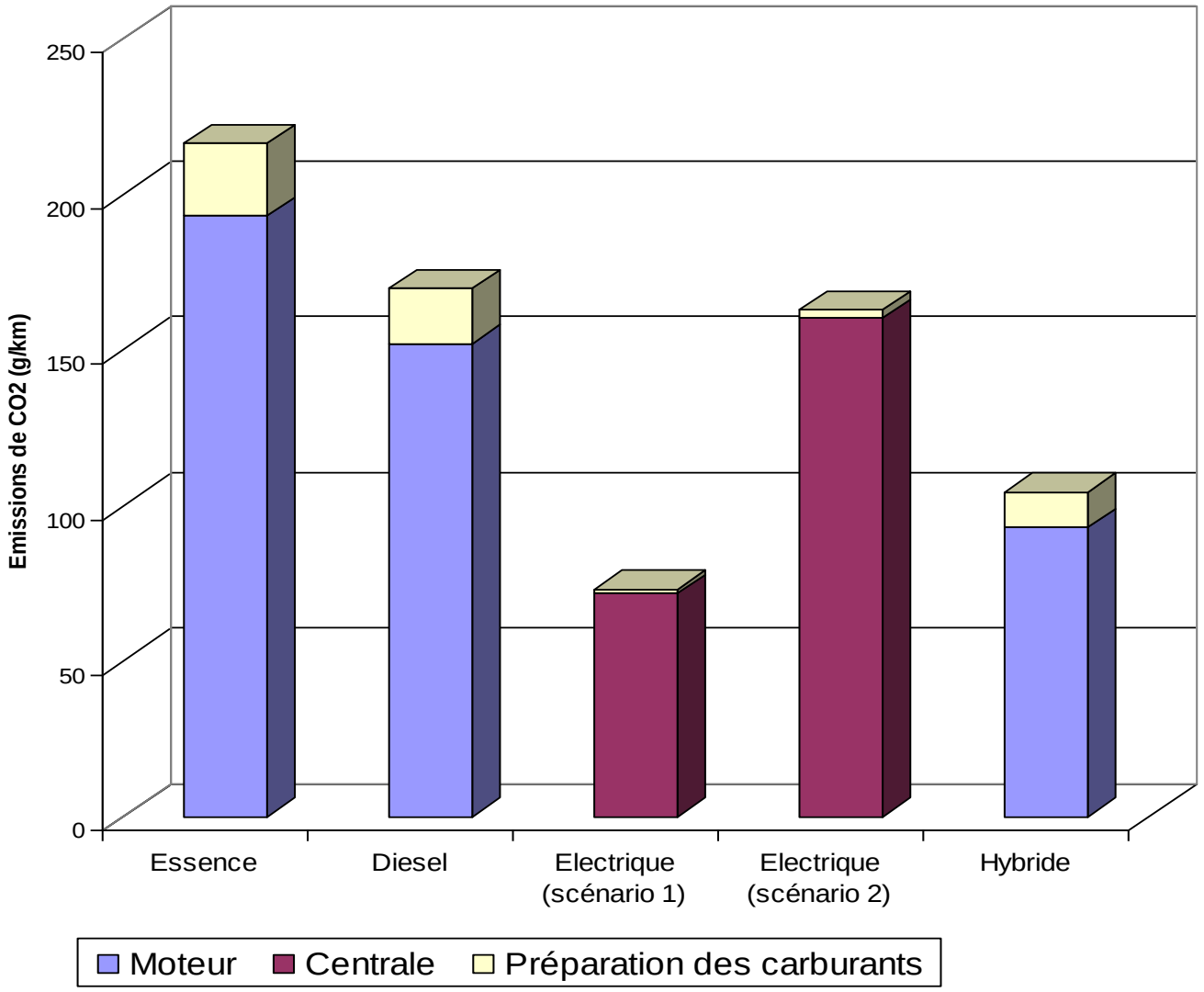


2. Keep informed, kill pre-conceived ideas, perform your own assessments

- Electric cars ?

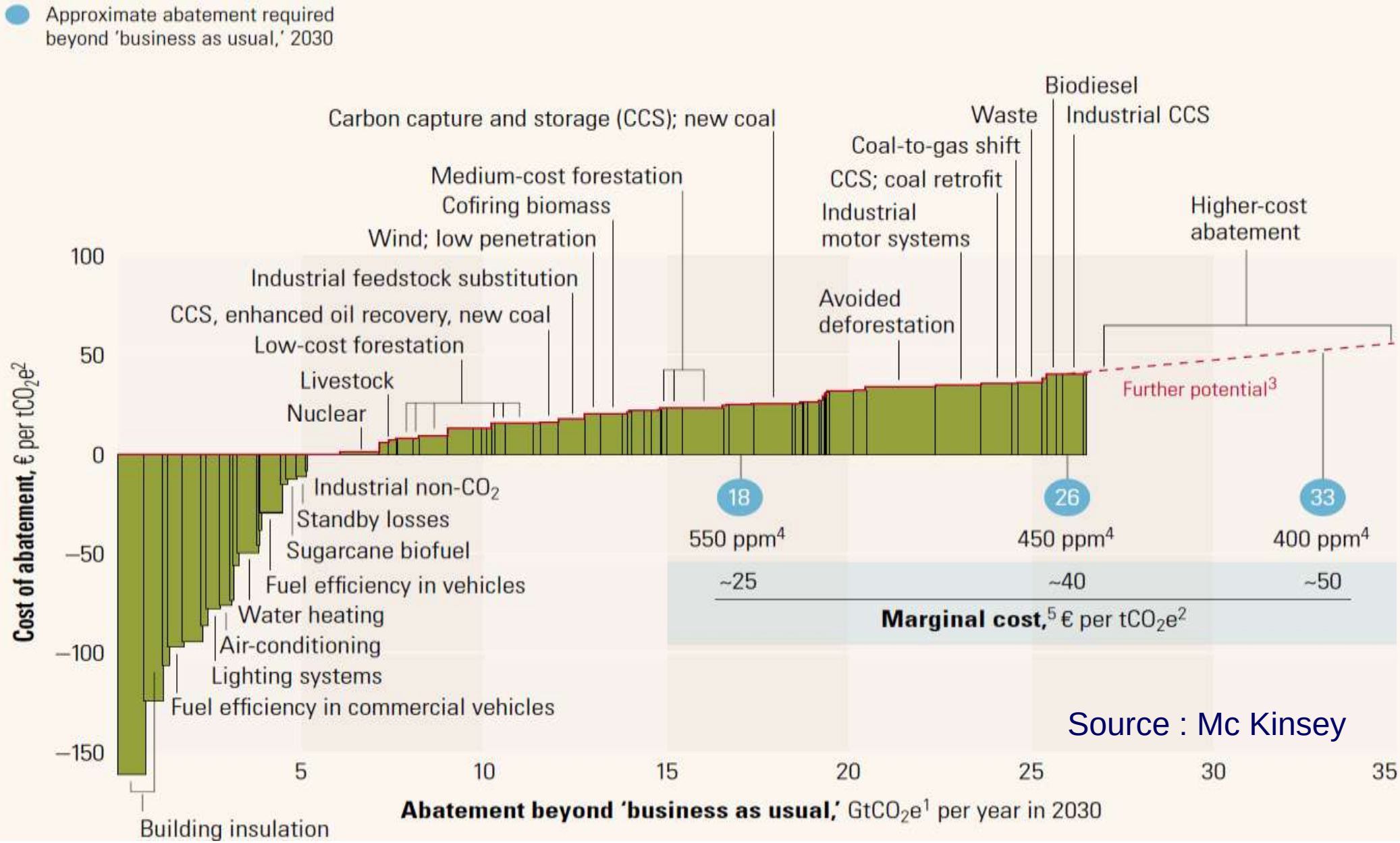
CO2 emission

g/ km



HOW ?

2. Keep informed, kill pre-conceived ideas, perform assessments



Source : Mc Kinsey

2. Keep informed, kill pre-conceived ideas, perform assessments

What is remarkable from this figure :

1) Most of the technologies necessary to reduce significantly our GHG emissions do exist
2) Numerous actions are already profitable today

CONCLUSION :

- New technologies are not always necessary :
  there is an urgent need to get **existing mature technologies** to the market
  (eg : insulation, eco-buildings, thermal solar panels, …)
- In several domains : **innovation** (breakthrough) is needed :
  not only technological innovation, but also as regards finance, behaviour, mindset (Rethink !)

HOW ?

3. Be pro-active Example : Computers

1 PC / server = 50 – 100 W
Utilisation of CPU = about 5 – 6 %

Virtualization of servers :
On each '*physical*' server,
possibility to run up to 10 '*virtual*' servers
(realized by software)

→ Purchase of only 1 serveur (instead of 10)
→ Utilisation of CPU = 60 %
→ Consumption of electricity : + 10% / 10 servers !
→ Increase in efficiency : a factor of 9 !!
(89 % reduction in consumption of electricity)
→ + Reduction of electric consumption for cooling

➔ 1 rack = 64 'physical' servers = 640 'virtual' servers

3. Be pro-active

- Example : Devices used on a daily basis : the GLUTTON ®

Picture : courtesy Chr. LANGE, Andenne, Belgium www.glutton.com

HOW ?

3. Be pro-active Example : CO2-neutral warehouse

tendances Trends

24 JAN. 2008

ENV

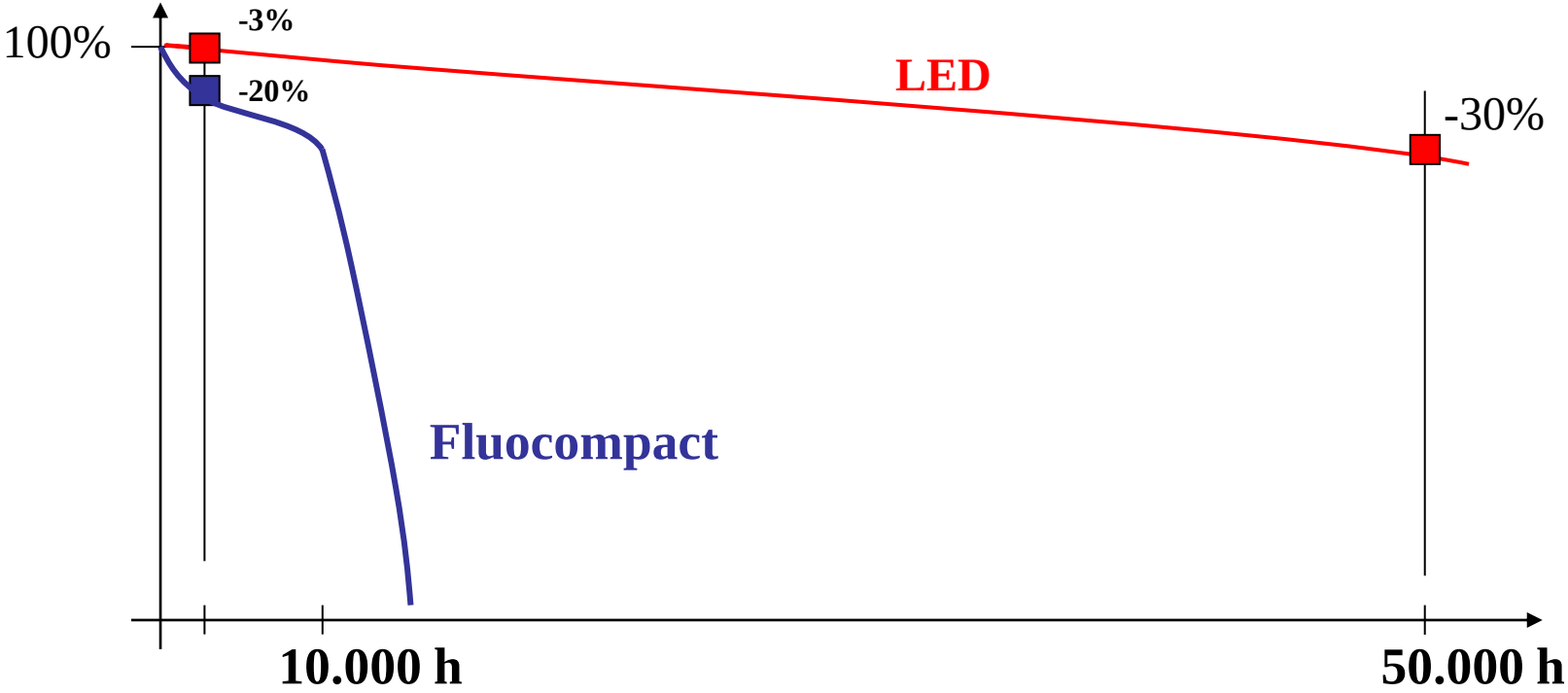
Une première chez Volvo Trucks à Gand

«L'usine neutre en CO_2 a été le projet le plus rentable de ma carrière»

A l'heure où les entreprises belges s'inquiètent des objectifs européens de réduction des gaz à effet de serre, Patrick Collignon, directeur général de Volvo Trucks à Gand, démontre qu'une réduction drastique des rejets de CO_2 est non seulement possible, mais peut aussi s'avérer très rentable. Christine Scharff

HOW ?

3. Be pro-active Example : LED lighting



Picture : courtesy Ph. SALSAC, Liege, Belgium info@LEDstime.be

HOW ?

3. Be pro-active Example : LED lighting

A commercial facility / shop illuminated during all working hours /
windows illuminated during working hours + evening + part of the night
Comparison :
- Classical low consumption appliances (fluorescent) (lifetime = 16.000 h)
- New LED appliances (lifetime = 50.000 h)

	Low cons. appl.	LED appl.
Purchase of appliances	12.000 €	17.000 €
Purch. of appliances 50.000 h	36.000 €	17.000 €
Cost of electricity 50.000 h	171.000 €	39.000 €
Total 50.000 h (10 years)	207.000 €	56.000 €

Payback LED : **150.000 € / 10 years** !!

Picture & numbers : courtesy Ph. SALSAC, Liege, Belgium info@LEDstime.be

CONCLUSION

As regards the key issue of SUSTAINABILITY,
one and only one strategy can be recommended :

GET ORGANIZED
PERFORM YOUR OWN ASSESSMENTS
ANTICIPATE
INNOVATE

CONCLUSION

It is not the strongest of the species that survive,
Nor the most intelligent,
But the ones most responsive to change

- Charles **DARWIN**