British Council and FoE Scotland lecture - University of Edinburgh, 9th February 2009

Building a Low Carbon Economy – an International Perspective

Professor Jacqueline McGlade
Executive Director
European Environment Agency

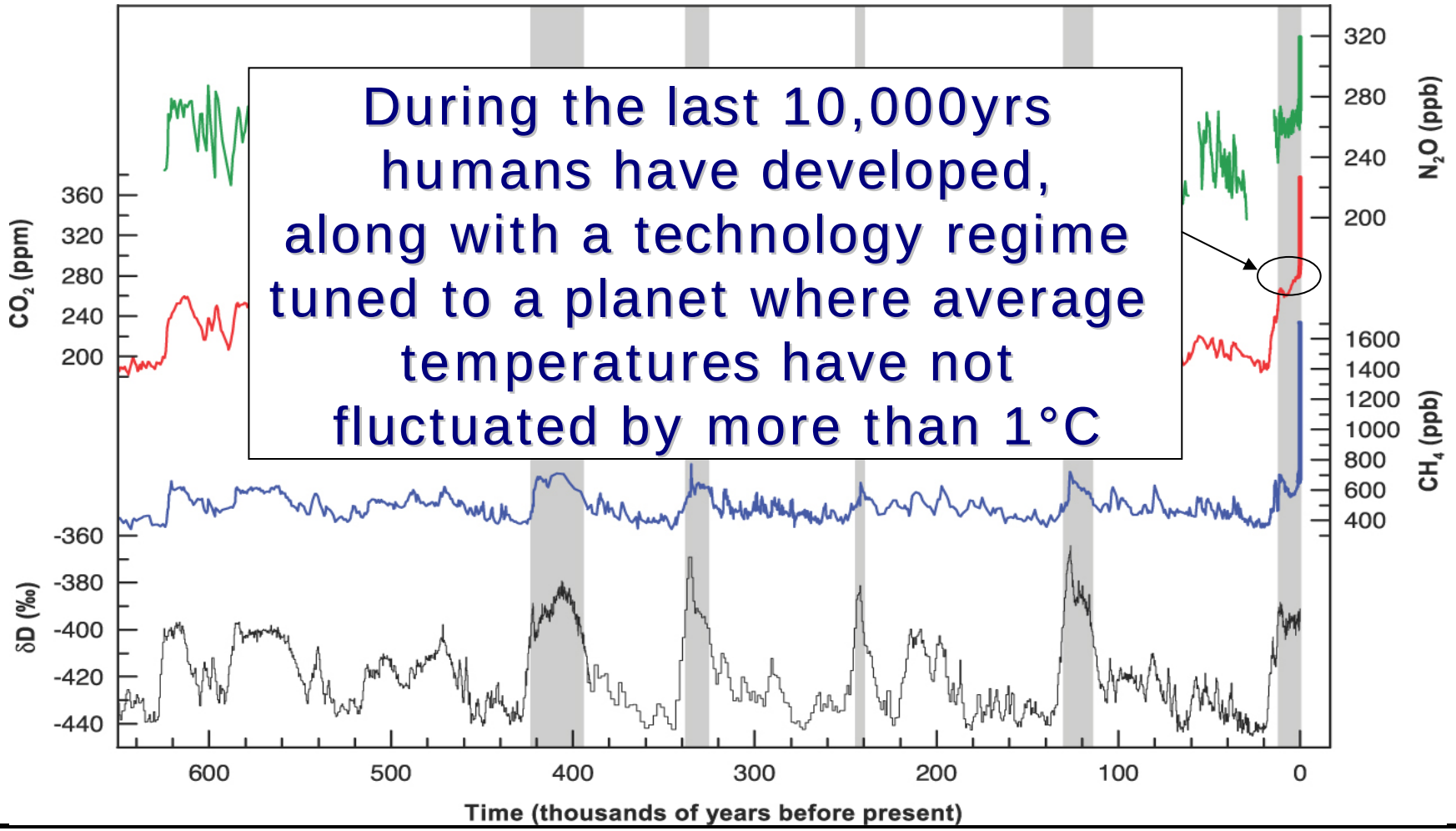
The EEA mission

The European Environment Agency is the EU body dedicated to providing sound, independent information on the environment

We are a main information source for those involved in developing, adopting, implementing and evaluating environmental policy, and also the general public

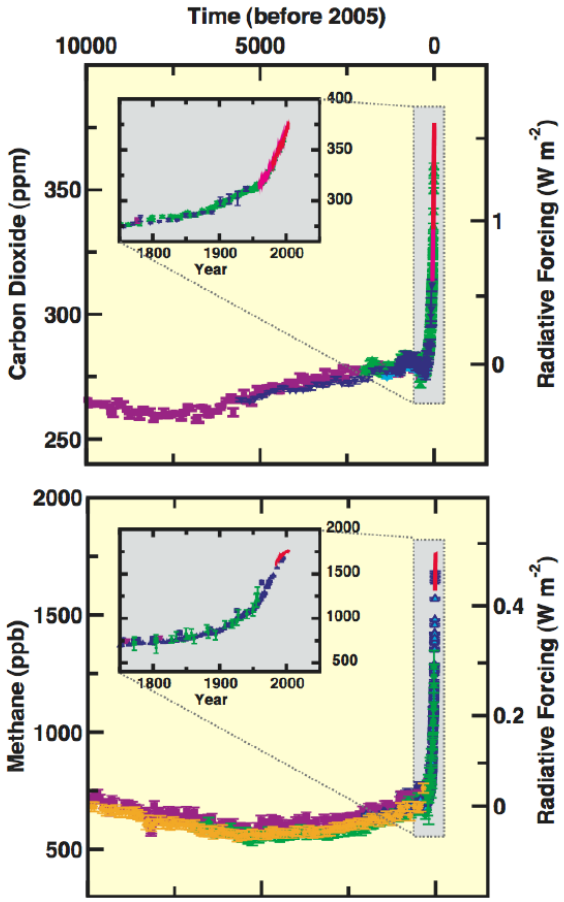
CO_2 concentration over the past 650 000 years

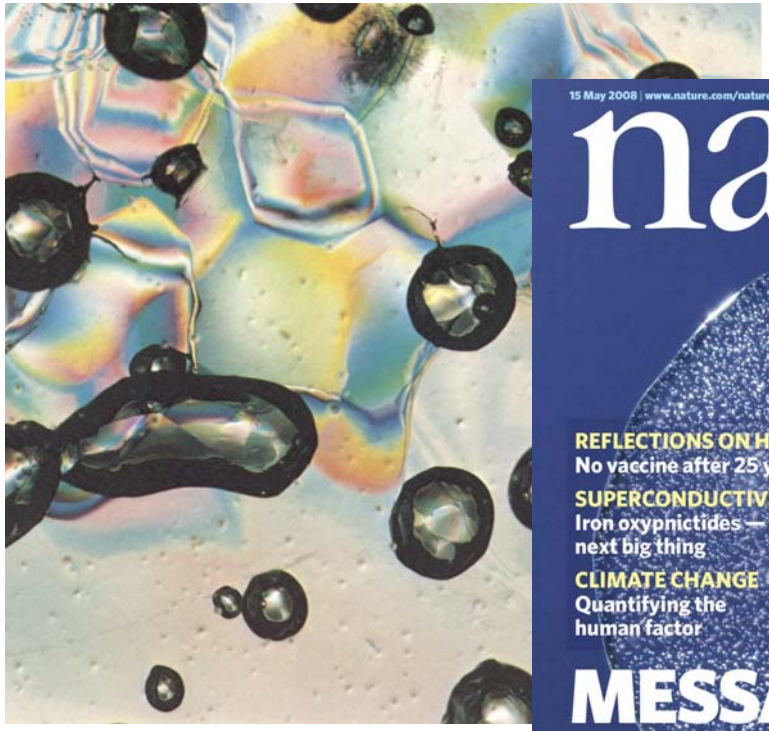
- Due to emissions from human activities the CO2 concentration is 387 ppm (2007), far exceeding the natural range over the last 650 000 years (180 – 300 ppm)



European Environment Agency

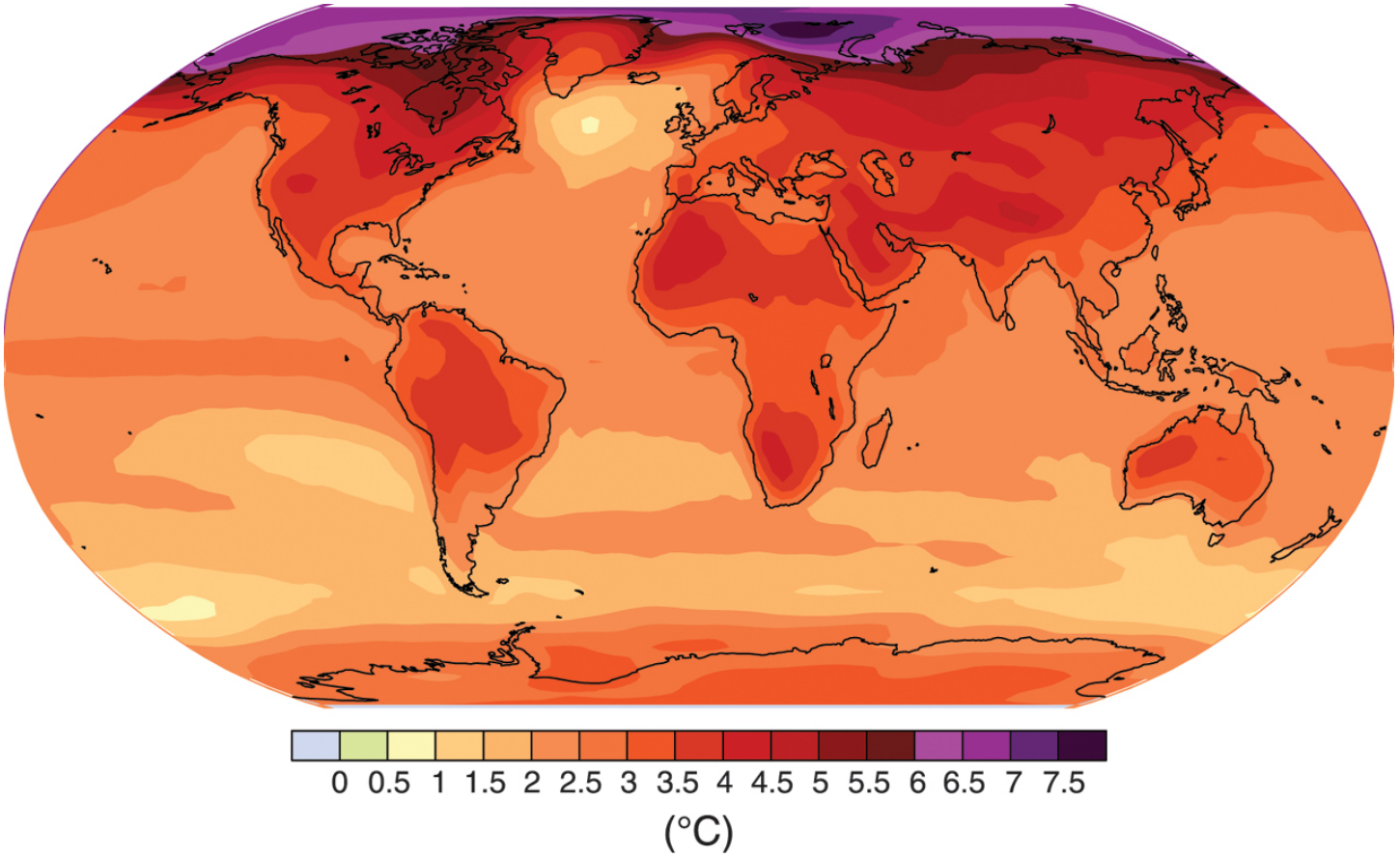
CO_2 : higher levels and faster rise





(IPCC, 2007, Fig. SPM-1)

Arctic temperatures have increased at twice global rates in the past 100 years and IPCC projections indicates a similar pattern for the next 100 years

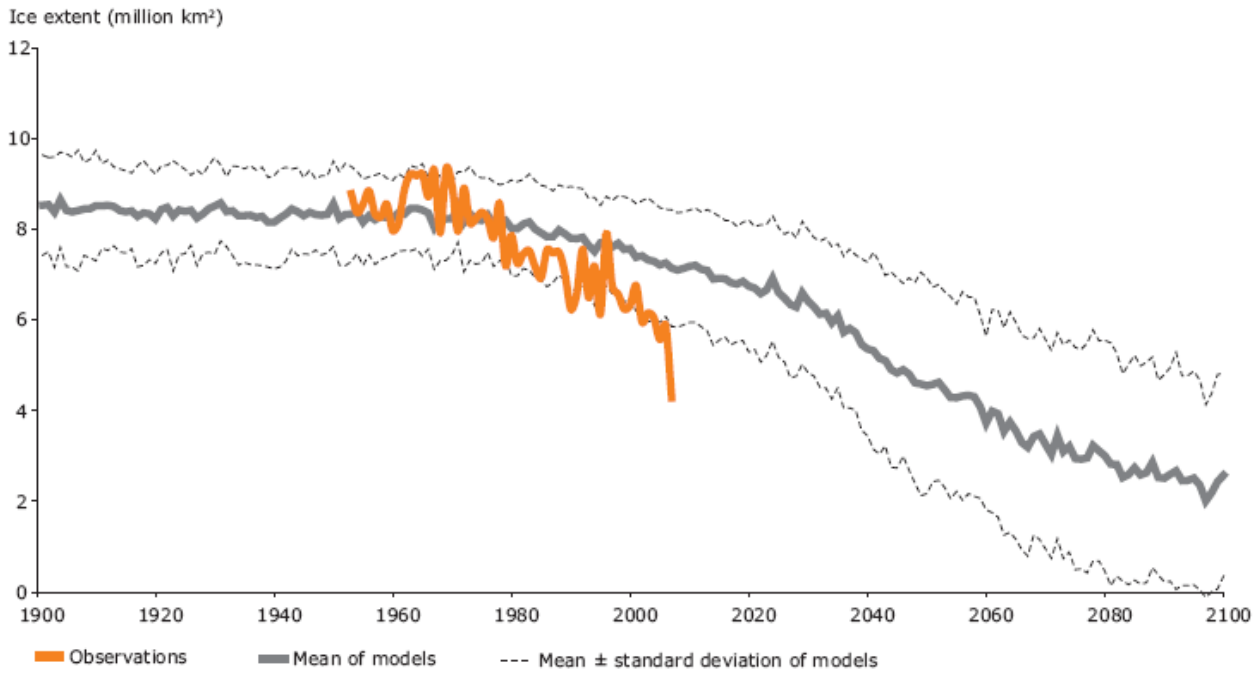


IPPC 2007, End of 21 st century projection (Average A1B SRES scenario)

Arctic sea ice

- Arctic sea ice extent has declined at an accelerating rate, especially in summer
- The record low ice cover in September 2007 was half of the size of a normal minimum extent in the 1950s

past



Observed and projected Arctic September sea-ice extent 1900-2100

The 2007 minimum sea-ice extent

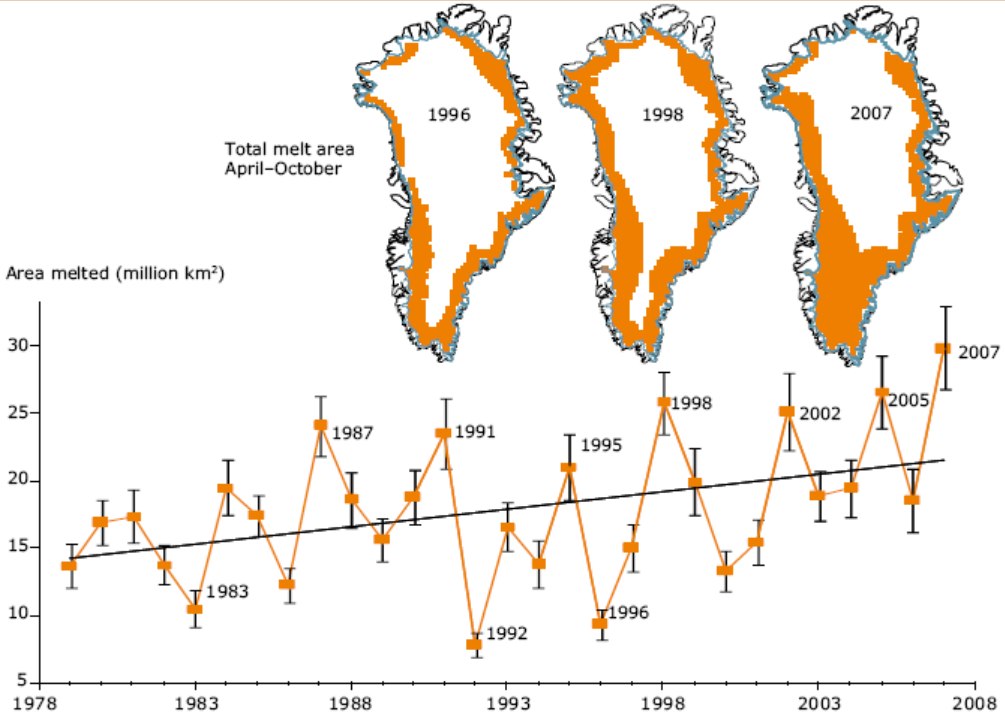
- Summer ice is projected to continue to shrink and may even disappear at the height of the summer melt season in the coming decades
- There will be still substantial ice in winter

future

Greenland ice sheet

- The Greenland ice sheet is losing 100 billion tons of ice per year since the 1990s
- The contribution of ice-loss from Greenland to global SLR is estimated at 0.14-0.28 mm/year for the period 1993-2003 and has since increased

past

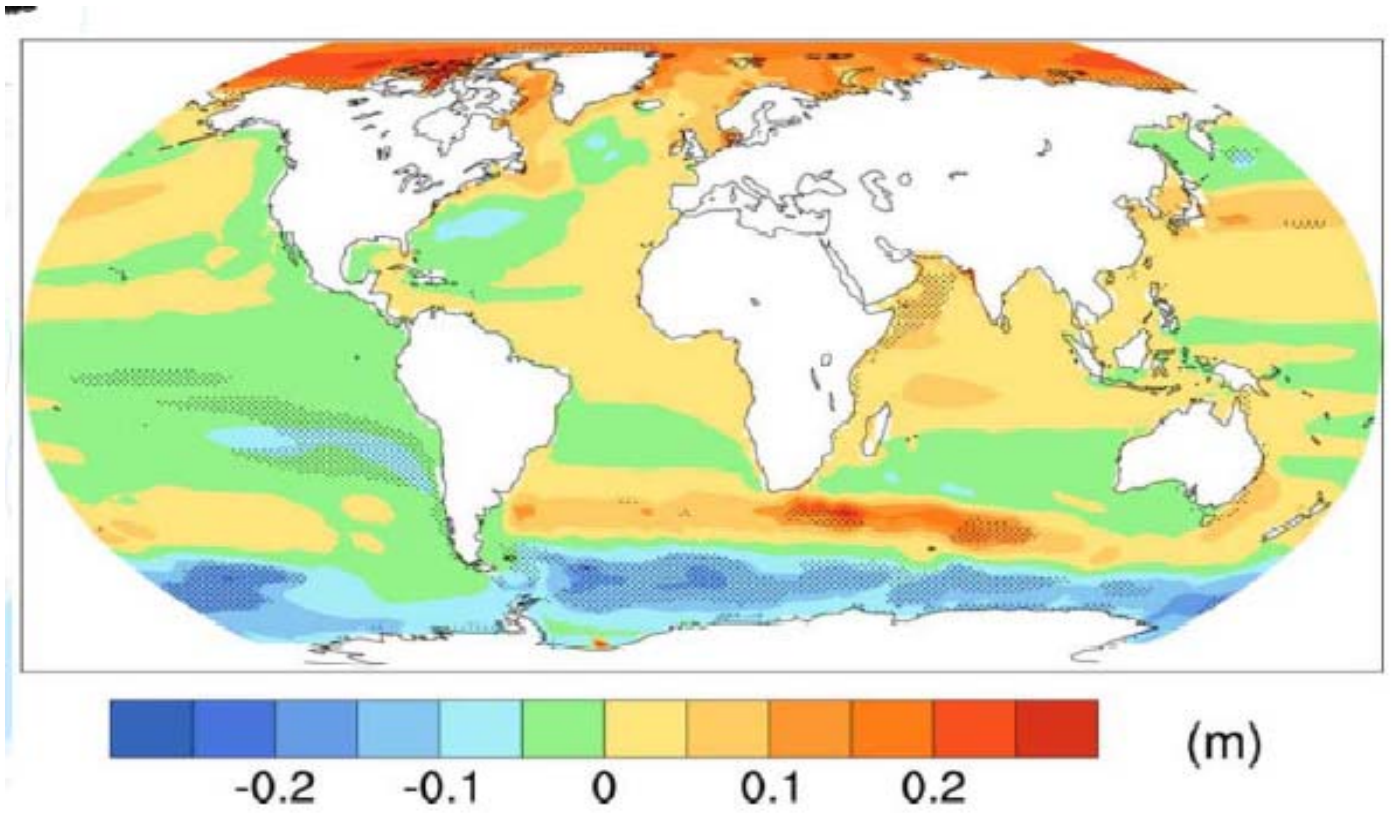


Area of Greenland ice sheet melting 1979-2007

- No reliable prediction of the future of ice sheets can be made, since internal processes are poorly understood
- In the long term, melting ice sheets have the largest potential to increase SLR

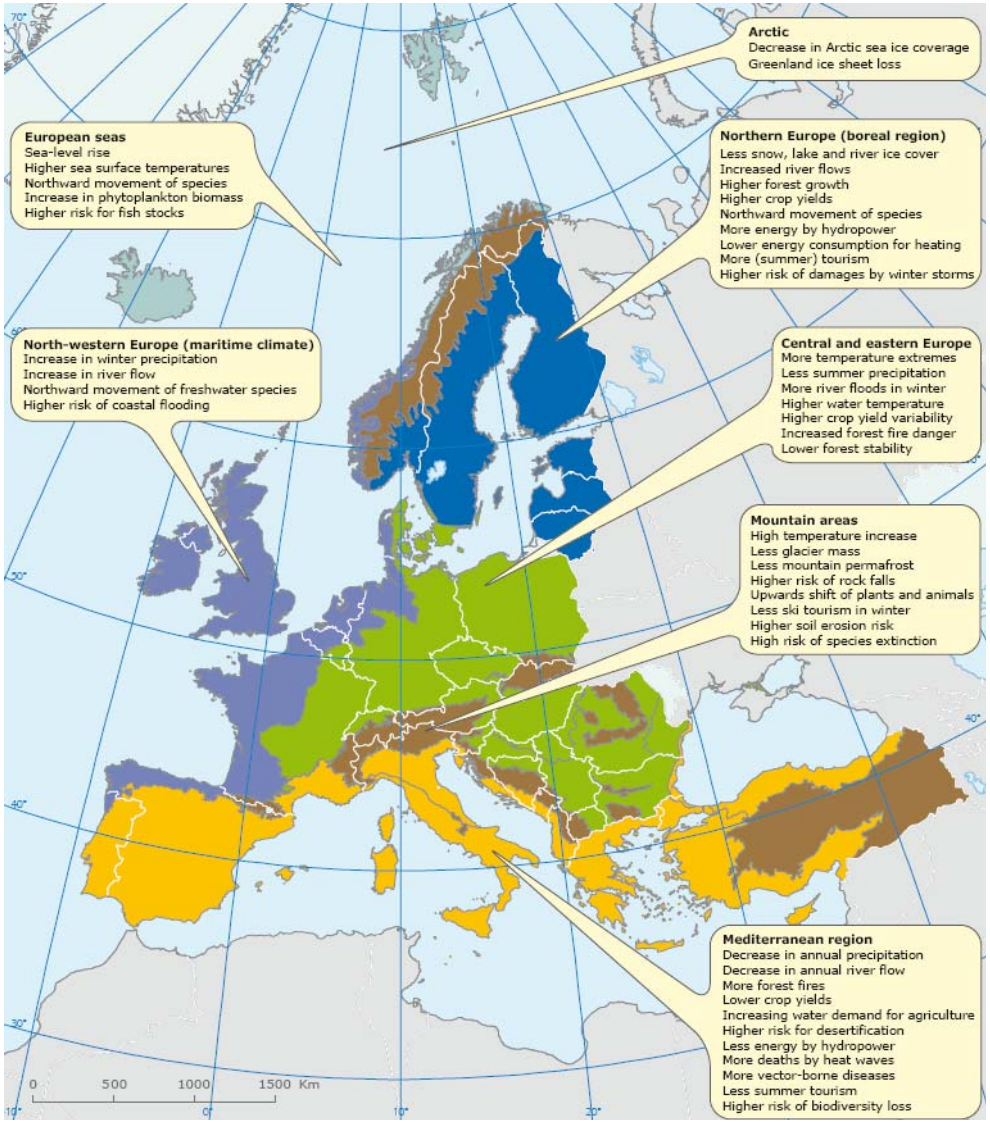
future

Regional sea level rise



Deviations from global mean sea level rise be 2100

Key past and projected impacts



Main biogeographic regions of Europe (EEA member countries)

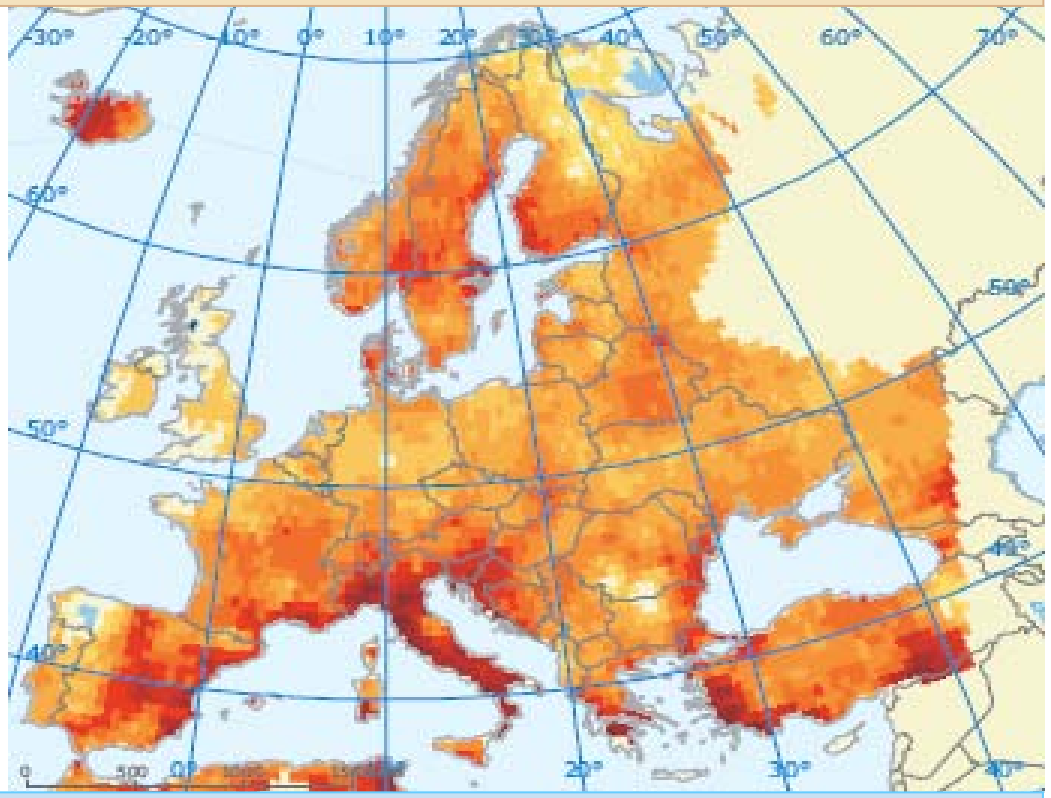
- Arctic
- Arctic — Greenland (not EEA member)
- Boreal region
- North-western Europe
- Central and eastern Europe
- Mountain areas
- Mediterranean region

European Environment Agency

Temperature extremes in Europe

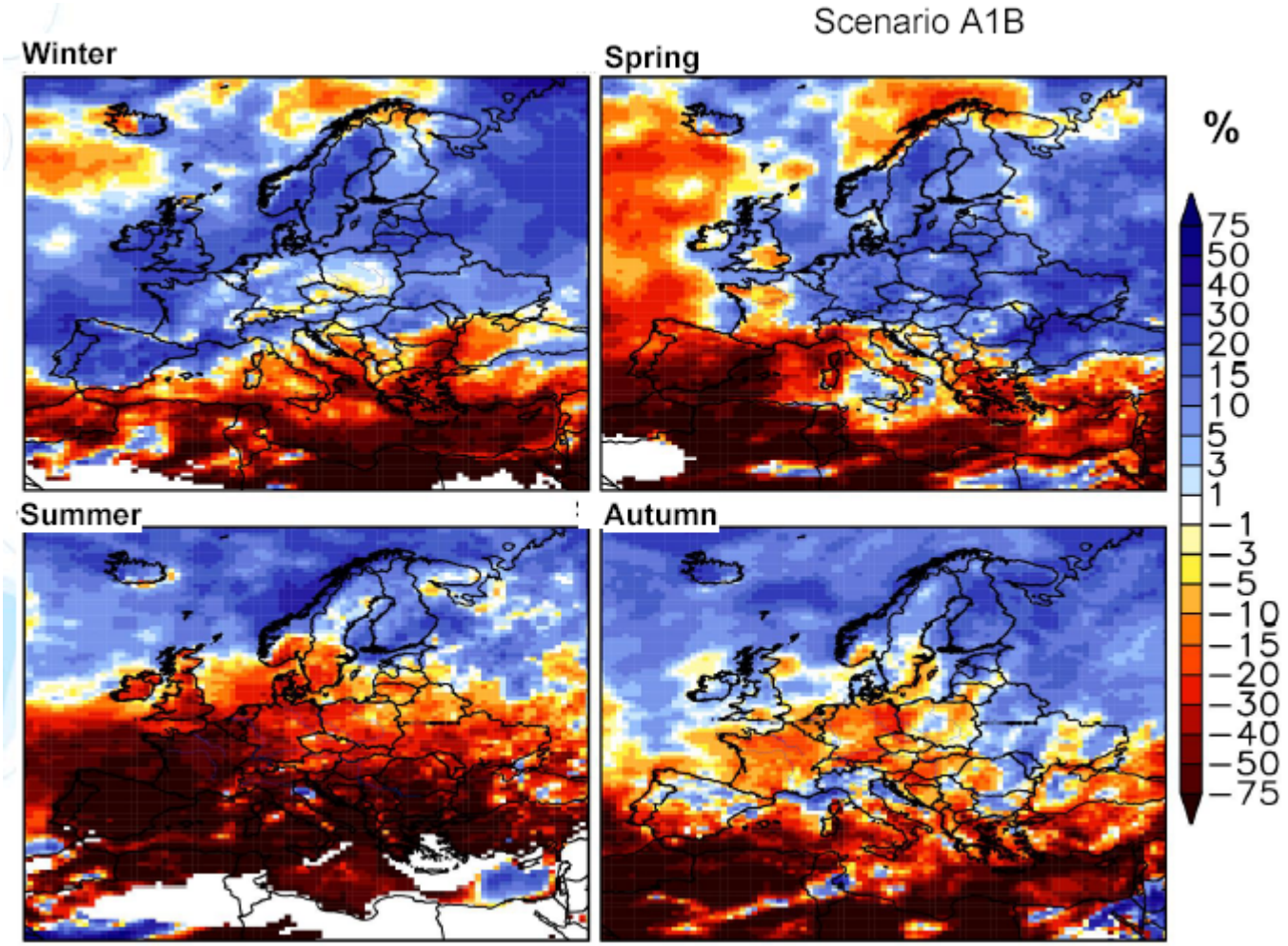
- Extremes of cold became less frequent and warm extremes more frequent
- Number of hot days almost tripled between 1880 and 2005

Observed changes in duration of warm spells in summer in the period 1976 - 2007

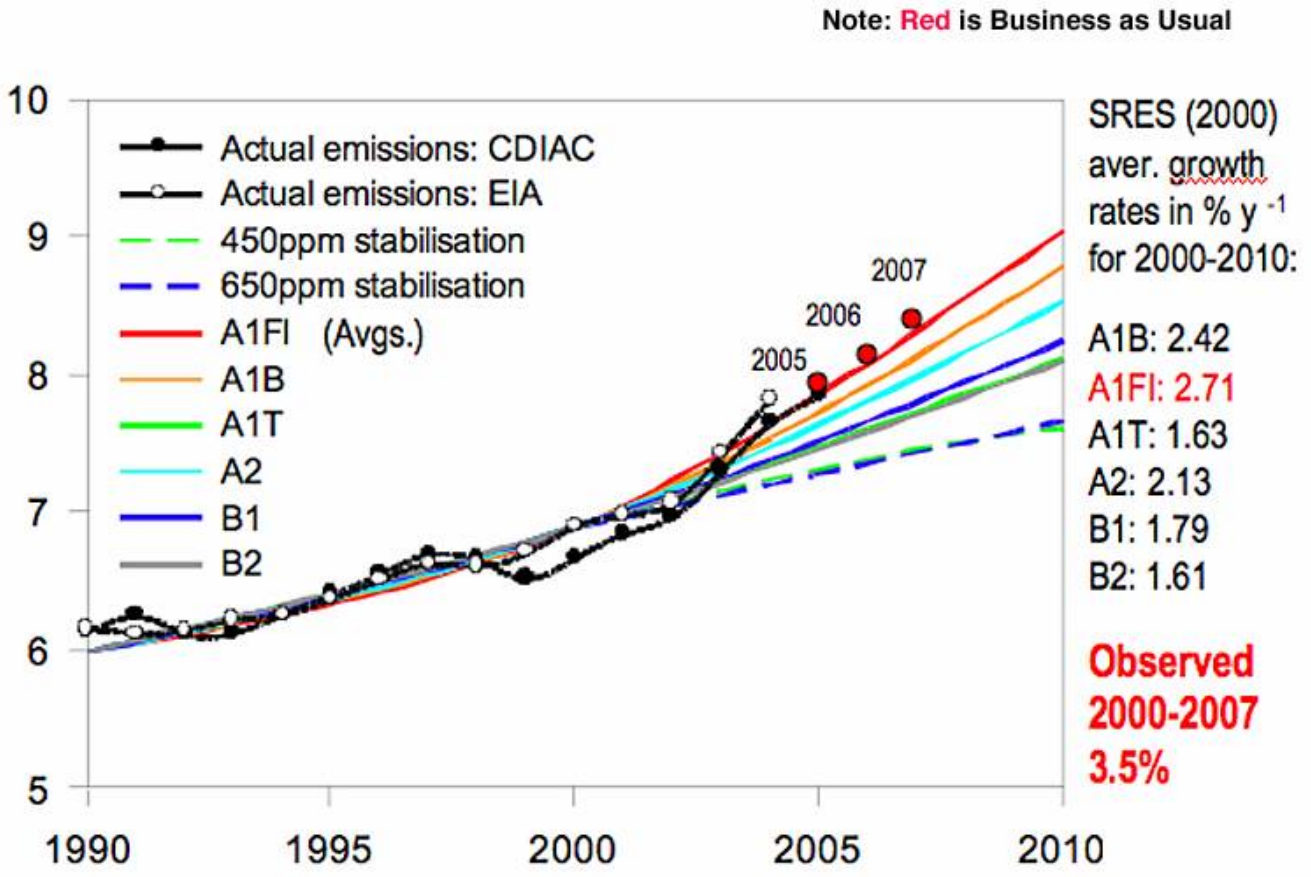


- Increase in frequency, intensity and duration of heat-waves
- Further decrease of number of cold days and frost extremes

Precipitation changes by 2050 - vulnerable regions

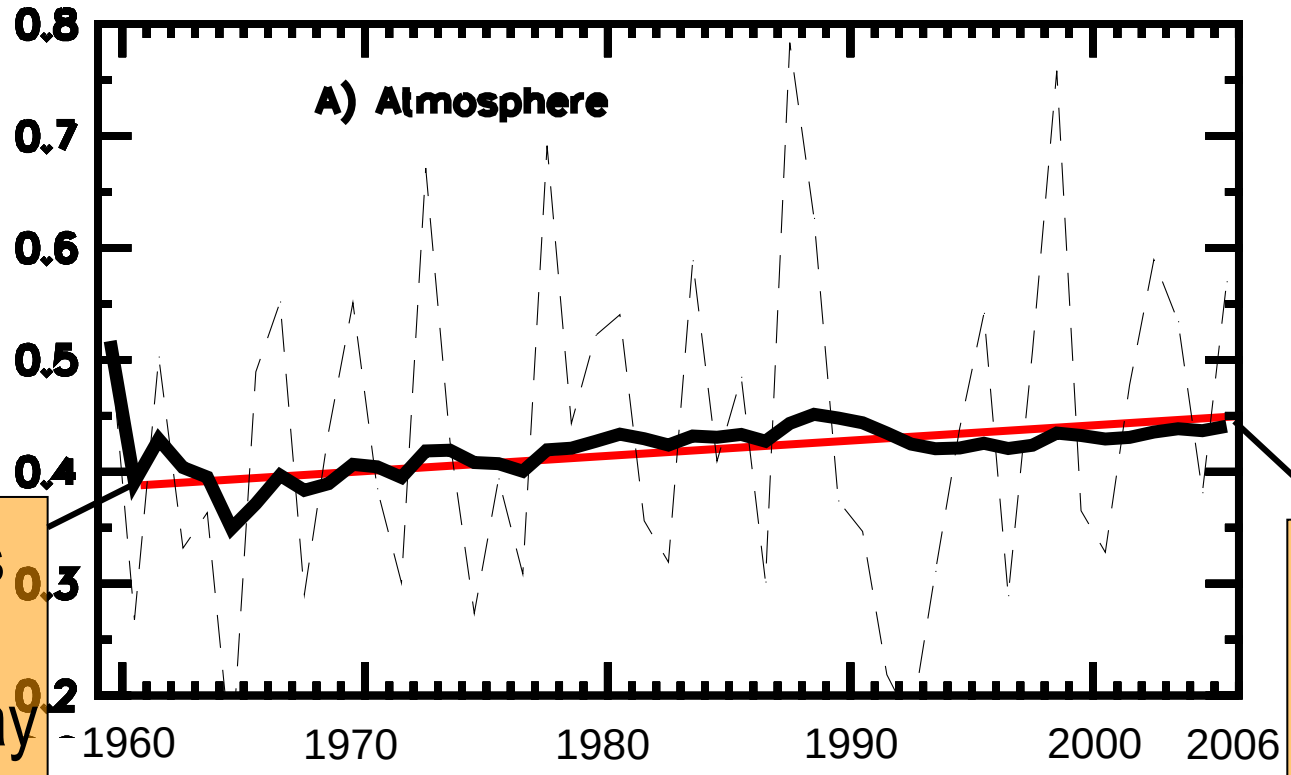


Fossil Fuel Emissions: Actual vs. IPCC Scenarios



Raupach et al 2007, PNAS (updated)

Fraction of all anthropogenic emissions that stay in the atmosphere



Emissions
1 tCO_2
400Kg stay

Emissions
1 tCO_2
450Kg stay

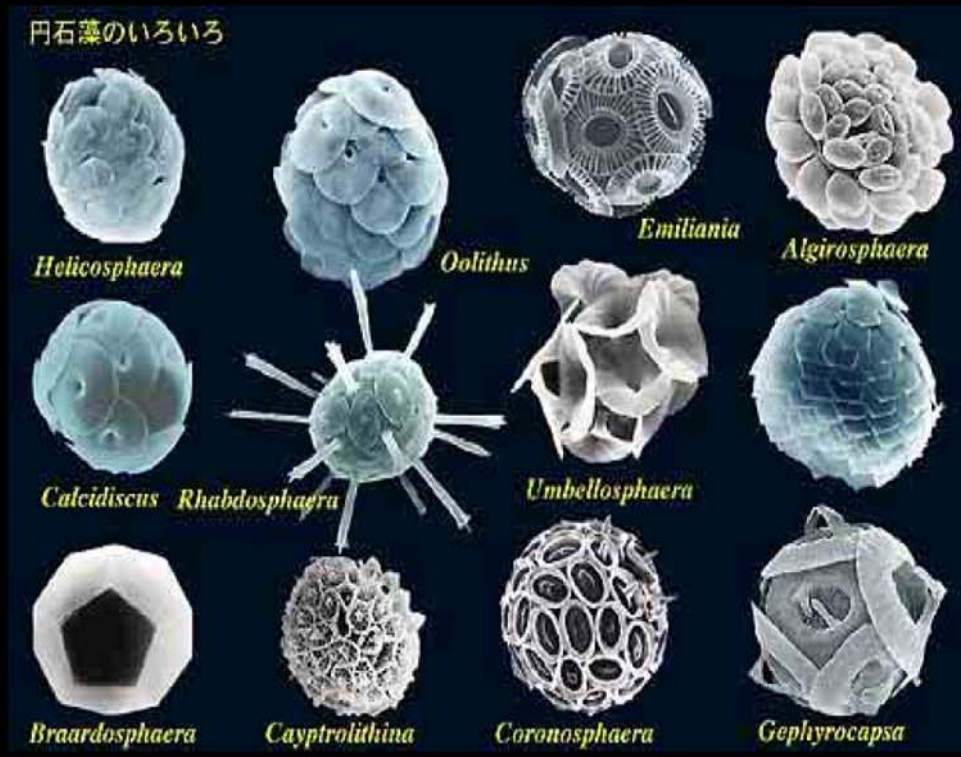
Canadell et al. 2007, PNAS

The ocean pH change will persist for thousands of years. Because the fossil fuel CO_2 rise is faster than natural CO_2 increases in the past, the ocean will be acidified to a much greater extent than has occurred naturally in at least the past 800,000 years [Caldeira and Wicket, 2003].

Corals

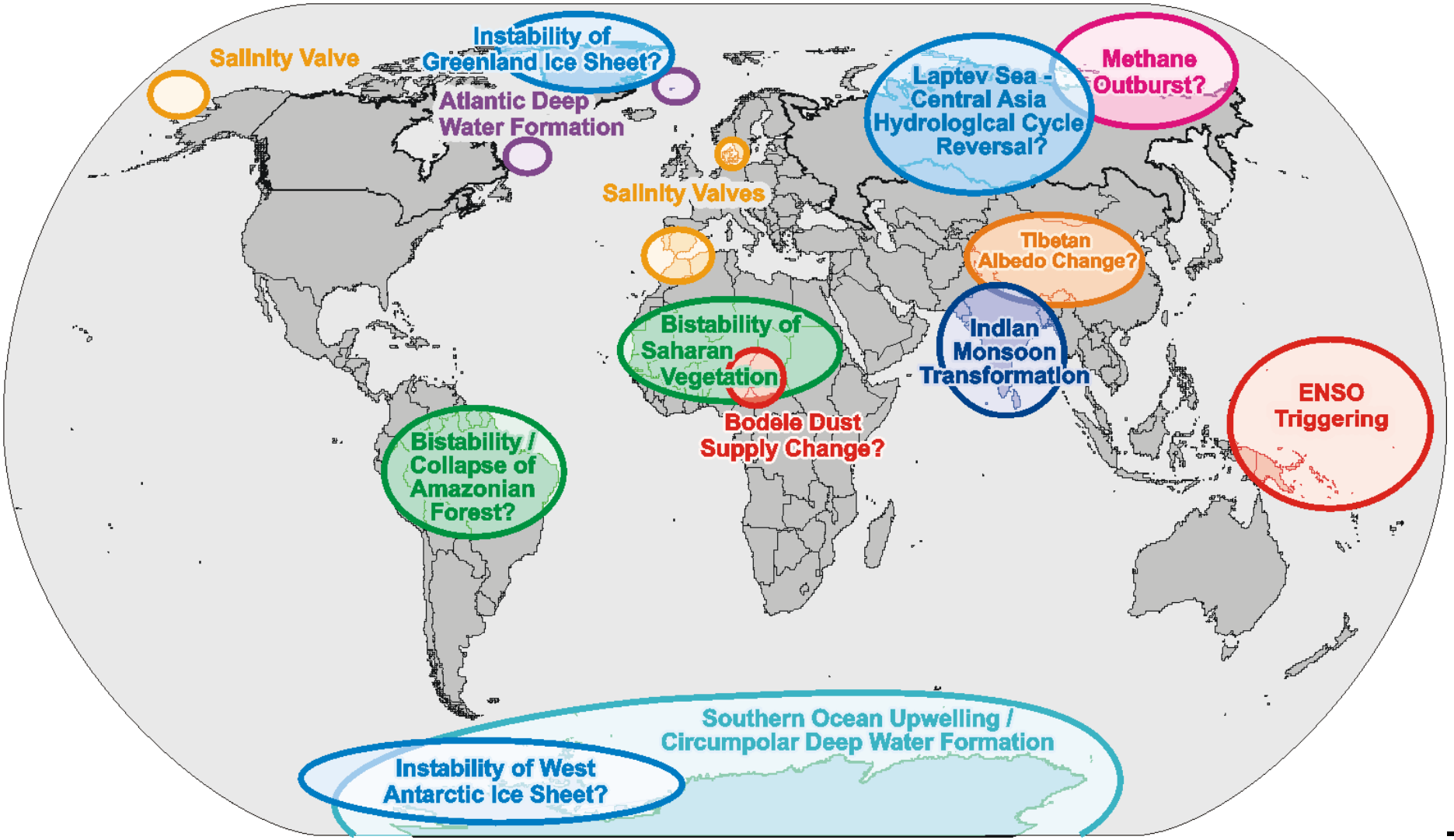
Photo: Missouri Botanical Gardens

Calcareous plankton

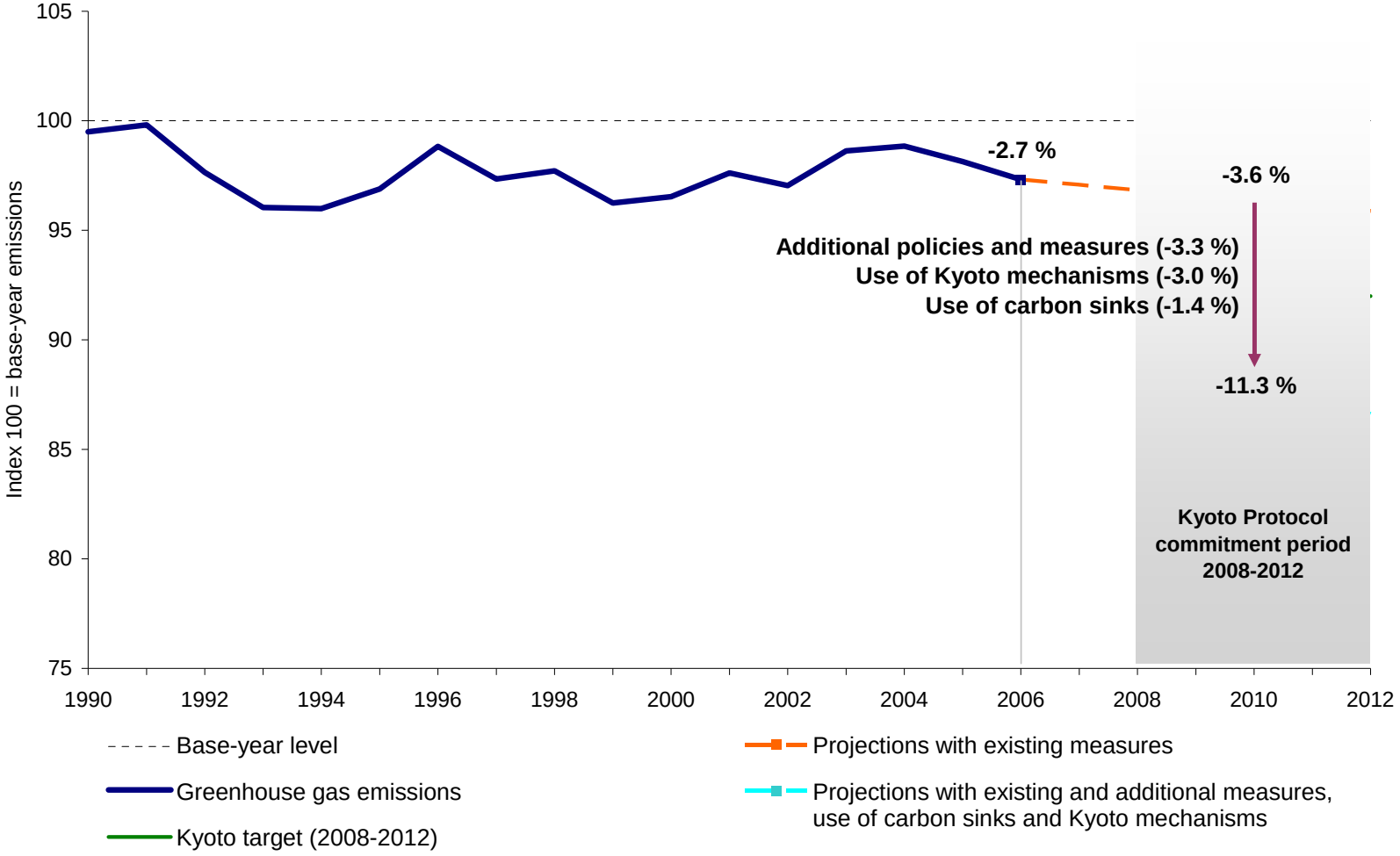


http://www.biol.tsukuba.ac.jp/~inouye

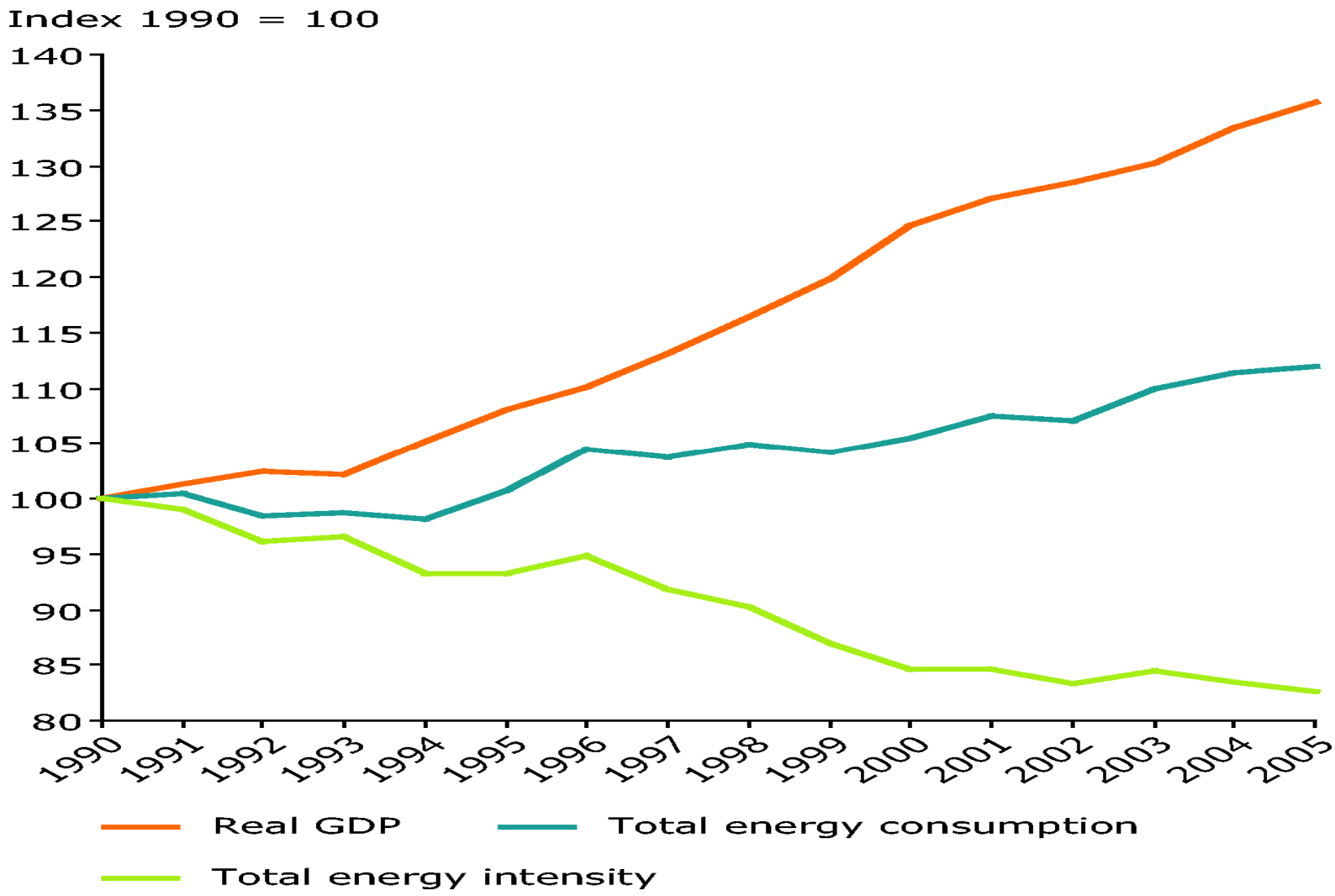
Tipping Points in the Earth System (Schellnhuber)



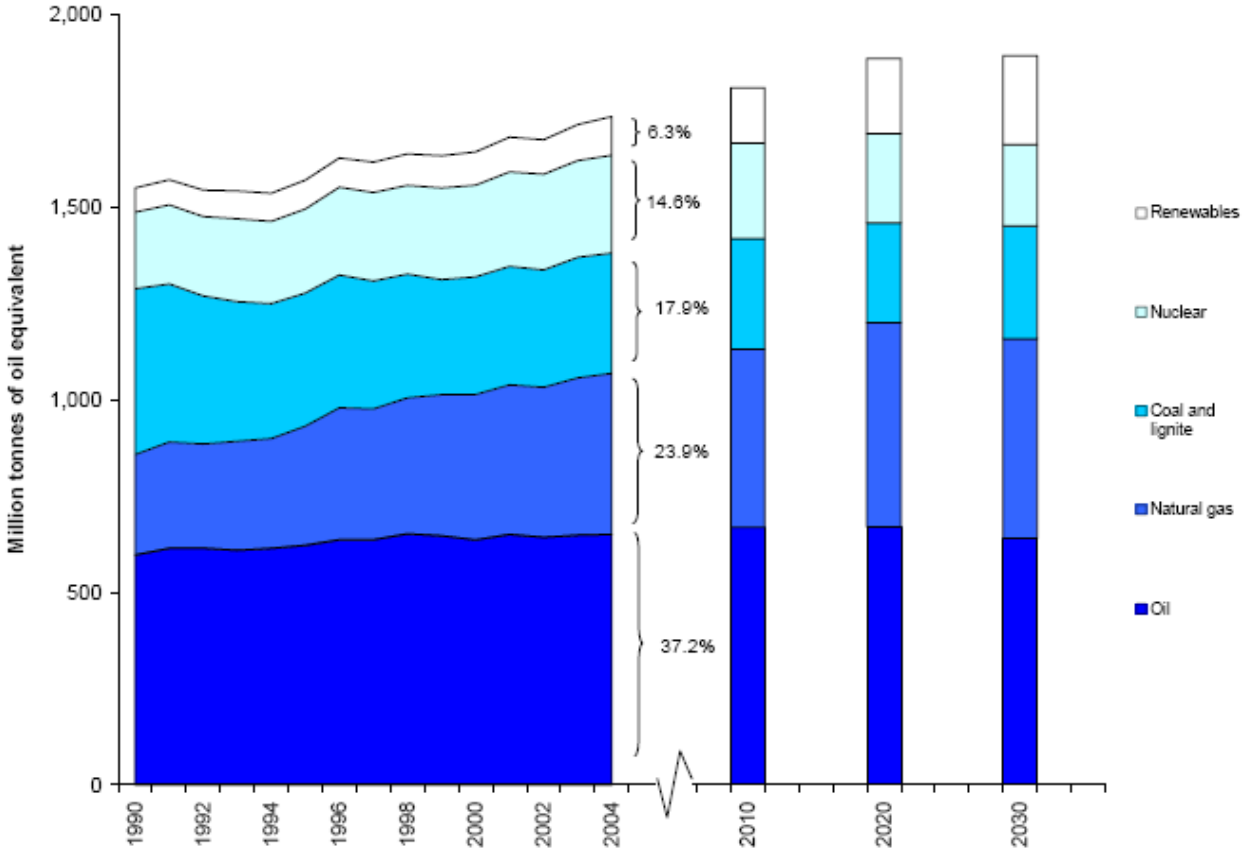
In 2006 EU-15 emissions were above the -8% Kyoto target, but commitments will be achieved by a large margin if all policies deliver



Trends in total energy intensity, gross domestic product and total energy consumption, EU-27



Total Energy Consumption by Fuel – EU 25



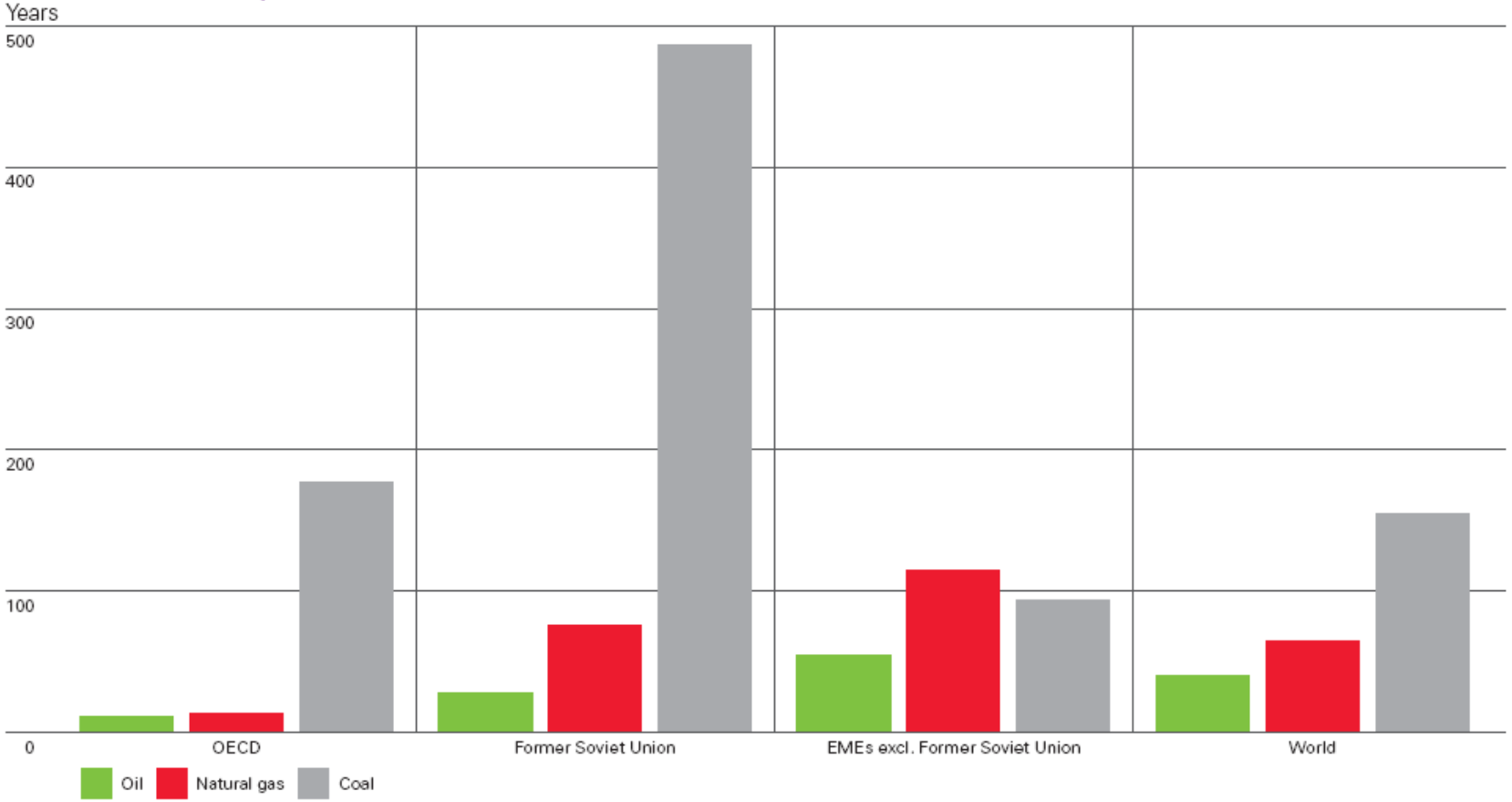
Data source: Eurostat (historic data), Primes Energy Model (European Commission 2006) for projections.

Key factors to take into account in designing the next steps

- Limits on exploitable fossil fuel resources
- Energy security concerns around non-indigenous sources
- Fiscal and legislative instability
- Incorrect price signals via subsidies
- Climate change policies and impacts on using indigenous sources

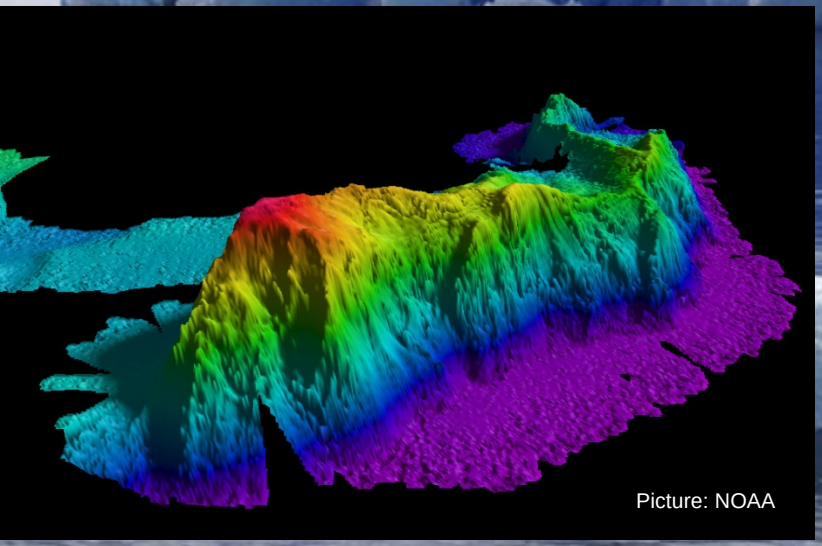
Fossil fuel reserves-to-production ratios

Fossil fuel reserves-to-production (R/P) ratios at end 2005

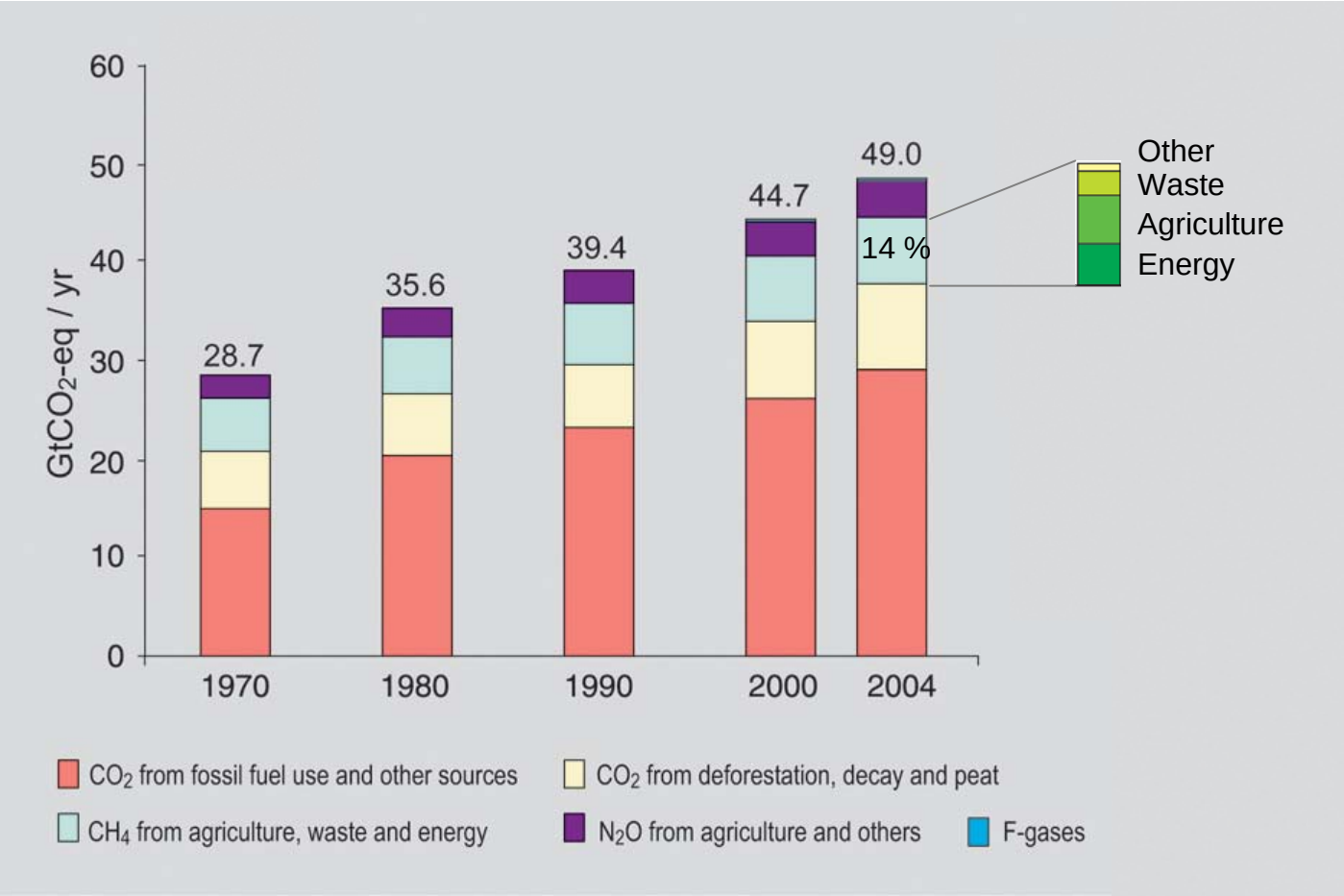


The world's R/P ratio for coal in 2005 was nearly four times that for oil and 2.5 times that for gas. Regionally, coal was even more dominant in the OECD and Former Soviet Union, while gas reserves were more abundant relative to production elsewhere.

The Arctic – the next frontier

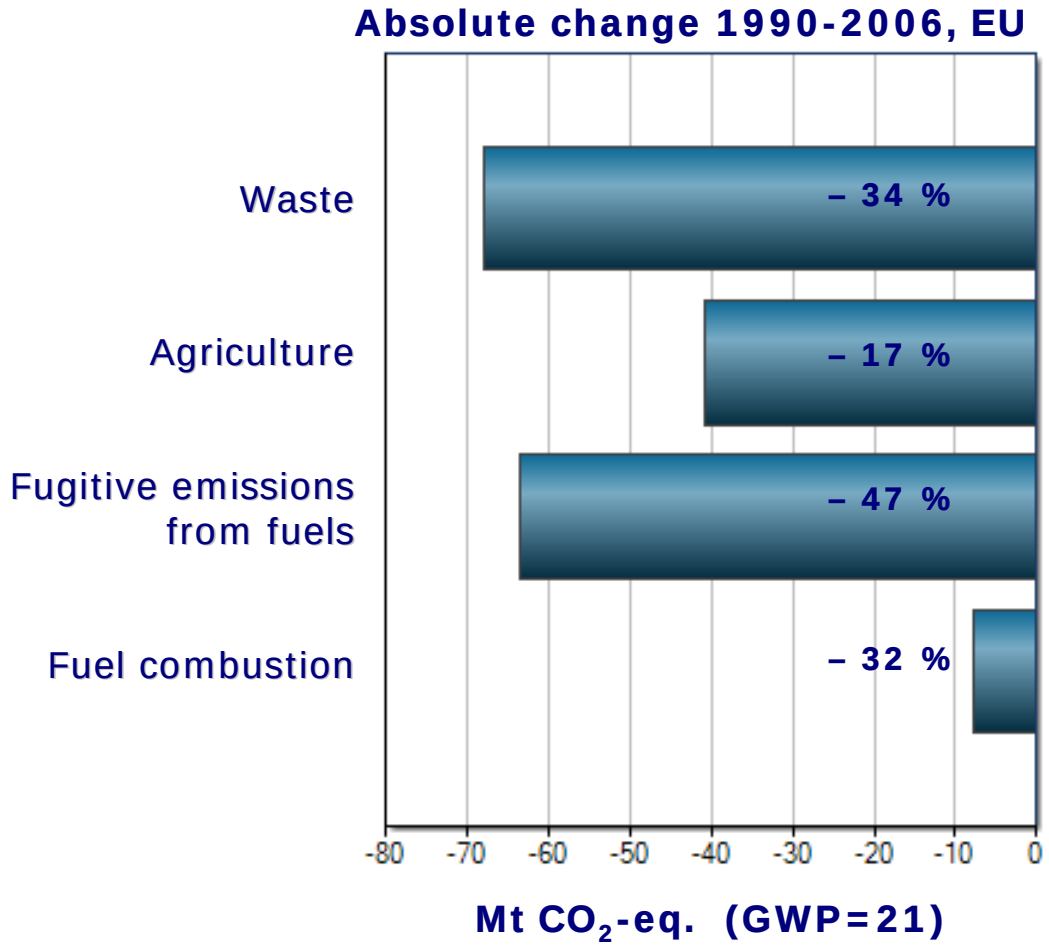


Methane is a significant contributor to worldwide GHG emissions



IPPC Fourth assessment report 2007, WG3 SPM, SYR SPM

EU27 has reduced CH_4 emissions since 1990 in all emitting sectors



- ↘ organic content of landfill waste
- ↘ waste disposal on land
- ↗ landfill gas recovery

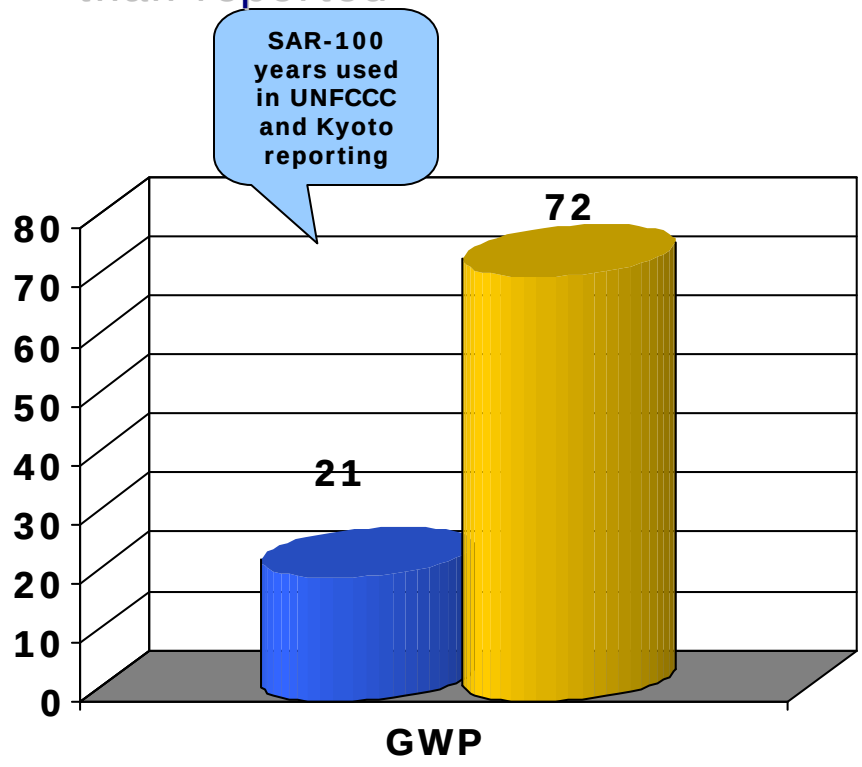
- ↘ number of cattle across EU

- ↘ coal mining (Germany, UK)
- ↘ natural gas production (Romania)

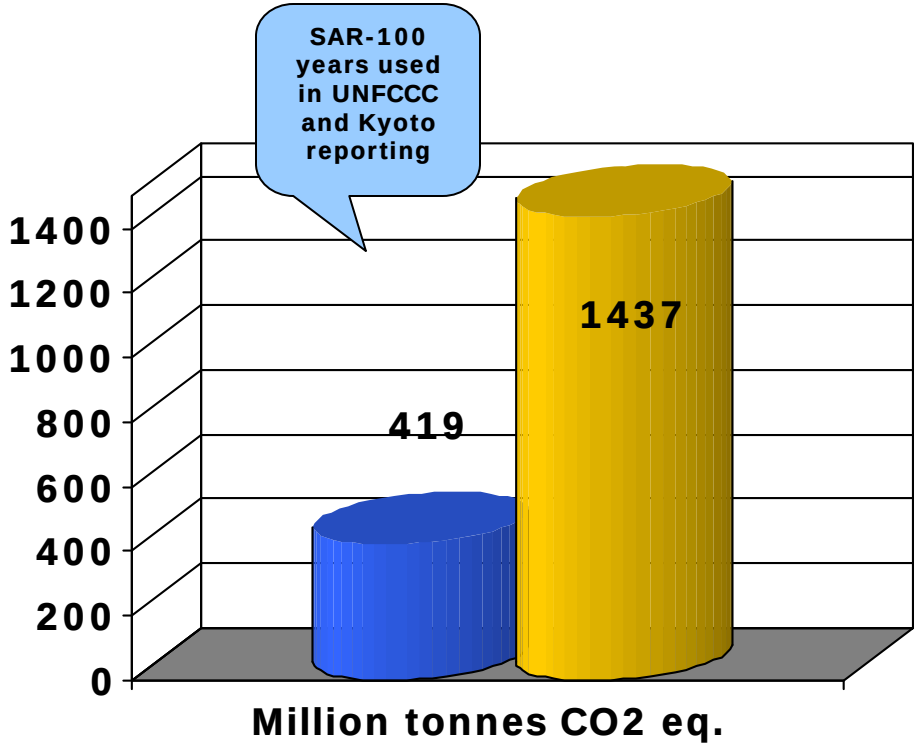
The largest decreases were observed in Germany and the United Kingdom (relative and absolute)

EU27 GHG emissions would increase by 1 billion tonnes (CO2 eq.) if the short-term effect of methane was fully taking into account

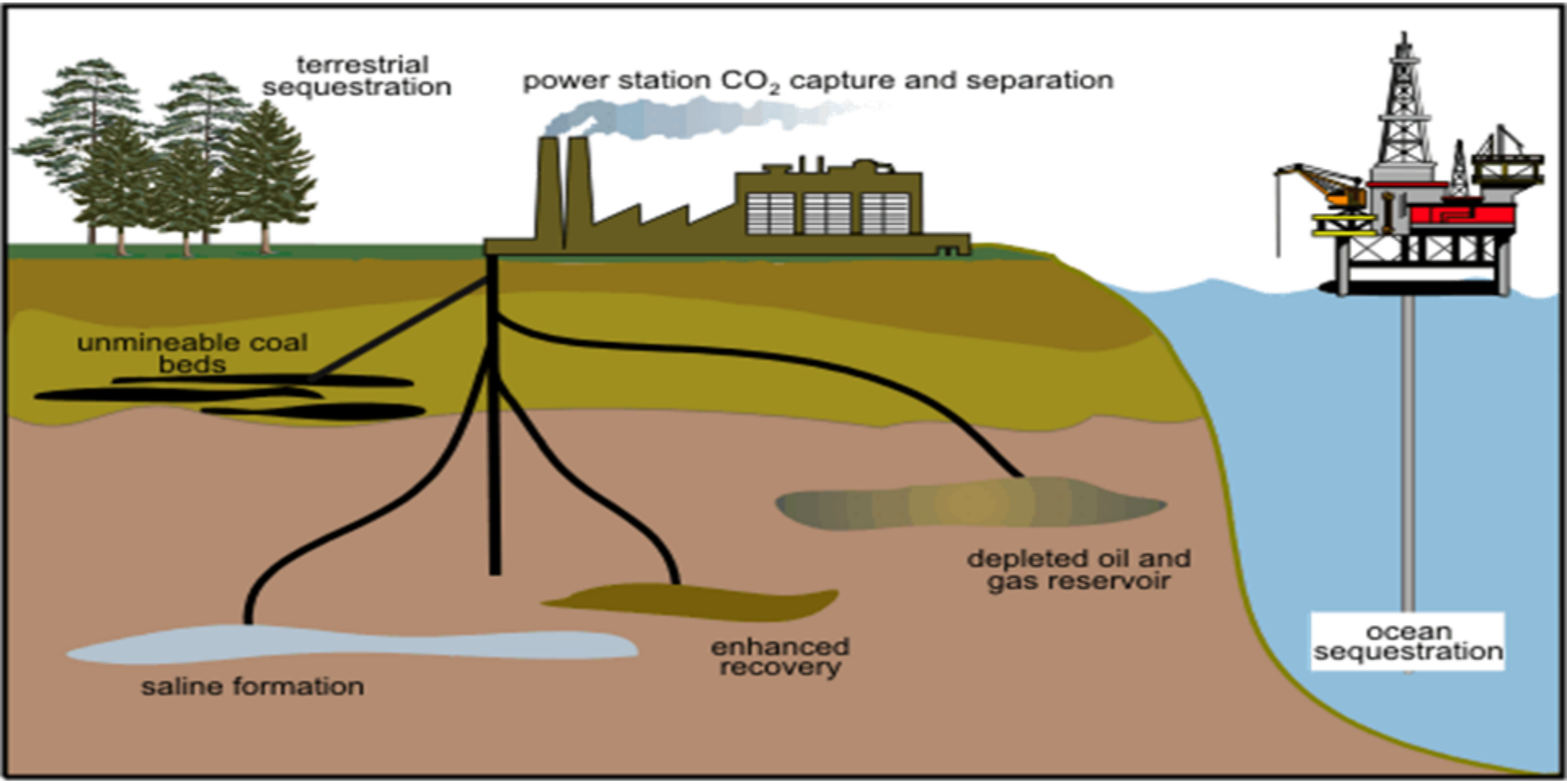
Average lifetime of CH_4 is 12 y. Methane 3,5 times more powerful than reported



CH_4 (CO2 eq.) emissions would be **1 billion** tonnes higher in the EU when using AR4 and 20y lifetime



Carbon Sequestration



The Swedish EU-presidency will address the role of intermediate climate policies in 2009

- Sweden has the EU presidency during the second half of 2009 and is responsible for coordinating the EU positions during COP15
- Sweden will address the link between air pollution policies, climate stabilization and co-control in a high level science policy workshop 19-21 October
- The EEA will contribute to the organisation of the workshop and dissemination of its results in the COP15 context and beyond

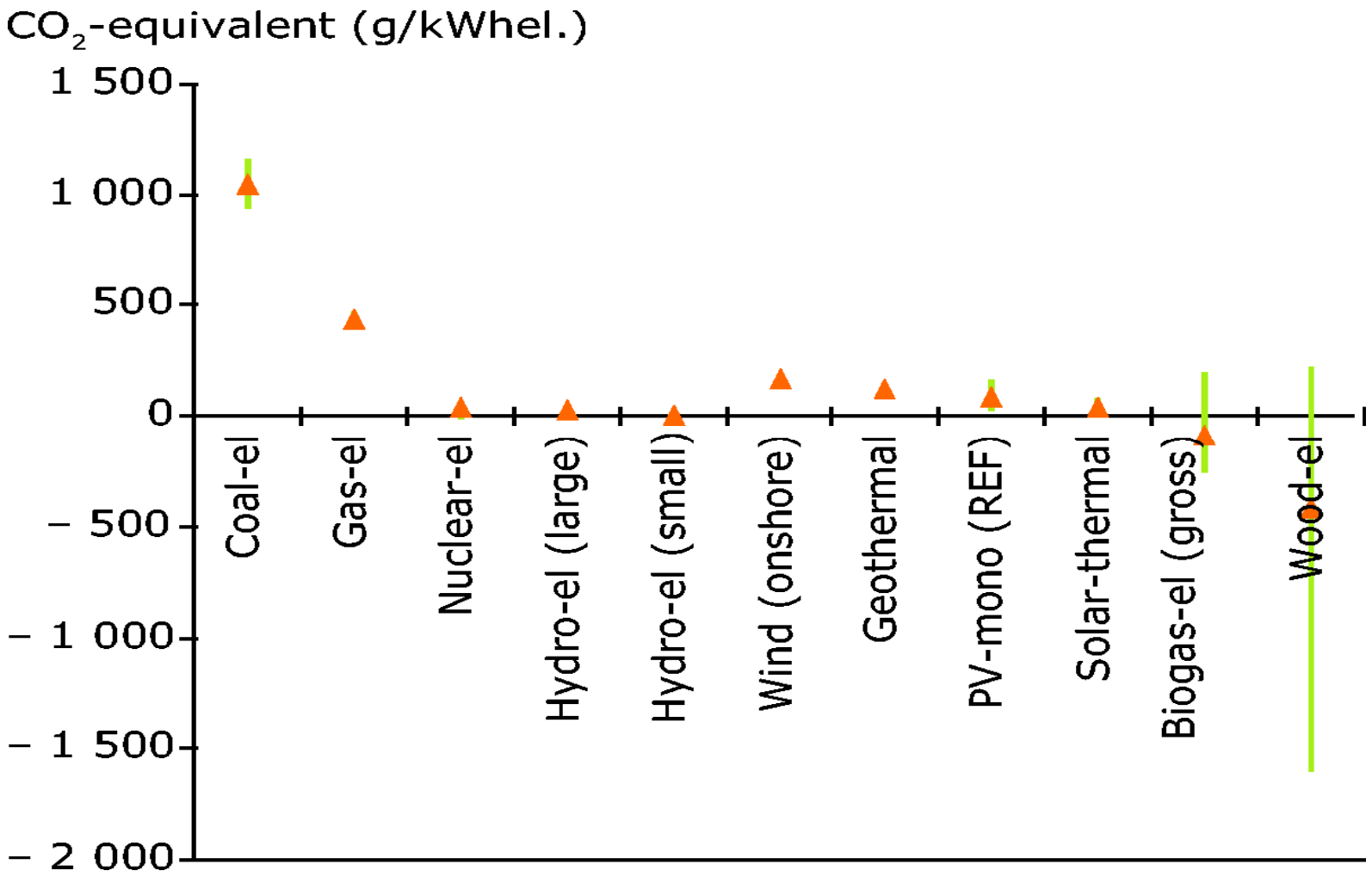
Legislative Framework

- EU Renewables Directive
  - December 2008 – Binding requirement that EU Member States must meet a binding target of 20% of energy from renewable sources by 2020
- Based on existing renewables (mostly hydroelectric power) this means UK must achieve an additional 15% by 2020
- Spread across transport, heat and electricity
- Depending on mix could mean 40% of UK electricity from renewables by 2020

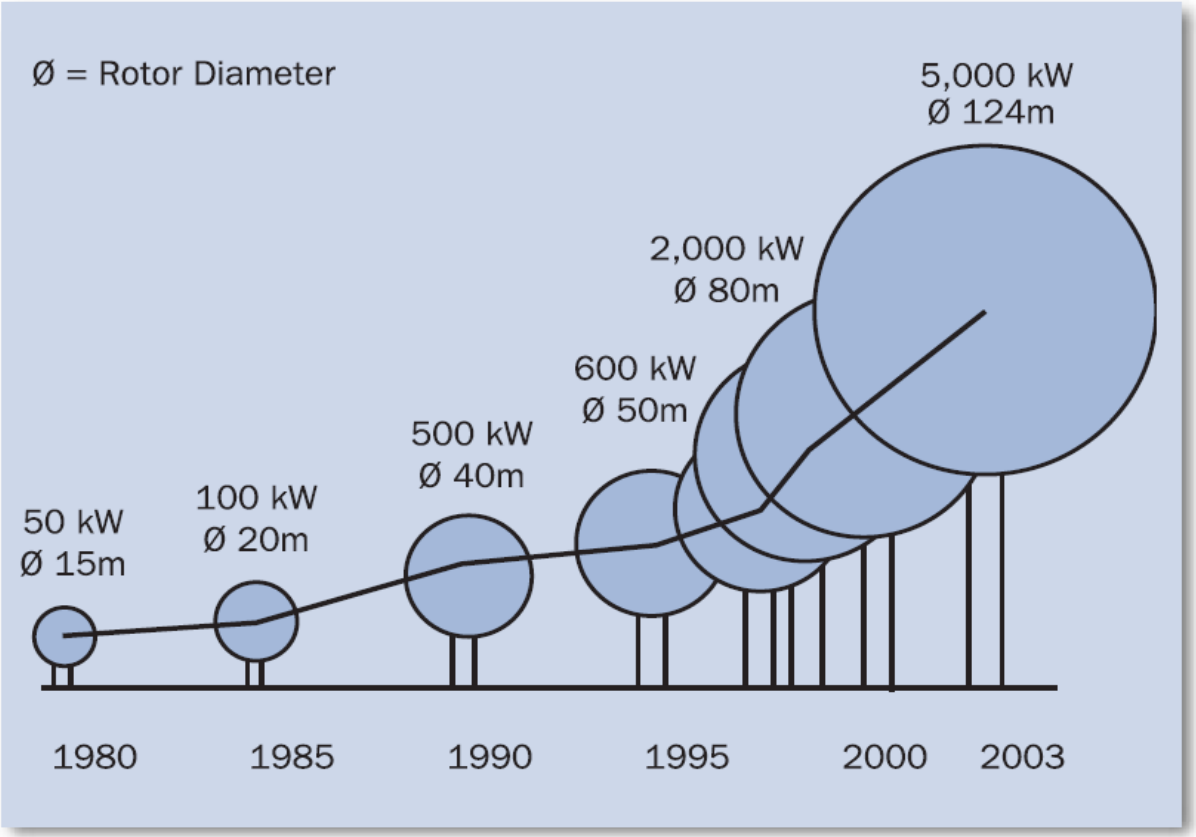
Diversity of subsidies, aid & incentives

- EU - traditional fuels €35b/yr ~ €82k/ DE coal miner
  - renewables €5b/yr
- US – fossil fuels $160b 2006; $300b 2007
- Food shortages in 2007 cost $324b ~ 3 yrs global food aid
- EU energy package €3.5b over 2 yrs (1.75b for interconnectors, 1.25b for carbon capture and storage, 0.5b offshore wind)
- UK package £100b for 4000 onshore & 3000 offshore installations,160k jobs by 2020
- Scotland Saltire Prize & Scotland EU energy
- etc..

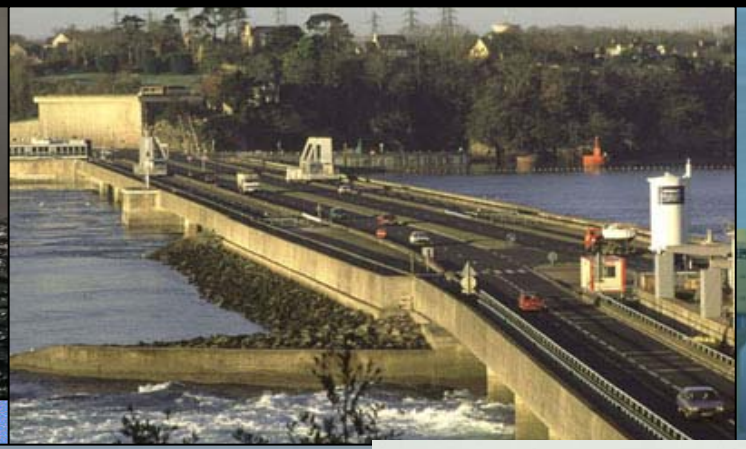
LCA GHG emissions of energy systems (EEA 2008)

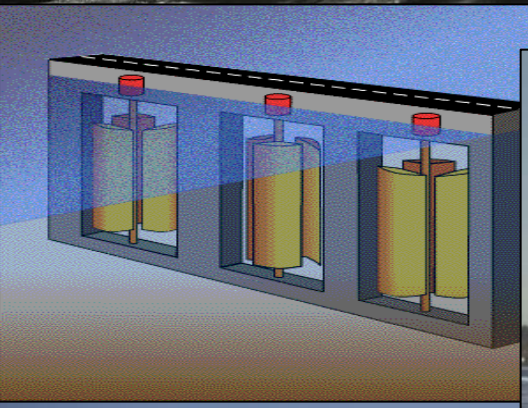


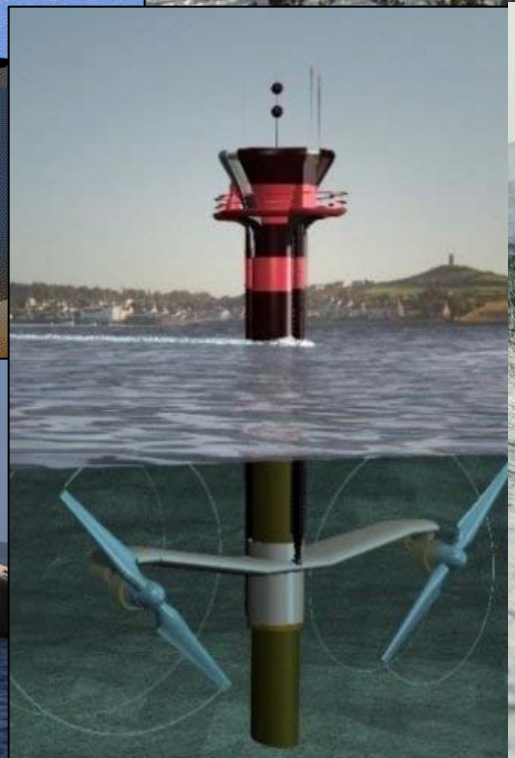
Turbine size



The oceans - a vast untapped energy source

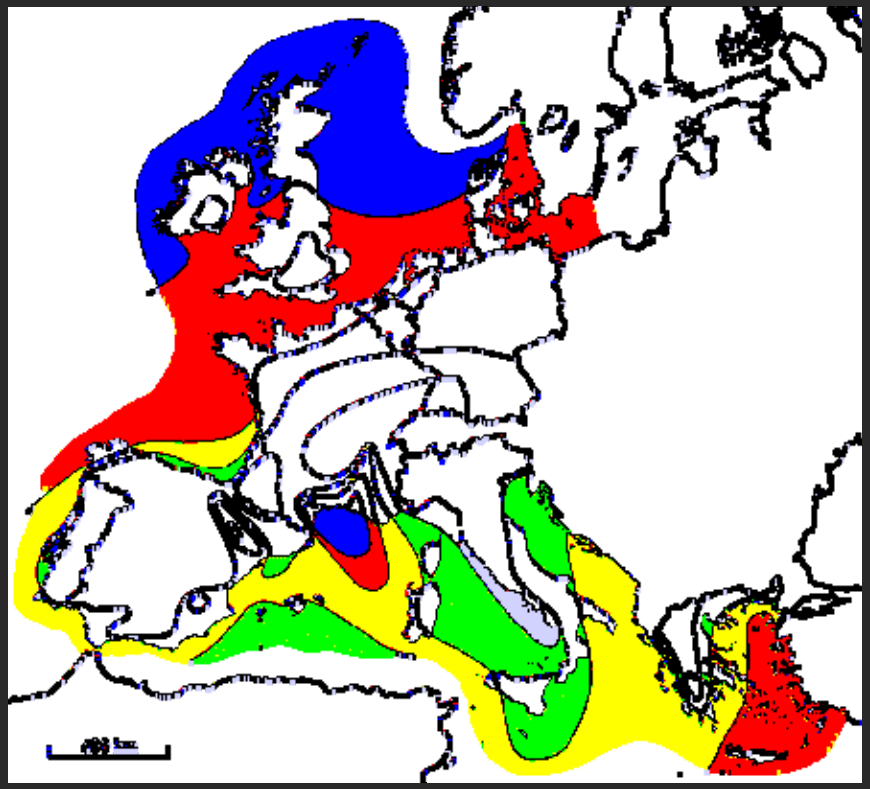






Decentralisation of power via new grid infrastructure

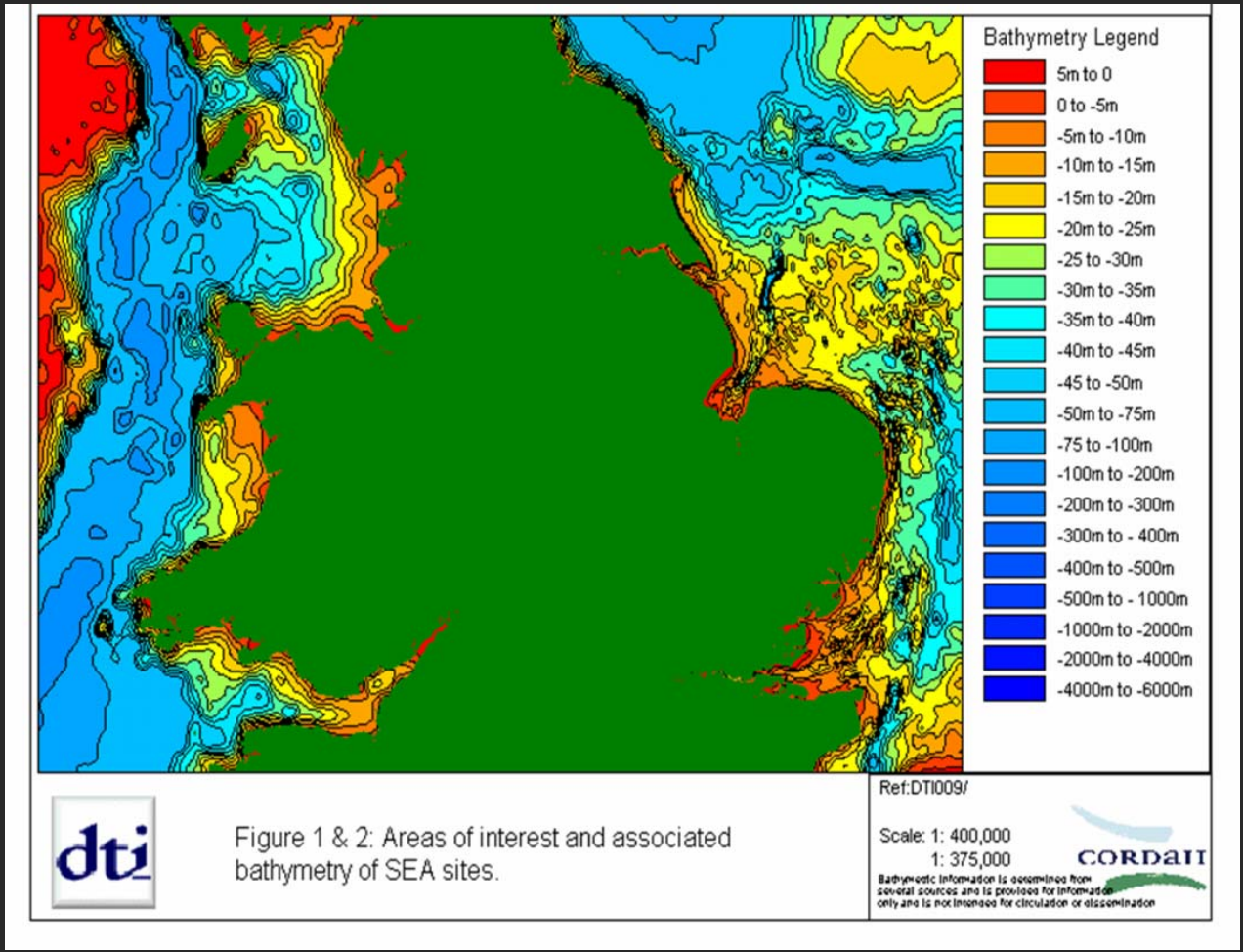
Offshore wind energy potential in the UK



- UK has very large offshore wind energy potential – largest in Europe

© Risø

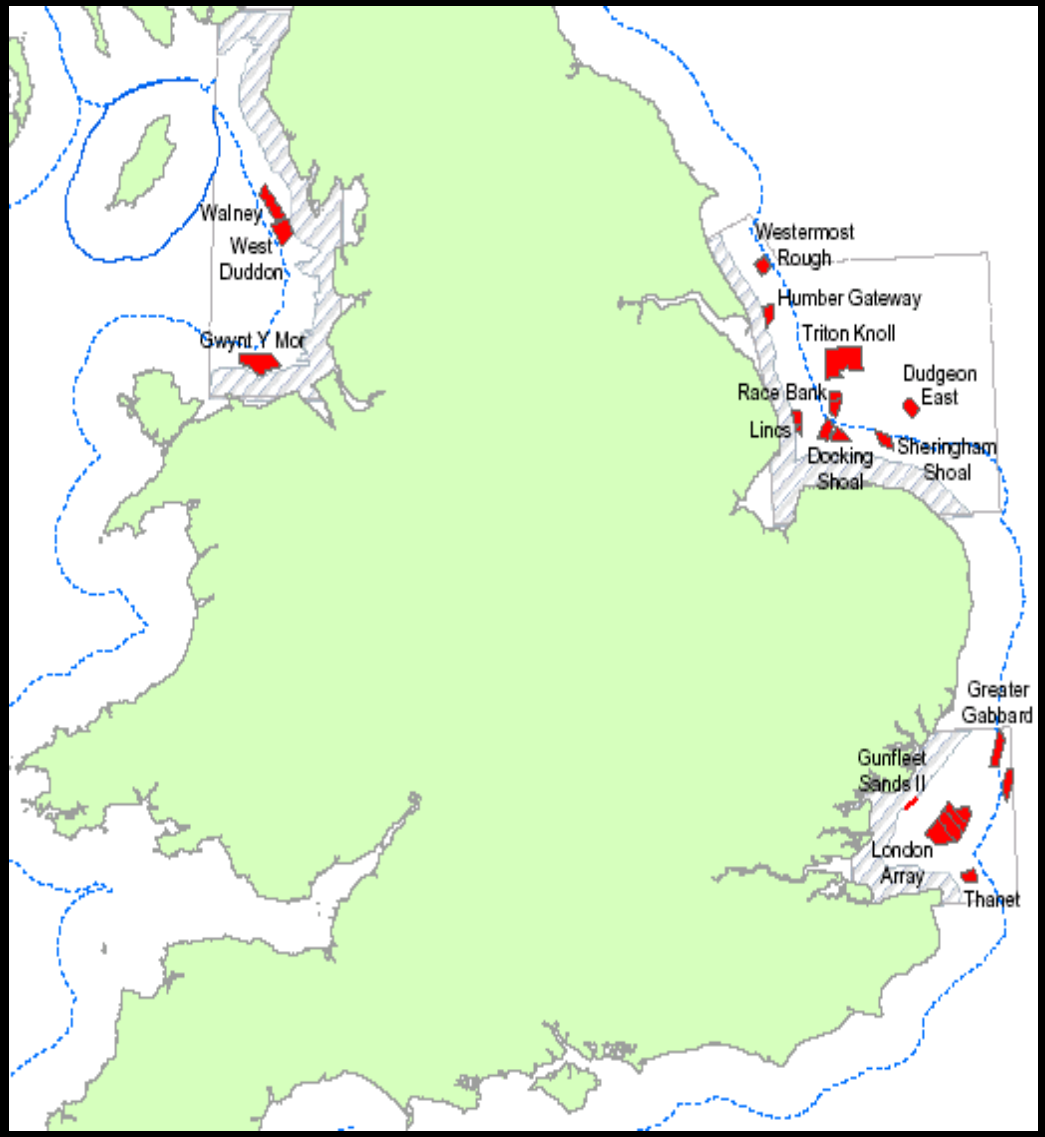
Many potential shallow water sites



UK offshore wind energy development

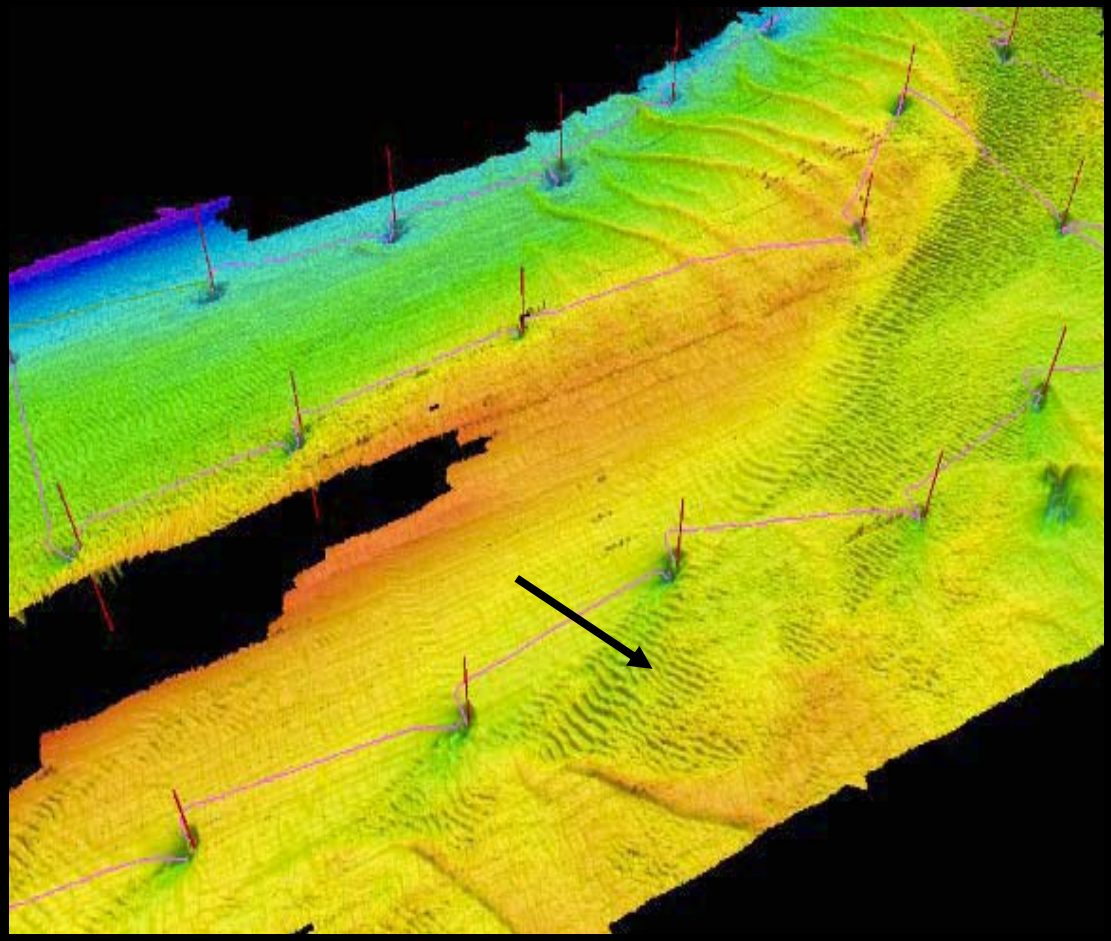
- 2001 Round 1 – 1 GW demonstration round to allow developers to gain experience (14 sites)
- Round 2 – 7.2 GW in three areas with greatest potential
- Round 3 - December 2007 – Strategic Environmental Assessment for up to 33GW. Subject to outcome of SEA Round 3 targetting 25GW by 2020

Strategic Areas – Round 2 – Proposed OWF sites



The challenges of moving offshore: foundations and seabed scour

http://www.offshore-power.net/Files/Billeder/scrobyaerial.jpg



Swathe bathymetry survey of February 2005 from the Scroby Sands offshore wind farm – Great Yarmouth. The black arrow indicates a scour wake extending to the neighbouring monopile.

Distance between these monopiles is about 375 m.

Should only be 40-60m of scour

Demonstrates need for regular surveys

Construction and maintenance

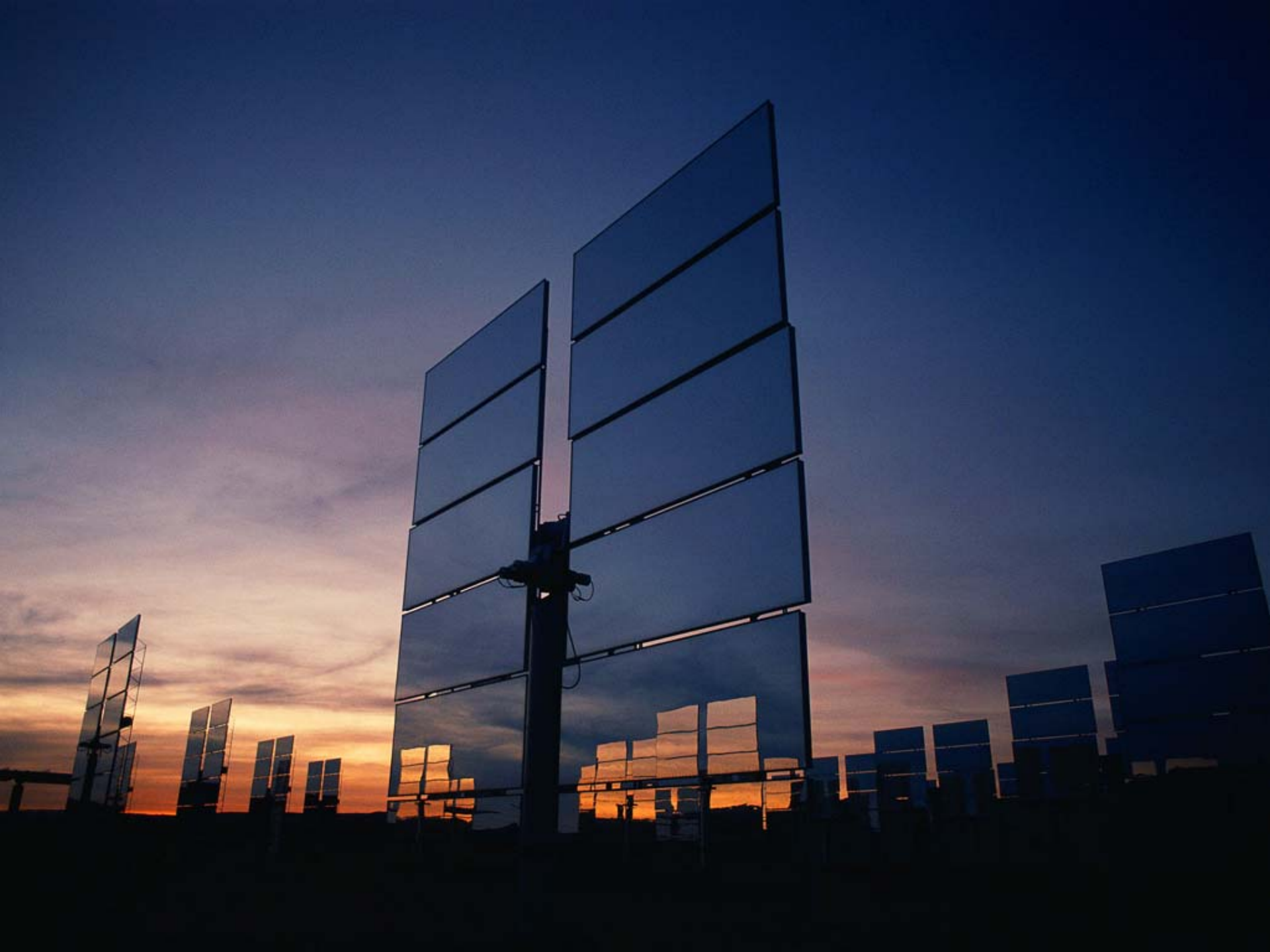
Waves and Tides

Pelamis,
Ocean Power Delivery

LIMPET, Wavegen

Seaflow Project,
Marine Current Turbines

TidEL,
SMD Hydrovision



Solar Power PVs and SCP with storage

- Costs dropping rapidly with new technologies andeconomies of scale ($0.7/watt by 2010)
- Market growing rapidly (projected at $40bn by 2010)

Energy Efficiency

- Major drive in Europe and elsewhere
- EU targeting 9% improvement in energy efficiency over next 9 years
- New EC Directive on Energy Performance of Buildings
- Global energy efficiency technology market currently worth $450bn (2005)

Scale of Market

- Renewables currently provide 13% of world energy needs
  - Dominated by geothermal, hydro and biomass
- Rapid growth in other technologies
  - Solar 41% per year
  - Wind 18% per year
- Prices dropping with technological developments and economies of scale

CLIMATE INTERACTIVE

Diverse partners creating a portfolio of fast, accessible, robust, transparent simulations and using them to enable a more effective global response to climate change

THE HEINZ CENTER

Sustainability Institute

citi

Rocky Mountain Institute

SEED

society for SOL organizational learning

Fidelity INVESTMENTS

THE FLETCHER SCHOOL TUFTS UNIVERSITY

ACTIVE PHILANTHROPY

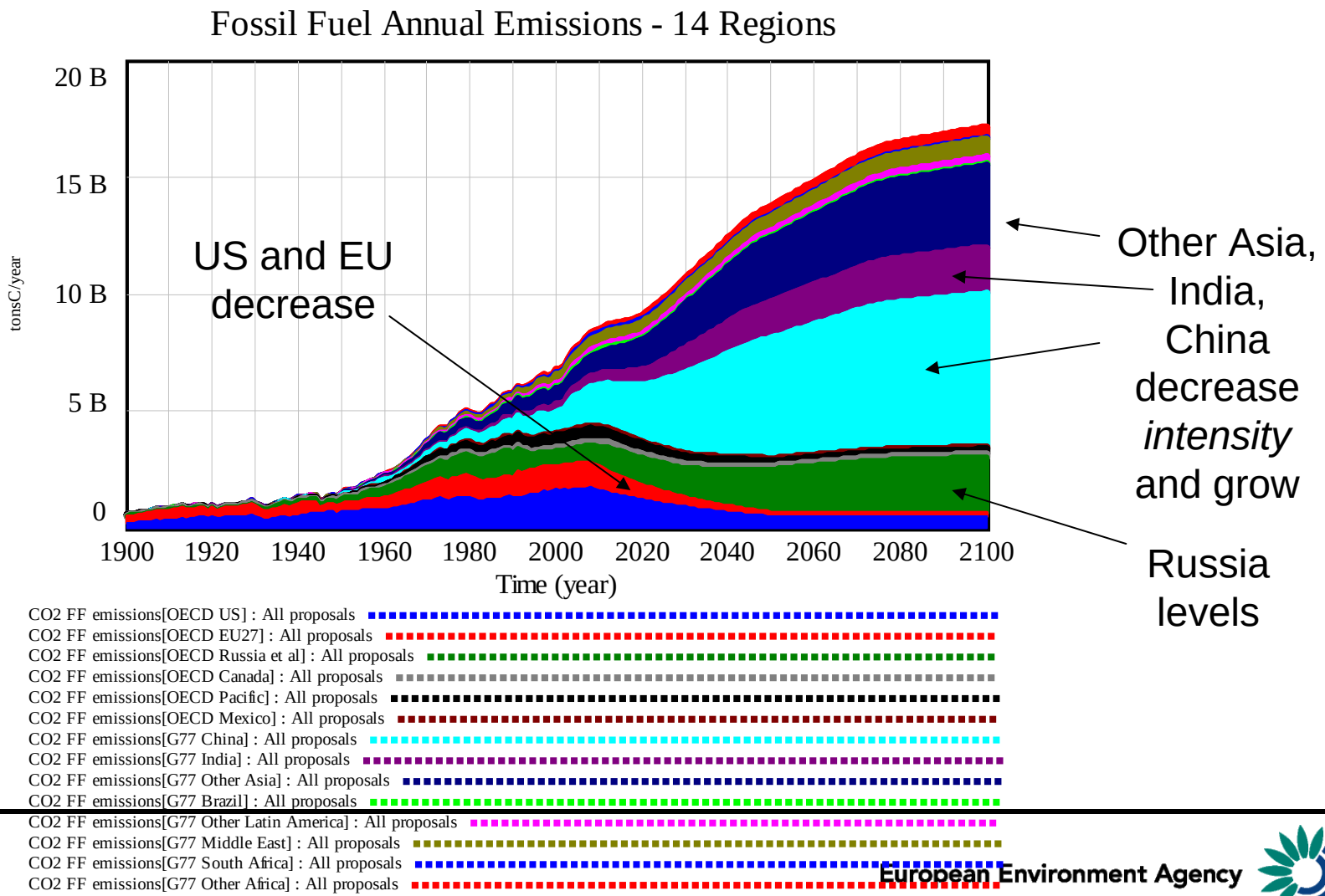
VENTANA systems, inc.

One Optimistic Interpretation of Current Commitments

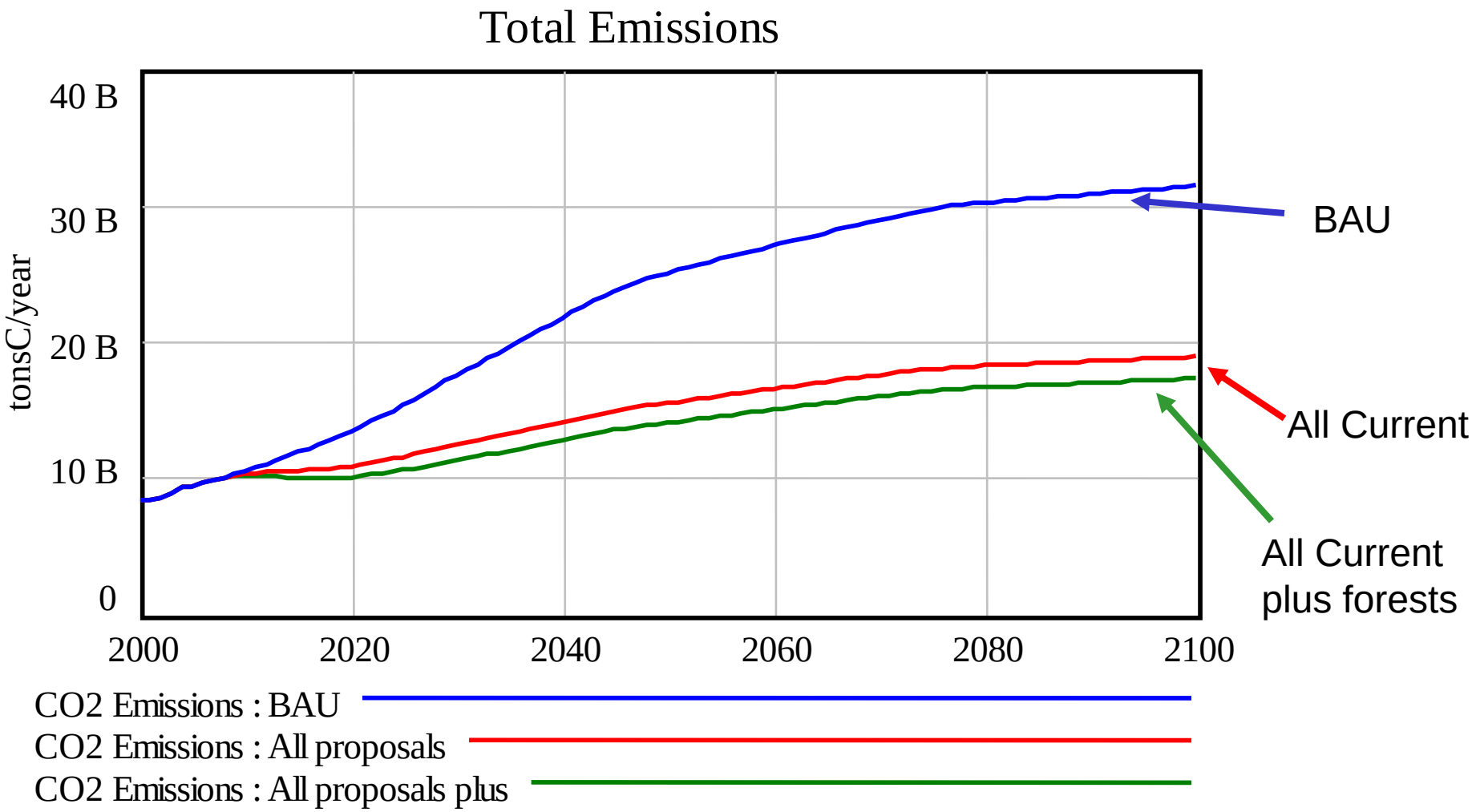
EU - Emissions 80% below 1990 by 2050	Brazil - 10-20% reduction of 2004 by 2020	China - Reduce emissions **intensity** 20% by 2020	South Africa - 40% below 2003 by 2050
US (Warn-Lieb) - 71% below 2005 by 2050	Other Latin America - bau	India - Reduce emissions **intensity** 20% by 2020	Other Africa - bau
Russia - 1990 levels	Mexico - 10% below 2004 by 2014	Other Asia - Reduce emissions **intensity** 20% by 2020	Global Deforestation - bau
Canada - 20% below 2006 by 2020	Middle East - bau	OECD Pacific - 60% below 2000 by 2050 (AUS)	Afforestation - bau

For references, see end of slide deck

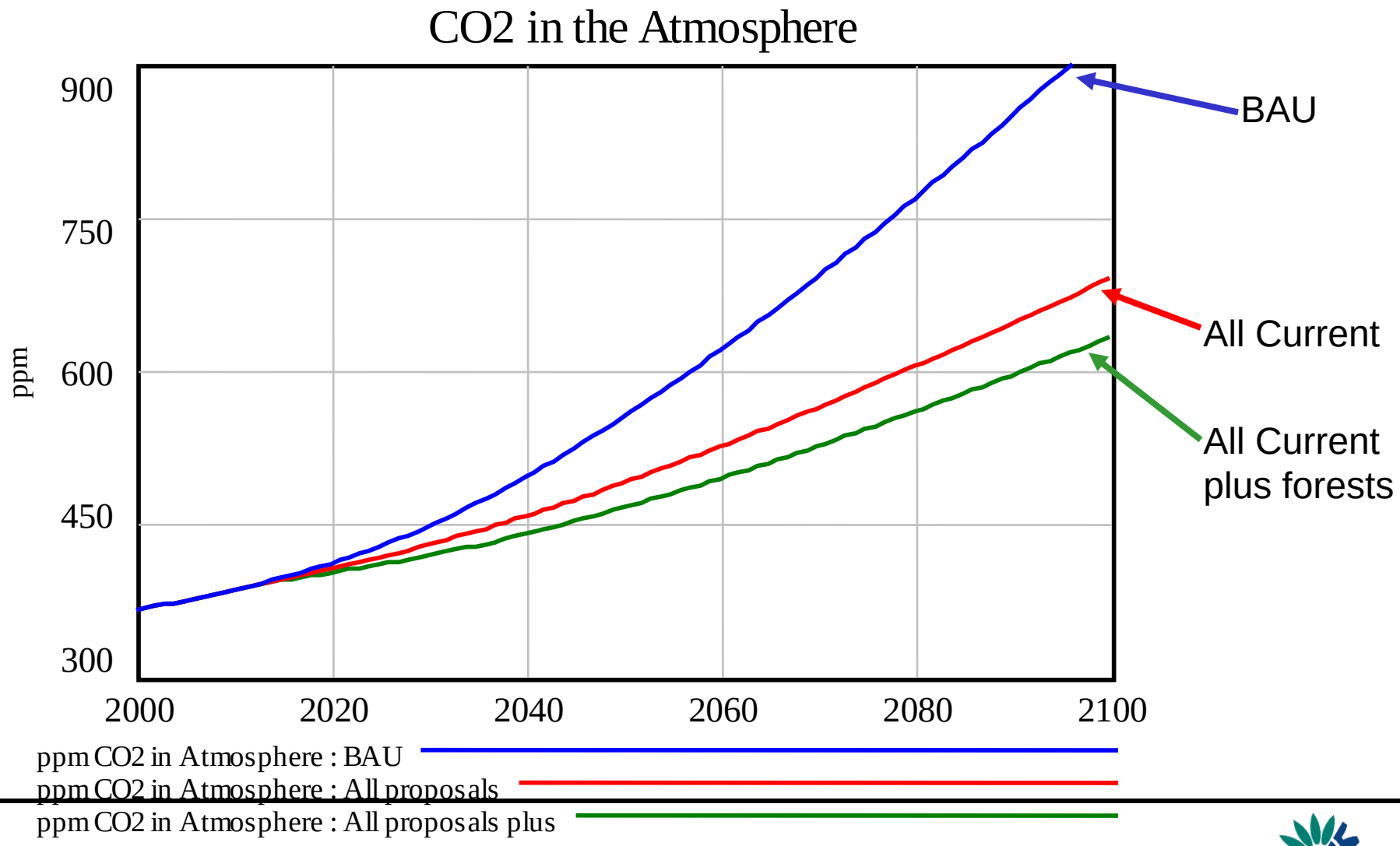
Stacked Annual Emissions with All Current Proposals



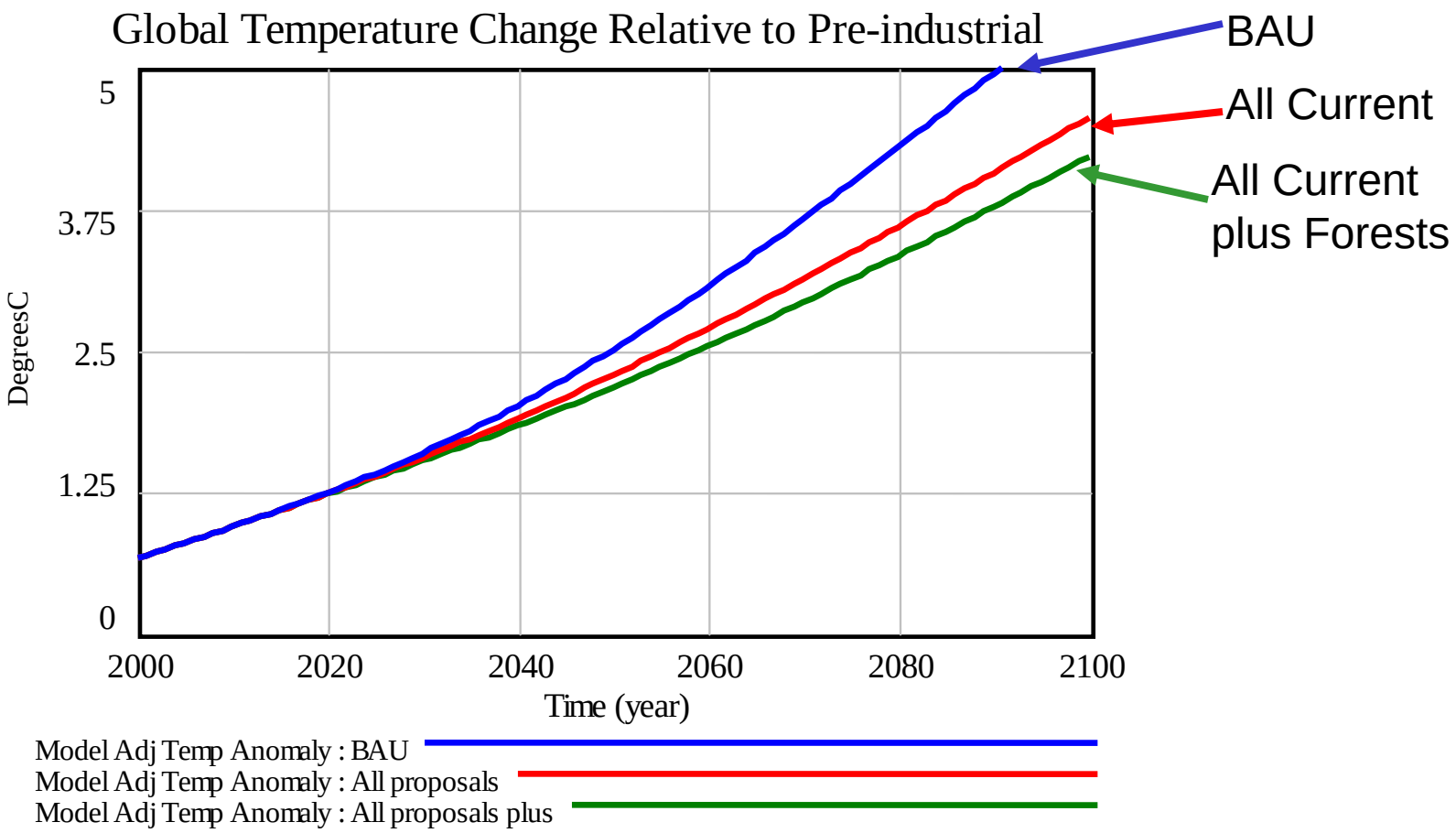
Total Fossil Fuel CO_2 Emissions



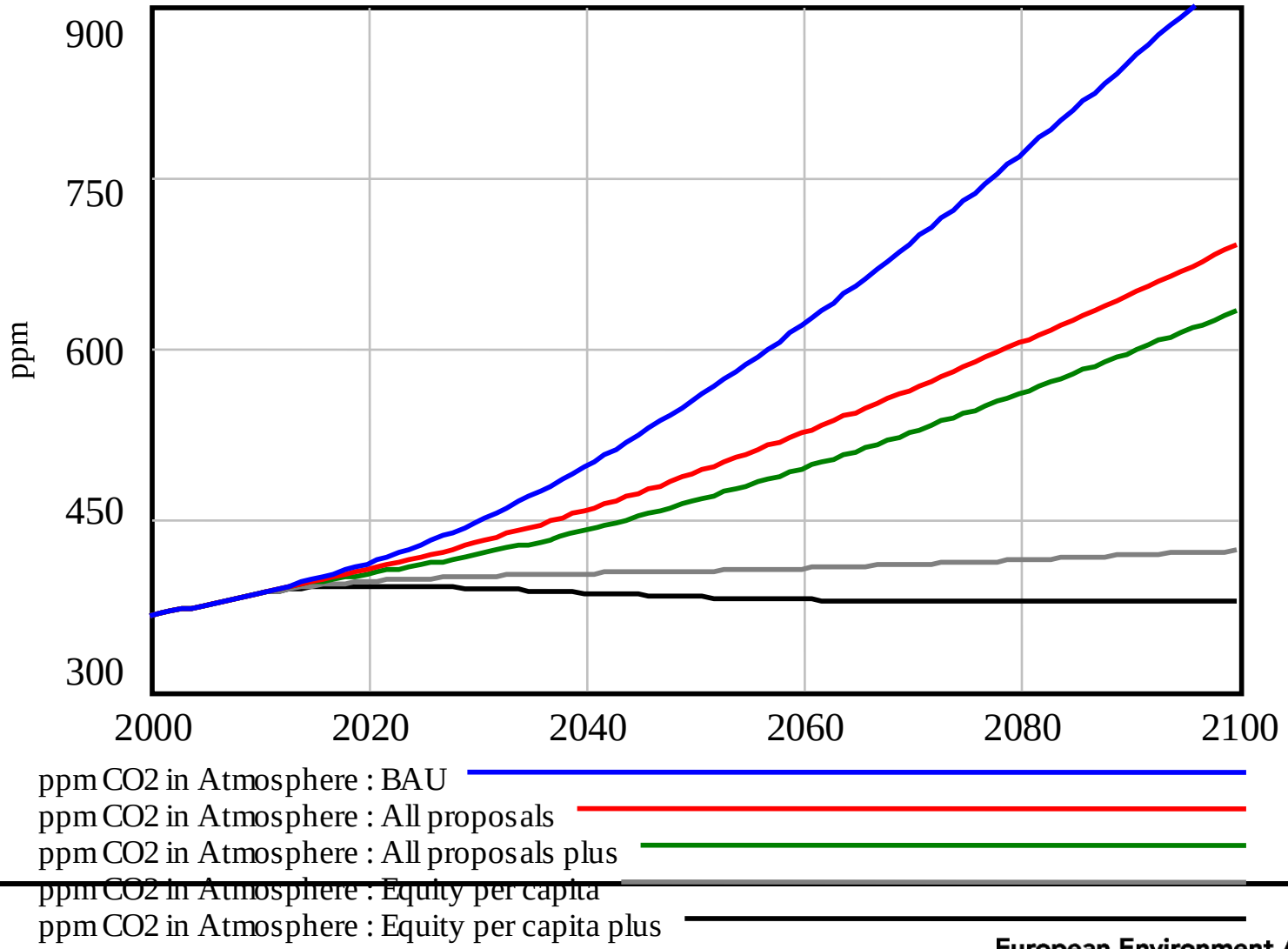
CO_2 in the Atmosphere Would Continue to Increase



Global Temperature Change



CO_2 in Atmosphere Results



The three systemic crises

- Systemic multiple crises: finance/real economy, energy/climate, ecosystem/biodiversity, social
- Trust crisis: exposure of concealed debts (including ecological debt which is not even recorded in accounting books)
- Governance crisis: responses are a series of untested rescue packages and trial and error solutions

Common features of these 3 systemic crises:

- Making money from money

- Over consumption

- Capital destruction

Can the past give us solutions to create a low-carbon economy for the future?

But even now, there are many who seem to believe they did little wrong: it was a once-in-100-years flood that could not have been anticipated, rather than something they caused and which has occurred repeatedly.

Joseph Stiglitz THE TIMES, January 27 2009

- Conditions today are radically different: population, resources
- Prevailing models do not anticipate the kinds of catastrophes we are now in and so cannot be used to extract ourselves from the situation we are in or avoid the next
- Metrics are not giving sufficient signal strength for the reality of today's ecological and economic dynamics

COMMON FEATURES	FINANCIAL CRISIS	CLIMATE CRISIS	NATURAL RESOURCES CRISIS
CAPITAL DESTROYED			
Financial	YES	YES	YES
Human	YES	YES	YES
Natural	YES	YES	YES
Social	YES	YES	YES
RISKS / DEBTS PASSED ON TO CURRENT AND FUTURE 'OTHERS'?	YES	YES	YES

COMMON FEATURES	FINANCIAL CRISIS	CLIMATE CRISIS	NATURAL RESOURCES CRISIS
MARKET PRICES: Cover All costs?	NO	NO	NO
Reflect real risks?	NO	NO	NO
TRANSPARENT TRANSACTIONS?	NO	NO	NO
ACCOUNTING FOR WHAT MATTERS?	NO	NO	NO
EARLY WARNINGS HEEDED?	NO	NO	NO
ROBUST AND SUSTAINABLE SYSTEMS?	**NO**	**NO**	**NO**

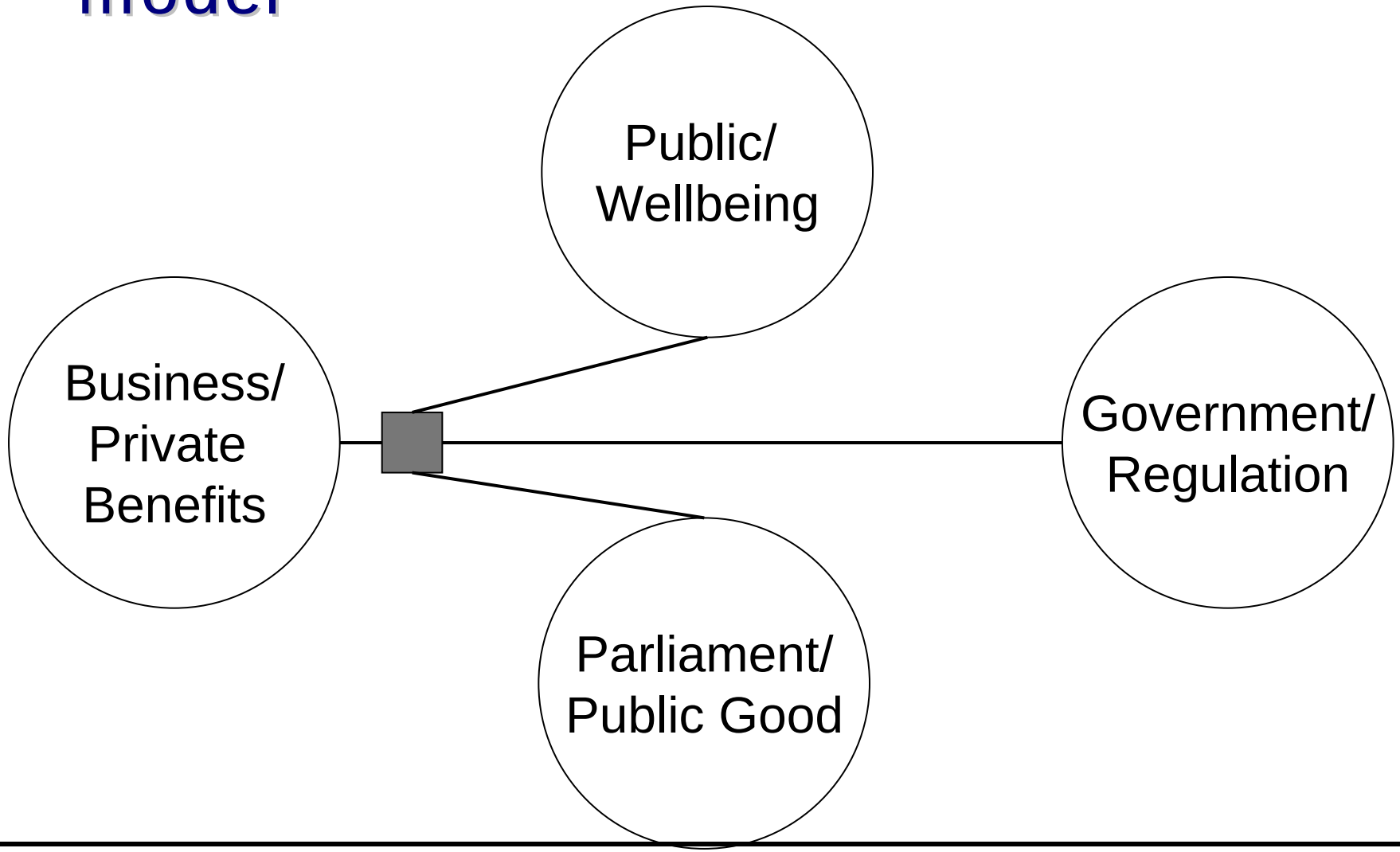
Some features of good governance

- Maintaining capitals
- Meeting needs of today's ageing populations and next generations
- Balancing resource consumption
- Public participation

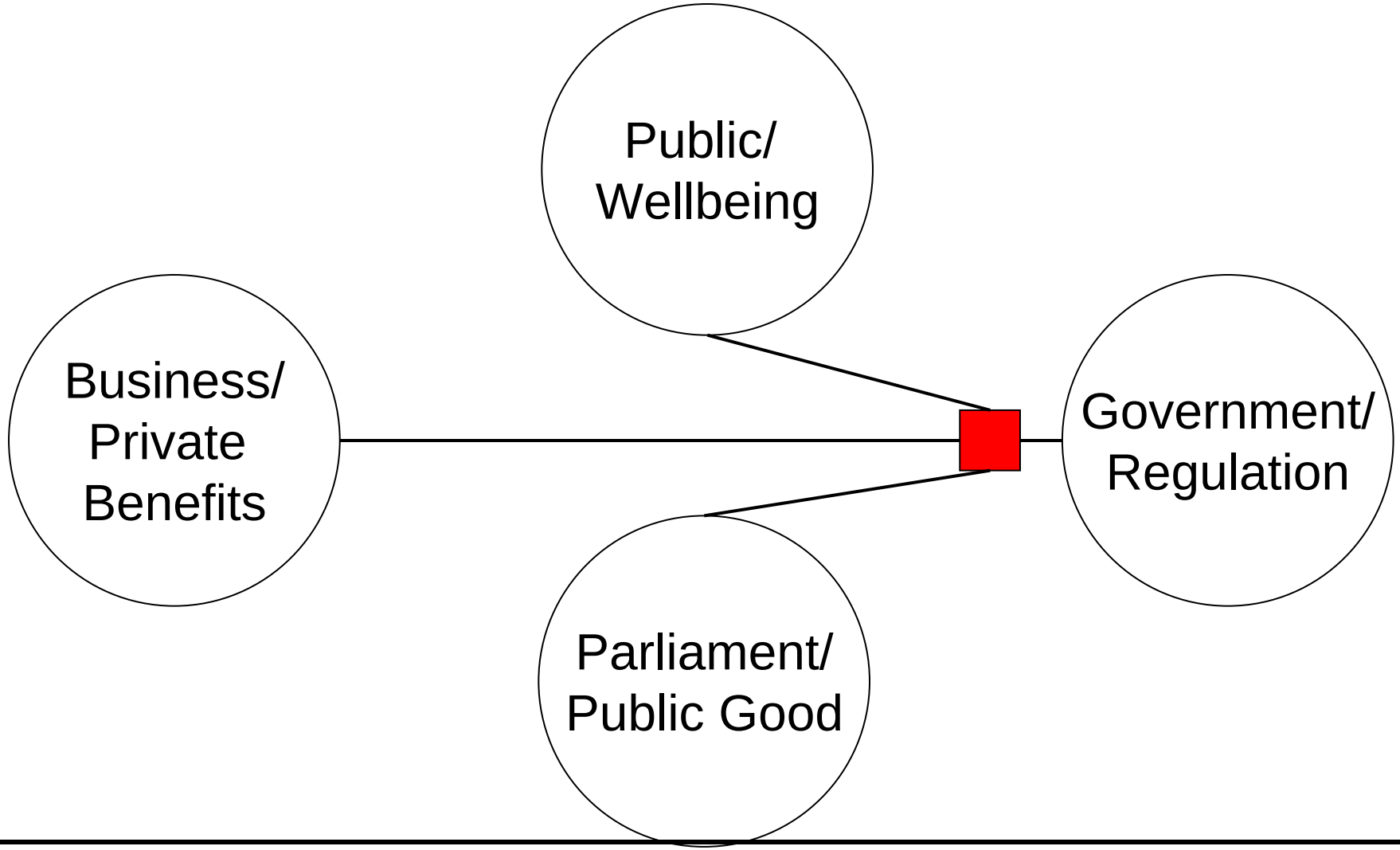
GOOD GOVERNANCE	FINANCIAL SYSTEMS	ENERGY SYSTEMS	ECOSYSTEMS
CONSUMING FLOWS WHILST MAINTAINING QUALITY AND QUANTITY OF ASSETS	CONSERVATIVE ASSET/ DEBT RATIOS	FROM *STOCKS* OF FOSSIL FUELS TO *FLOWS* OF RENEWABLES	MAINTAINING NATURAL CAPITAL *STOCKS* WHILE SECURING *FLOWS* OF ECOSYTEM SERVICES
ALL RISKS AND DEBTS INTERNALISED INTO MARKET PRICES	REALISTIC ASSET/ DEBT PRICING	EXTERNALITIES INTERNALISED INTO PRICES	EXTERNALITIES INTERNALISED INTO PRICES
ECONOMIC TAX & SUBSIDY REFORM TO FINANCE "GREEN NEW DEAL", AGEING POPULATION COSTS ETC	***"TOBIN TAX" ON CURRENCY/COMMODITIES SPECULATION?***	***FROM TAXING PEOPLE TO TAXING ENERGY AND RESOURCES***	***FROM TAXING PEOPLE TO TAXING ENERGY AND RESOURCES***
TRANSPARENT TRANSACTIONS	UNDERSTANDABLE FINANCIAL PRODUCTS	MARKET PRICES REVEALING "ECOLOGICAL TRUTH"	MARKET PRICES REVEALING "ECOLOGICAL TRUTH"

GOOD GOVERNANCE	FINANCIAL SYSTEMS	ENERGY SYSTEMS	ECOSYSTEMS
ACOUNTING FOR WHAT MATTERS	REAL DEBT / ASSET RATIOS	ALL COSTS/ SUBSIDIES	ECOSYSTEM SERVICES AND ASSETS
	"B E Y O N D G D P"		
EARLY WARNINGS FROM LATE LESSONS	"INCONVENIENT TRUTHS" ACTED ON		
COMMUNITY LEVEL INITIATIVES	MICRO-FINANCE	DISTRIBUTED NETWORKS	CO-MANAGEMENT OF ECO-SYSTEMS
DIVERSE DISTRIBUTED,PARTICIPATORY, RESILIENT AND SECURE SYSTEMS?	YES	YES	YES

Current deregulated governance model

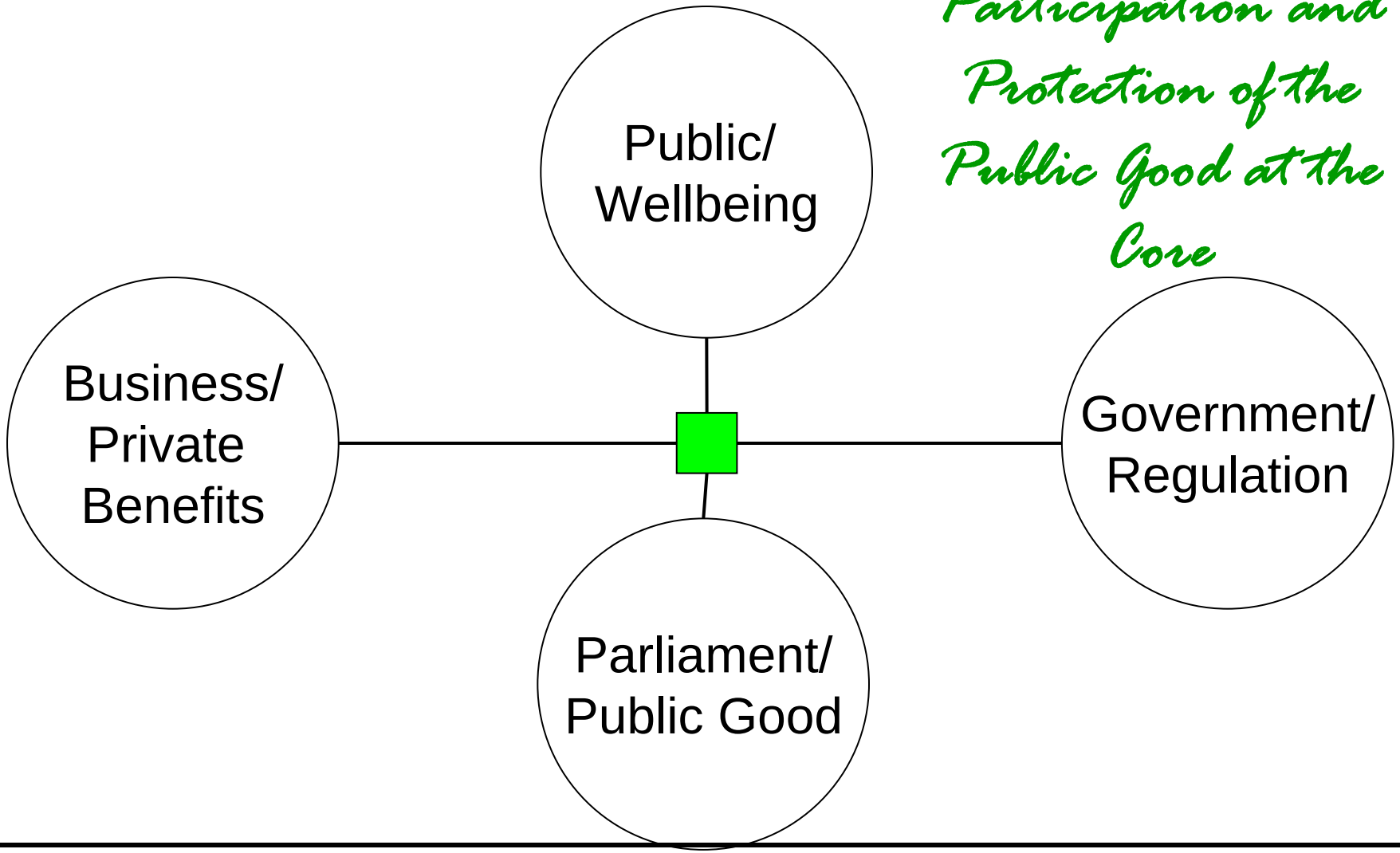


State control governance model ??

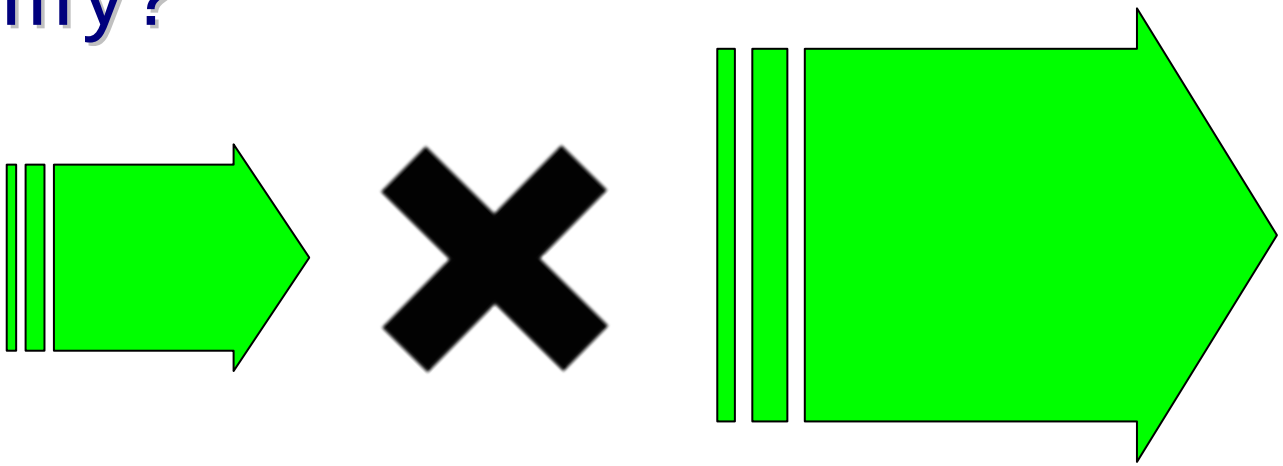


Green Economy

Public Participation and Protection of the Public Good at the Core



A Green Multiplier for a Green Economy?



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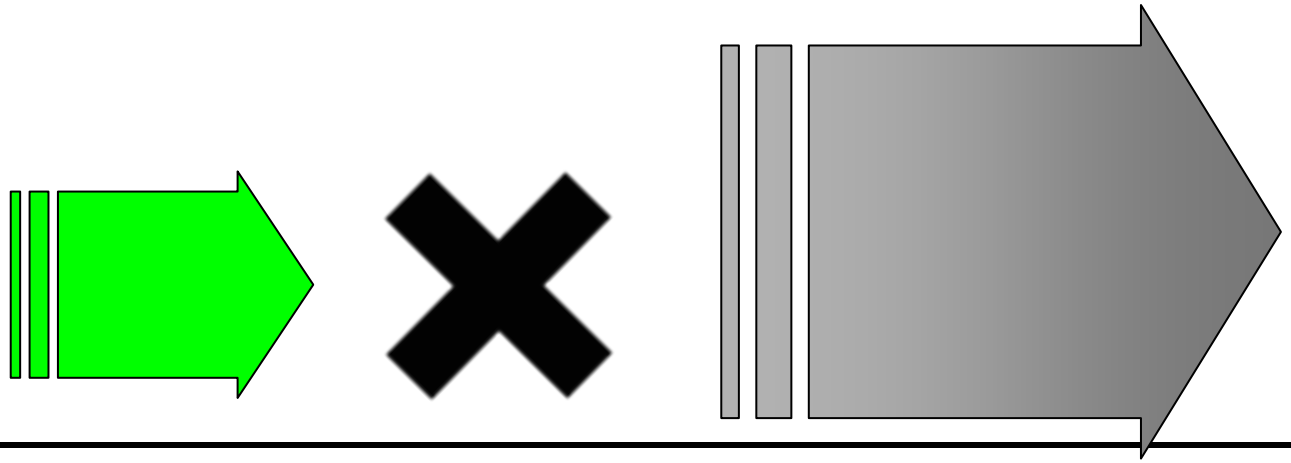


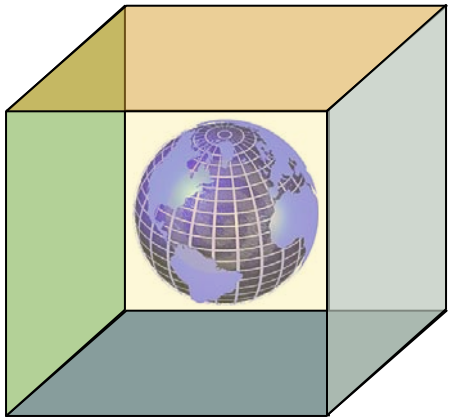
Ensuring we avoid negative feedbacks in the process of enormous inputs of fiscal packages

- **Green Governance requires participation of all**
  - **International institutions**: common objectives, equity
  - **National governments**: regulation, justice, security
  - **Parliaments, democratic bodies**: protection of the public good
  - **Local governments, communities:** participatory stewardship
  - **Households:** consumption patterns, from goods to services
  - **Business:** full costs, ecoprofits

- **Macroeconomic steering of GGND requires "Beyond GDP" accounting**
  - **Concealed capital consumption**
    - Consumption of ecosystem capital
    - User cost of non renewable assets
  - **Full cost of goods and services**
    - Full cost of domestic commodities
    - Full cost of imported commodities
  - **Net Disposable National Income**
    - As SNA headline aggregate

Feasible approach to harnessing the crises

Georges Braque – Harbour in Normandy, 1909



Ecosystem Footprint
(land, soil, water, carbon)

Biodiversity Rarefaction
(loss of adaptability)

HANPP
(biomass diverted from Nature)

Landscape Ecological Potential
(the landscape radiography)

Consumption of Ecosystem Capital
(restoration costs of potentials)

€

Catchments Exergy Loss
(from water evaporation & pollution)

Adjustment of Net Disposable National Income

Thank you for your attention!

Professor Jacqueline McGlade
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European Environment Agency