

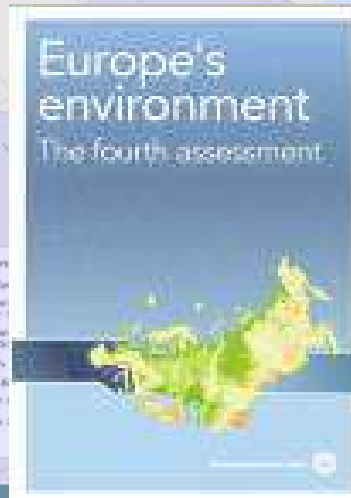
# Decentralisation for a post-carbon society

Prof. Jacqueline McGlade  
Executive Director

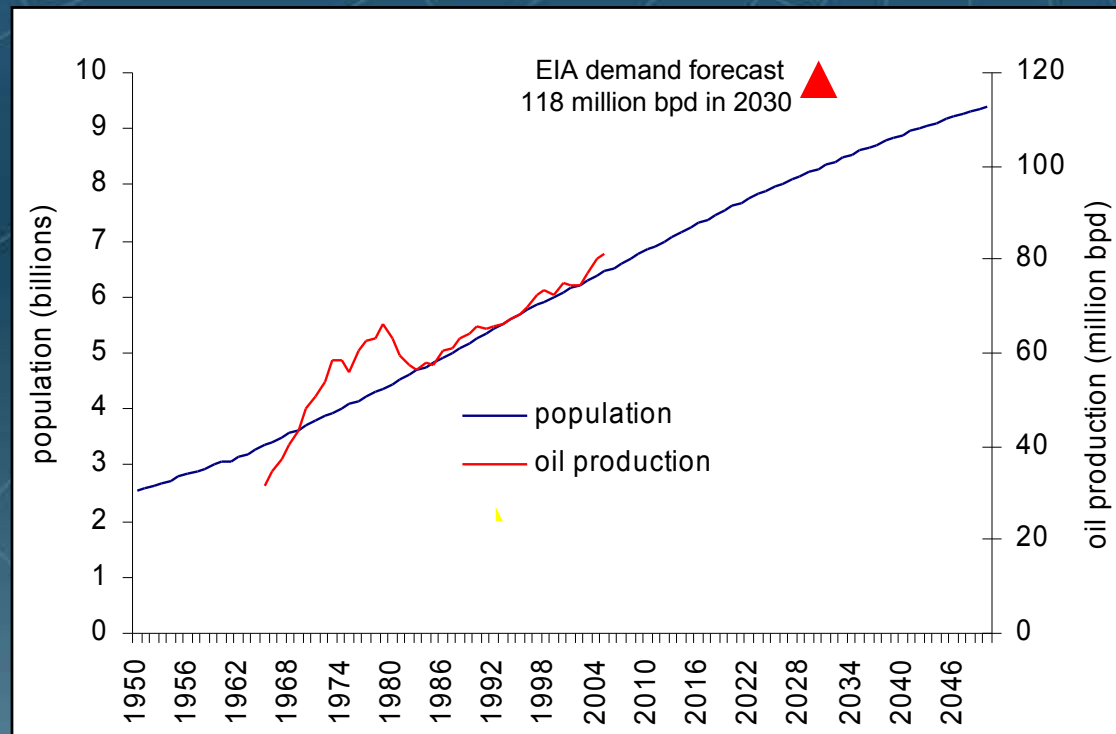


# 53 countries and over 870 million people

- Environmental pressures in the region from economic activities such as agriculture, tourism, transport and energy
- Still no access to safe drinking water and adequate sanitation for over 100 million people the region
- The water supply in EECCA and SEE is often intermittent and of poor quality.
- Decoupling between economic growth and its environmental impacts is needed.



# World population to grow by 1.8 billion by 2031



Consumption growth since '65:

- total energy 284%
- oil 268%
- gas 435%



Energy demand growth:

- developed world +111%
- emerging economies +645%

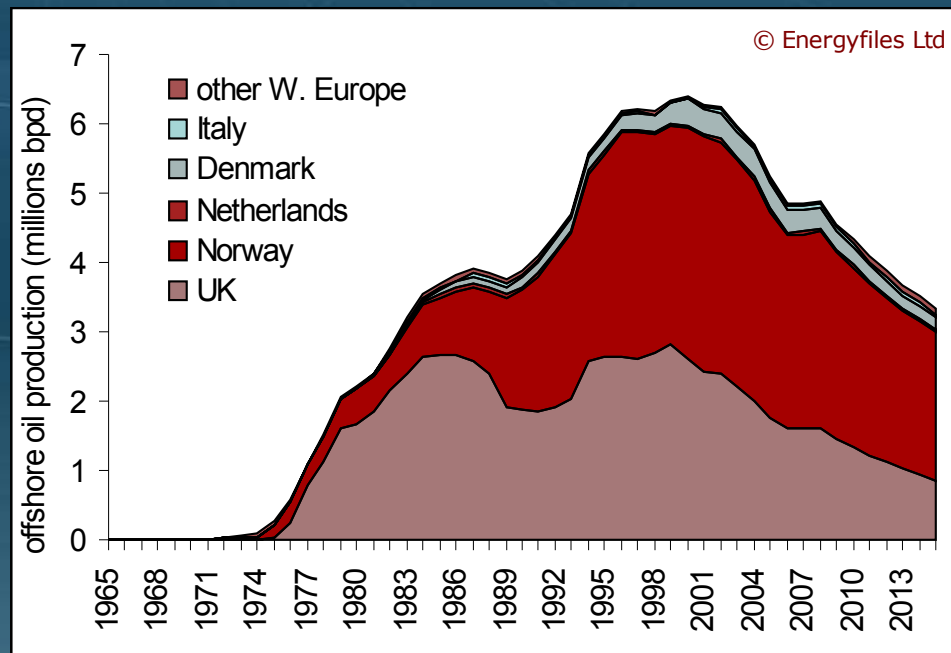




# Oil is the real problem - it is the fuel of transportation



picture courtesy Transfuture.net



## European offshore oil production forecast

- Oil accounts for 32% of global energy consumption
- Demand is growing
- Non-Opec production is declining
- Major politically-induced constraints



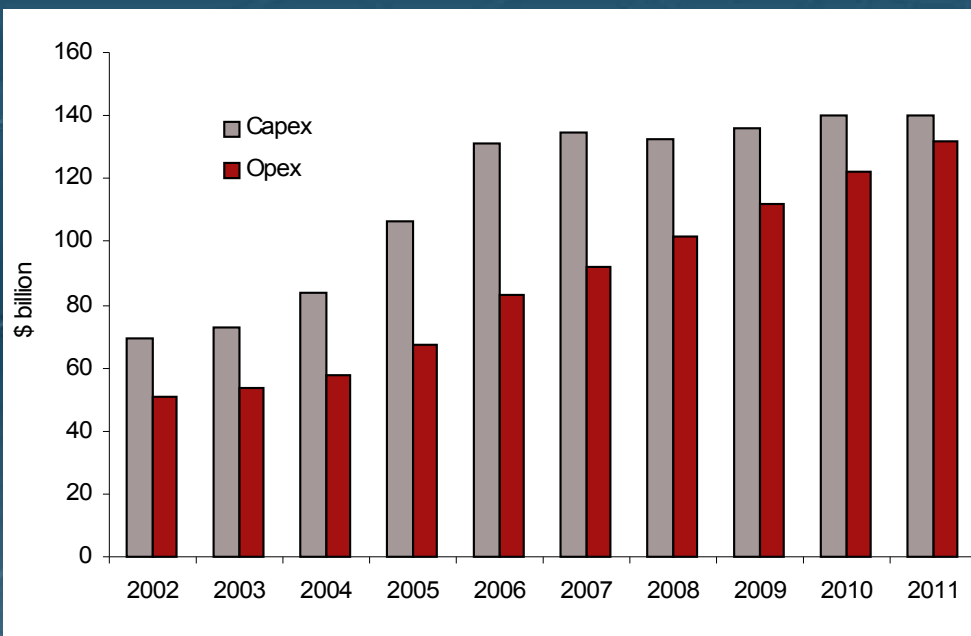
# “Easy oil” has gone - the remainder is in difficult places



- And in deepwater

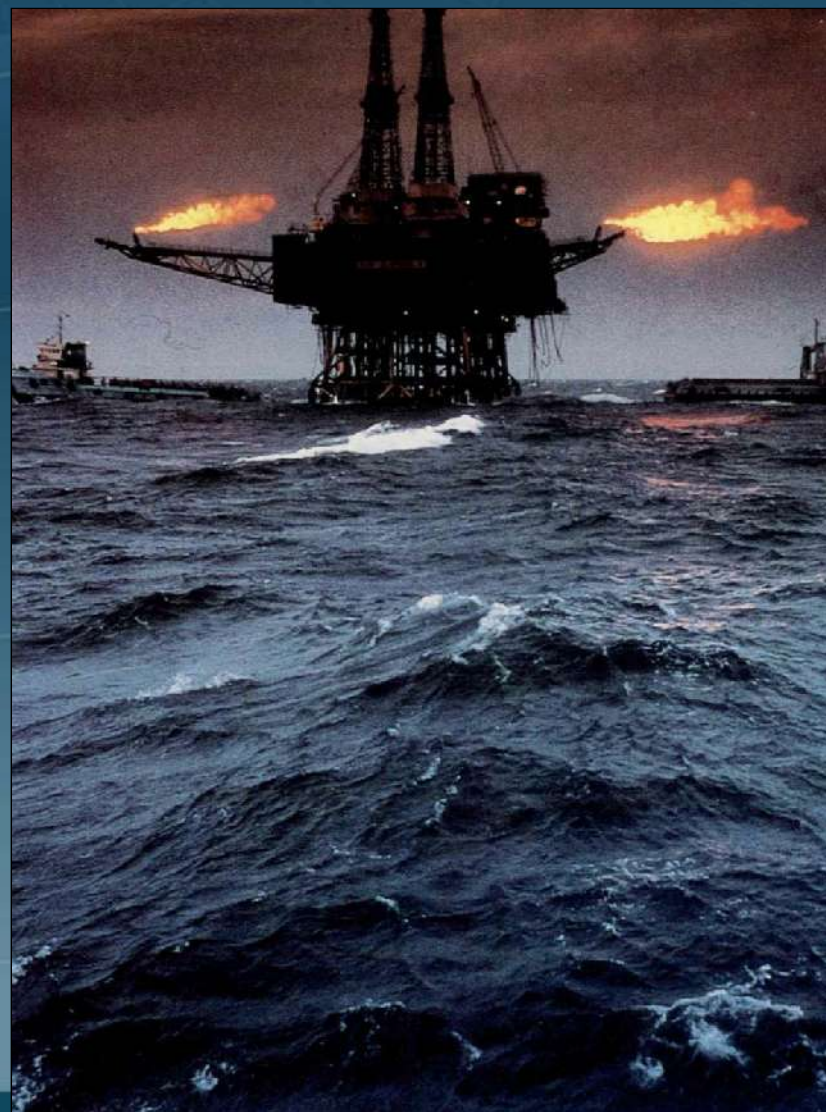


# Field Operations - a massive ageing offshore infrastructure



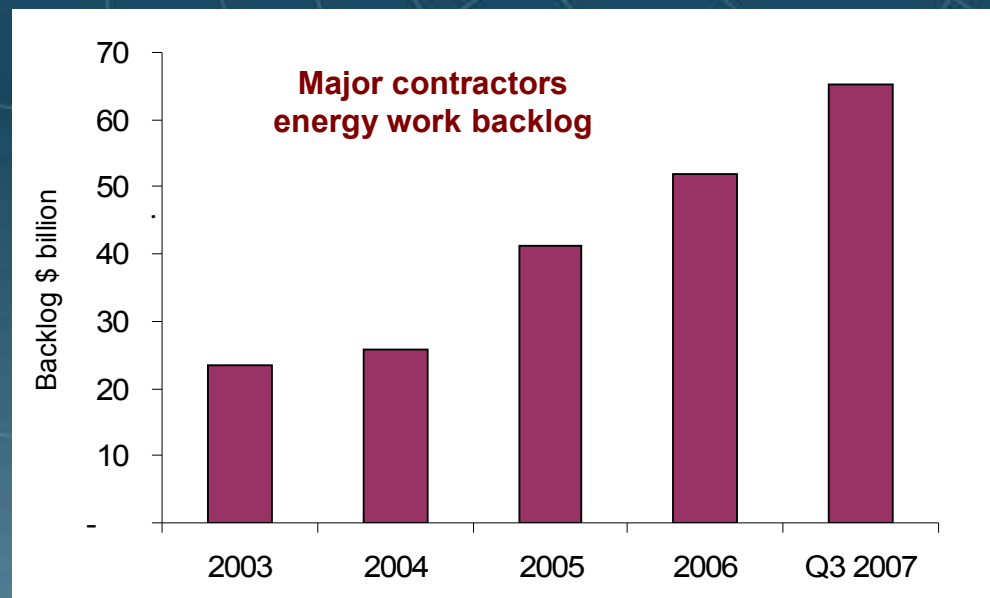
Source: Douglas-Westwood.

- 6,000 fixed platforms, 186 floating
- 175,000 km subsea pipelines
- 3,300 subsea wells operating
- 635 offshore drilling rigs
- A growing maintenance problem
- Need for major modifications
- Growing technical complexity
- Future decommissioning issues



# So why not deploy more resources to sort the problem?

- Energy contractors overwhelmed with work
- Capacity is already sold for years ahead
- Shortages of:
  - drilling rigs
  - construction vessels
  - manufacturing capacity
  - raw materials
  - skilled people



# Is peak oil happening?

## World will face oil crunch 'in five years'

Fin Times  
July 10  
2007

IEA says supply falling faster than expected  
Dependence on Opec to increase as prices rise  
By Javier Blas in London

The world is facing an oil supply "crunch" within five years that will force up prices to record levels and increase the west's dependence on oil cartel Opec, the industrialised countries' energy watchdog has warned.

In its starkest warning yet on the world's fuel outlook, the International Energy Agency said "oil looks extremely tight in five years time" and there are "prospects of even tighter natural gas markets at the turn of the decade".

The IEA said that supply was falling faster than expected in mature areas, such as the North Sea or Mexico, while projects in new provinces such as the Russian Far East, faced long delays. Meanwhile consumption is accelerating on strong economic growth in emerging countries.

The problem is exacerbated by the fact that supply from non-members of the Organisation of the Petroleum Exporting Countries will increase at an annual pace of 1 per cent, or less than half the rate of the rise.

The widening gap between rising consumption and lagging

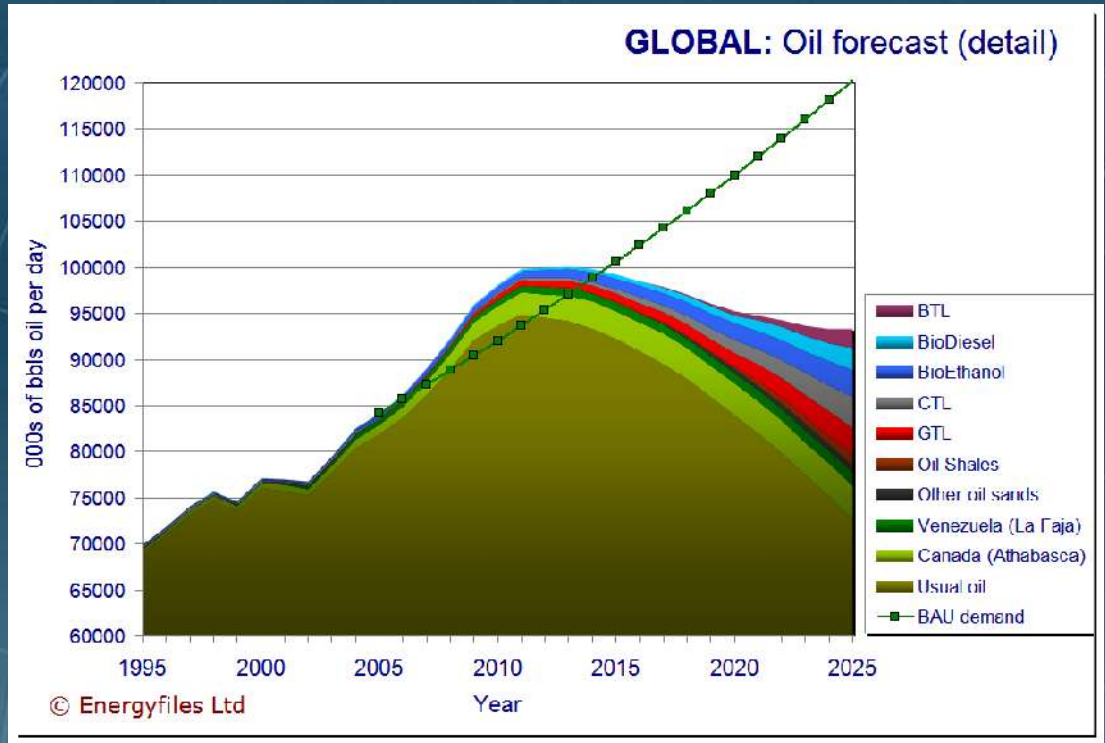
The IEA Medium Term Oil Market Report came as oil is approaching last year's record high Brent crude oil yesterday rose 72 cents to a 11-month high of \$76.34 a barrel.

Refineries are already paying record high prices as producing countries have cut the discount at which they sell their oil relative to Brent, according to an analysis by the FT. Most of the discounts had been reduced to levels not seen since 2004 and some even to six-year lows.

Oil demand will grow at an annual rate of 2.2 per cent during the next five years, up from a previous estimate of 2 per cent, to reach 95.8m barrels a day in 2012. China, the Middle East; and other emerging countries will lead the increase.

Rex Tillerson, the chairman and chief executive of Exxon-Mobil, said recently that he thought non-Opec oil production was close to levelling off. He told the FT: "We still see capacity for a little more growth, but pretty modest, and then in our own energy outlook it begins to plateau. And that results then in this call on Opec."

Oil production is set to suffer a dramatic decline from today's 1.7m barrels a day to just 1.0m b/d in 2012, according to the IEA. The IEA estimates Opec would have to supply about 36.2m b/d in 2012, up from today's 31.3m b/d. That would reduce the

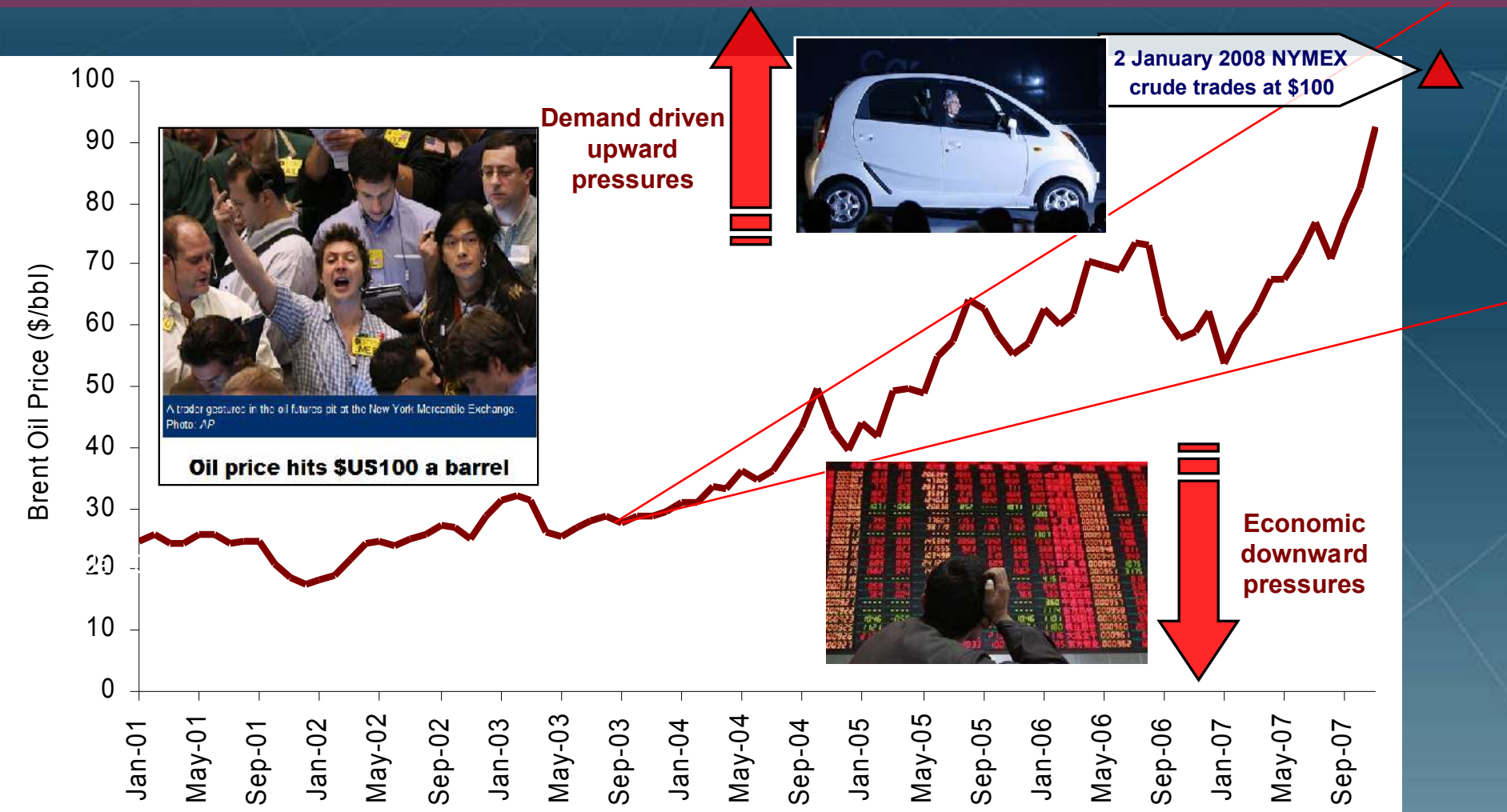


Source: Financial Times article on IEA International Energy Outlook, 10 July 2007

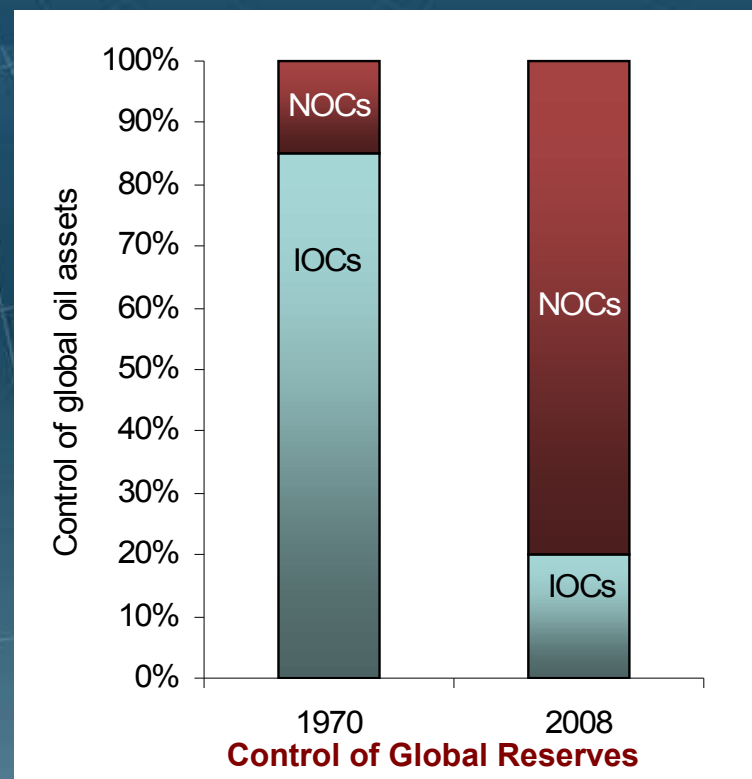
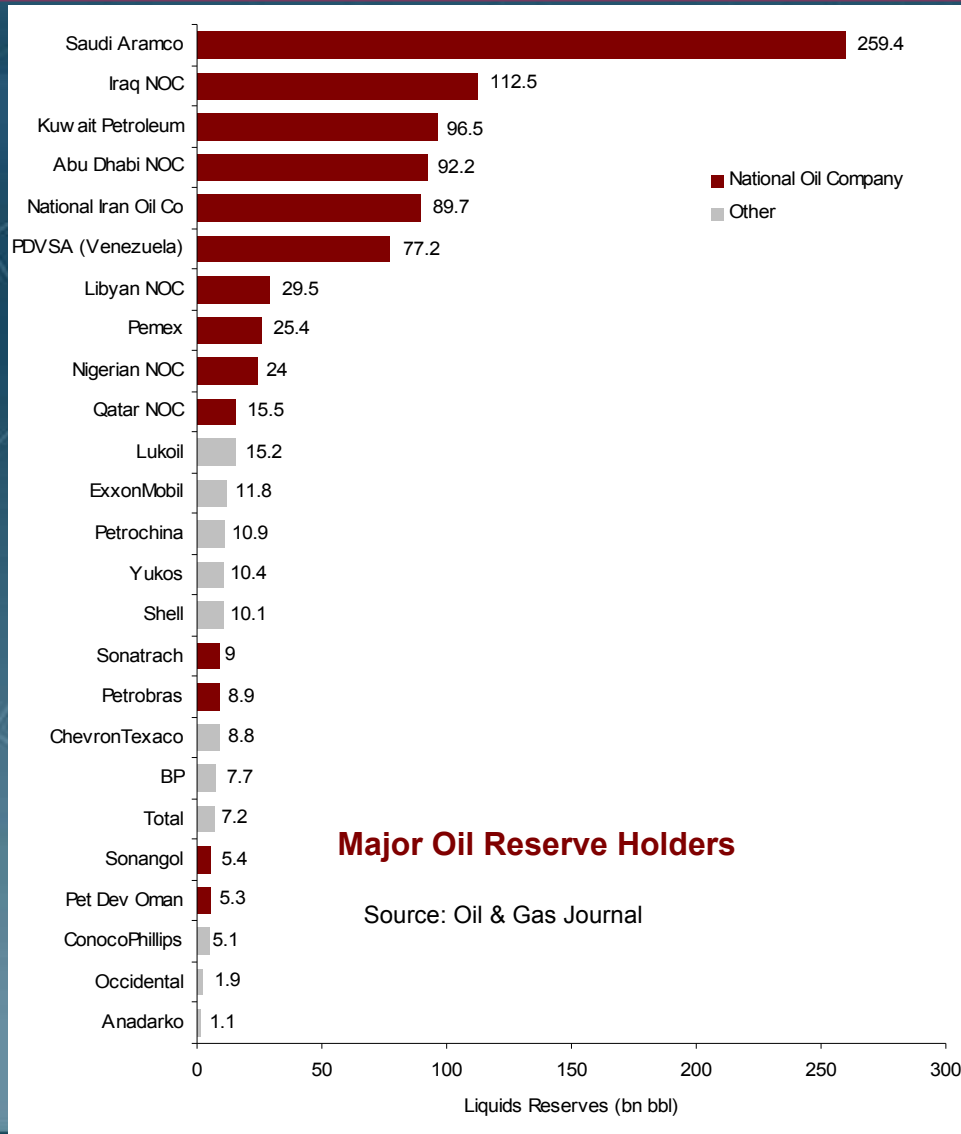
- "Will increase the West's dependence on OPEC"
- "Oil demand will grow to 95.8 million bpd by 2012"
- "Non-OPEC oil production is close to levelling off" Rex Tillerson, Chairman, Exxon
- "Oil production will never exceed 85 mn bpd" – T Boone Pickens



# Long-term upwards price pressures & increasing volatility



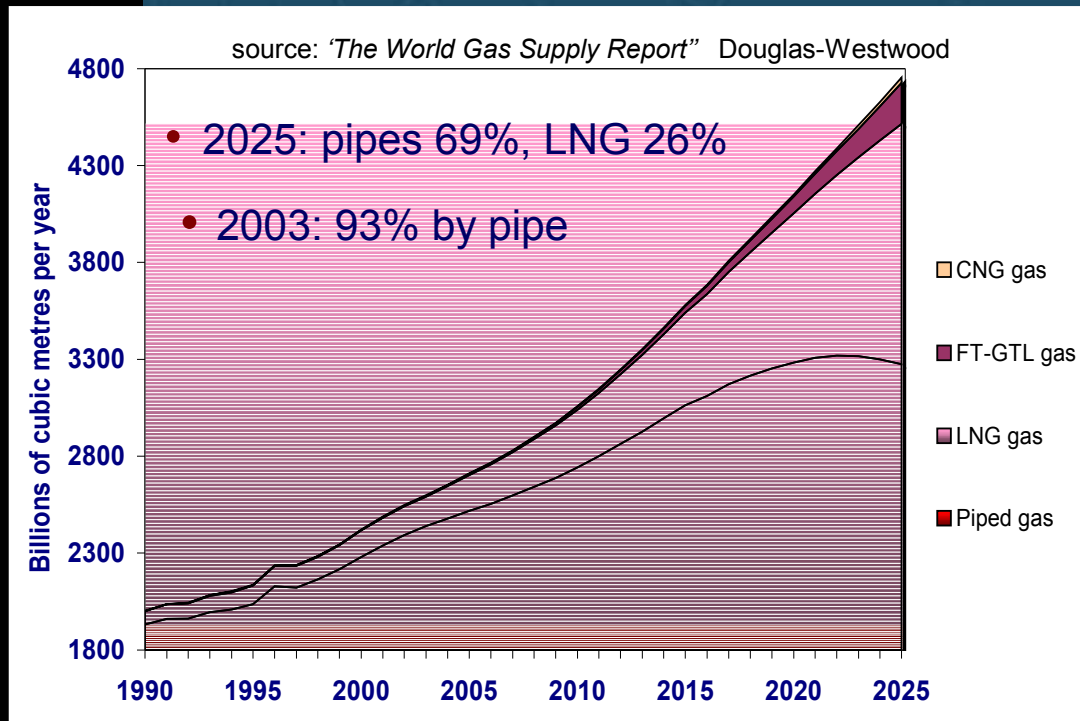
# The state oil companies now control global oil reserves



<sup>2</sup> data: James A Baker IPP; FT 3 Jan 2008

- The western oil majors need a new business model

# Gas - a global drive to monetise assets



© www.energyfiles.com

- Major production growth forecast
- Surge in LNG & GTL trade
- 'Subsea' to shore developments becoming increasingly popular



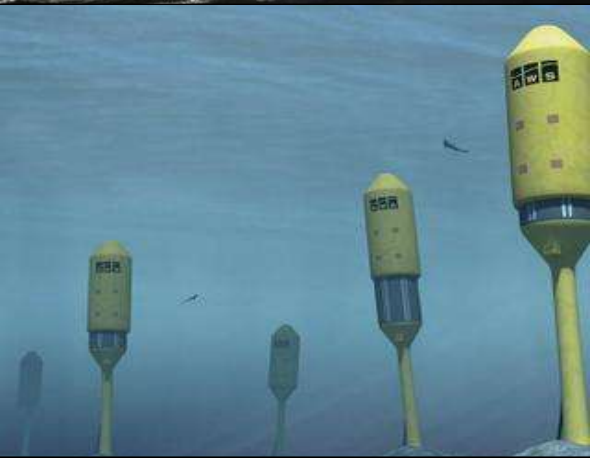
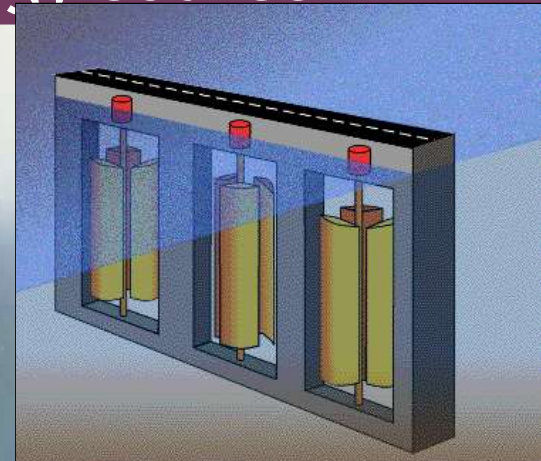
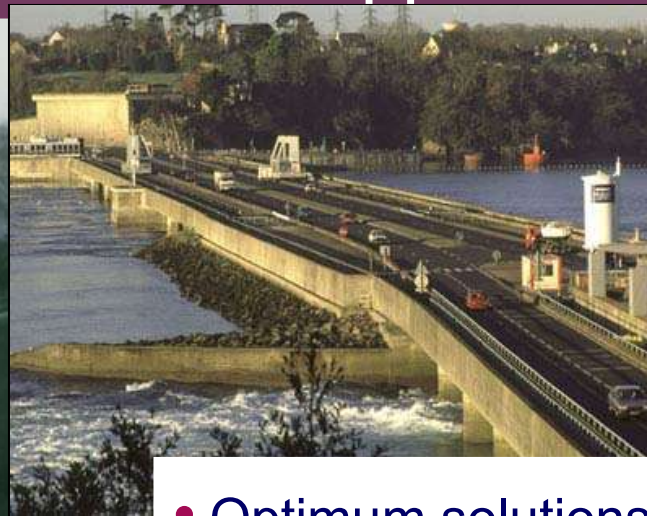


# Gas Flaring: a major global issue

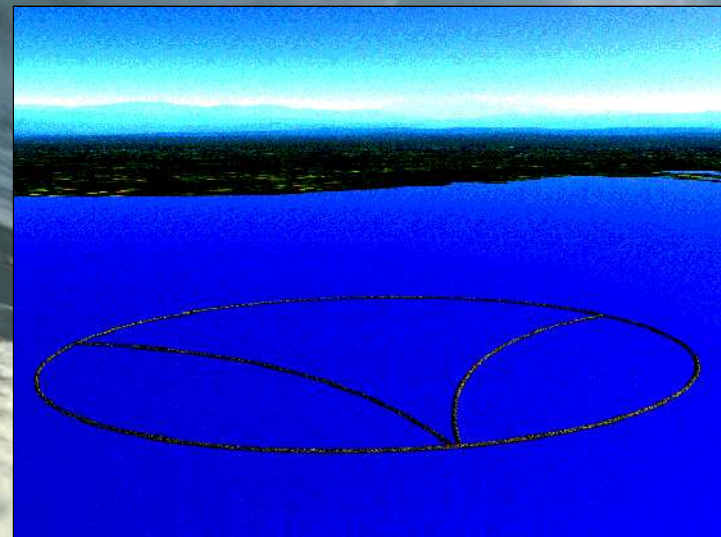
- Nigeria exports 13 million tons of LNG but flares 18 million equiv. tons
- Russia – around 50 bcm/y flared plus similar volume in pipe leaks
- Worldwide about 150 billion m<sup>3</sup> flared
- Equivalent to 33% of US gas consumption or 75% of global LNG trade
- Adds 390 million tons of CO<sub>2</sub> p.a. (equiv. to 115 million cars – 1/7<sup>th</sup> of world cars)
- Waste of a valuable resource

Shell gas flare at Rumuekpe River State Niger Delta. Picture: Peter Roderick

# The oceans remain a vast untapped energy source

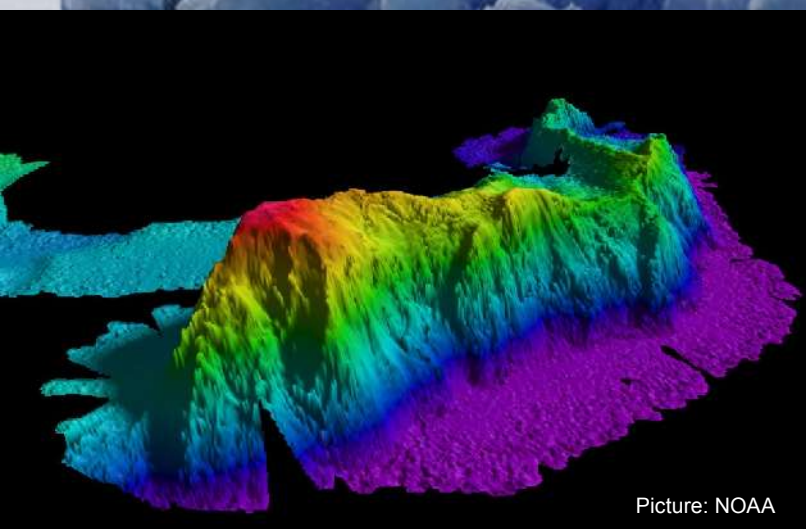


- Optimum solutions not yet evolved?
- Many (>80) wave & tidal power concepts
- Most still waiting commercial proving





# THE ARCTIC - THE LAST OFFSHORE FRONTIER



Picture: NOAA





# Climate change - a cause célèbre



# Atmospheric view

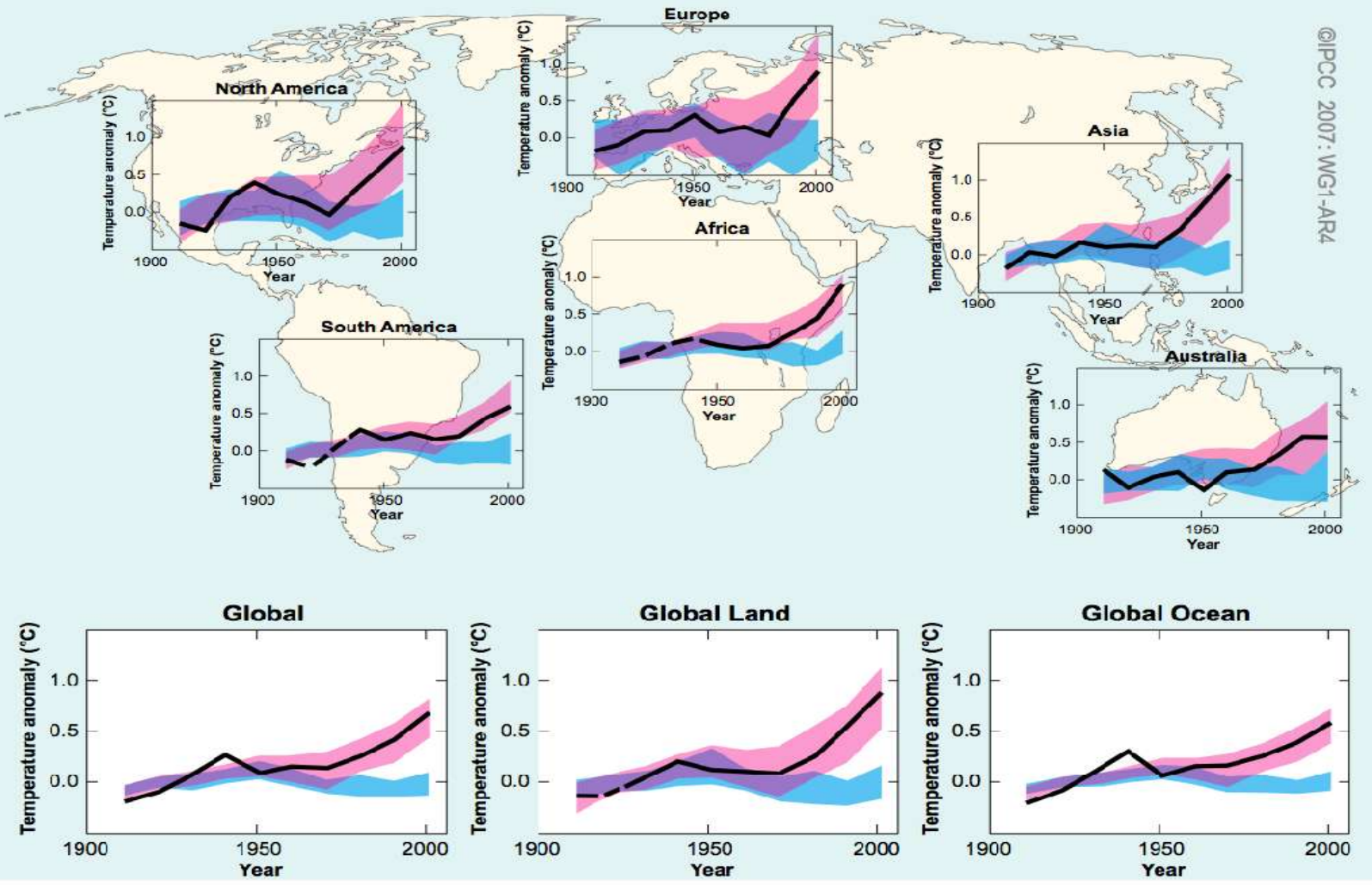


Ulrike Hoffmann EEA



# Understanding and Attributing Climate Change

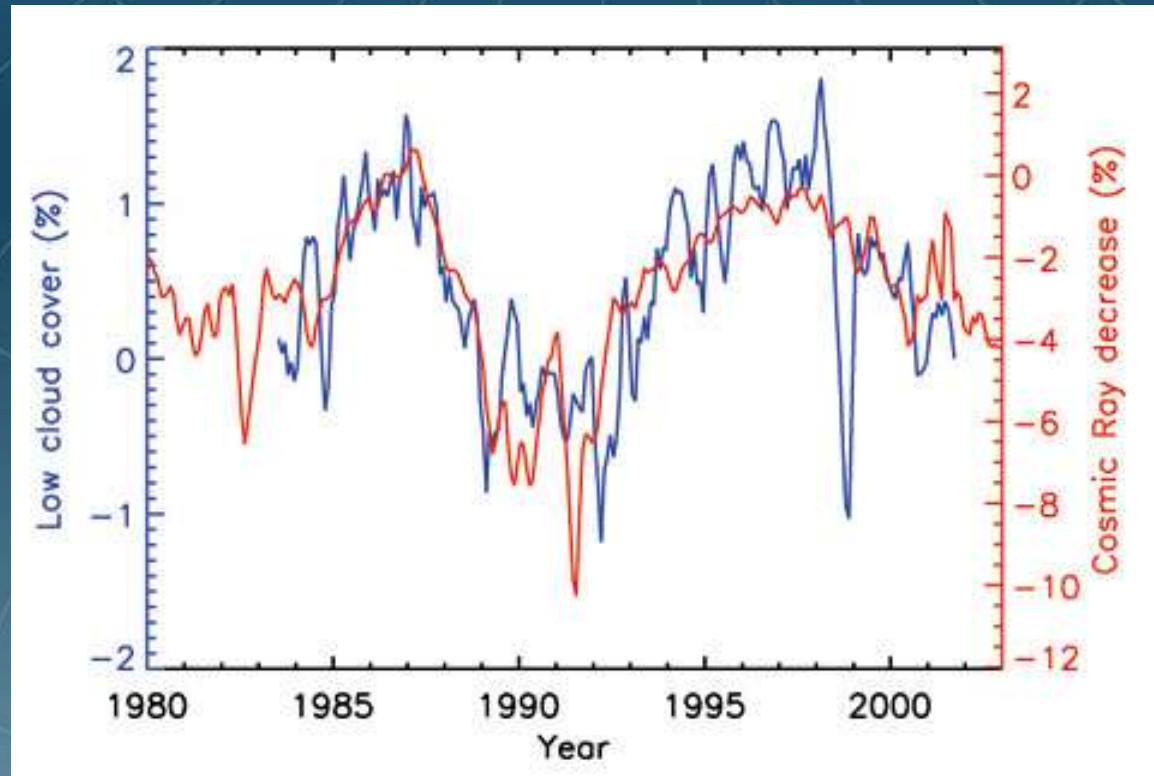
## Global and Continental Temperature Change



©IPCC 2007: WG1-AR4



# Cosmic rays - Henrik Svensmark



<http://ourworld.comuserve.com/homepages/dp5/warm11.jpg>



# Milankovich cycles - Bill Ruddiman





# *Anthropocene* - Paul Crutzen et al.

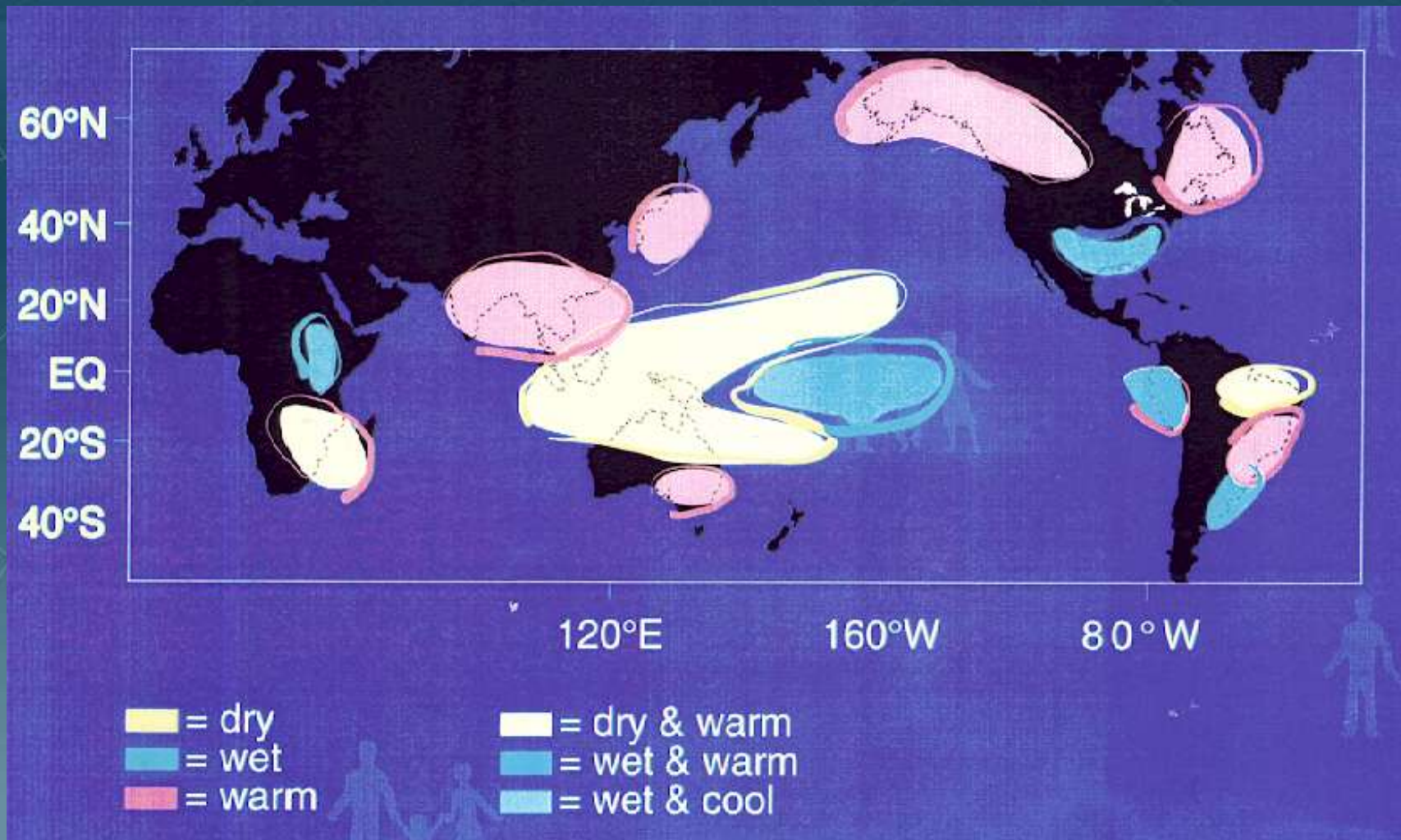




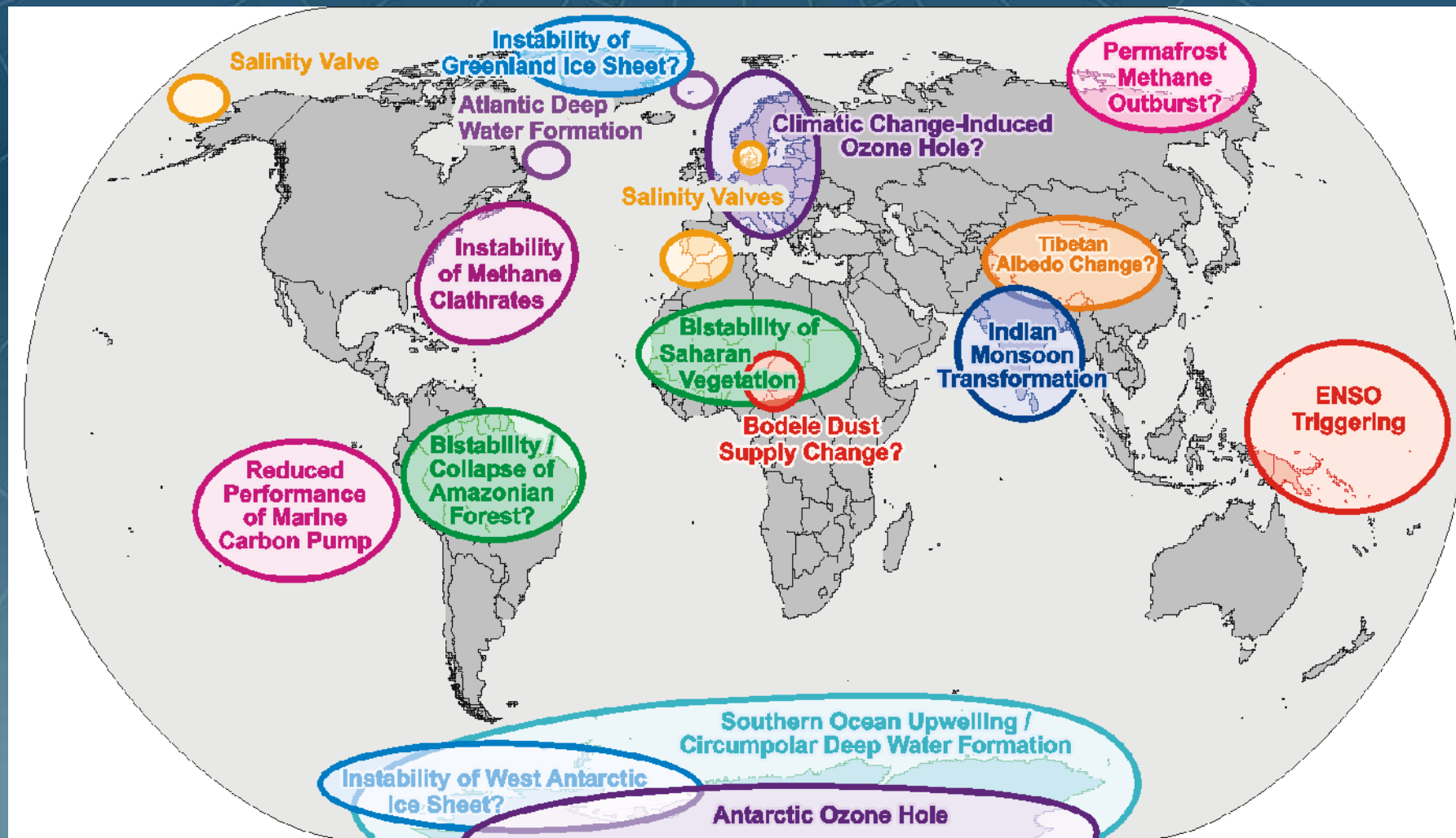
# Planetary dynamics and the earth's surface



# Impact of El-Nino in the Northern Hemisphere Winter



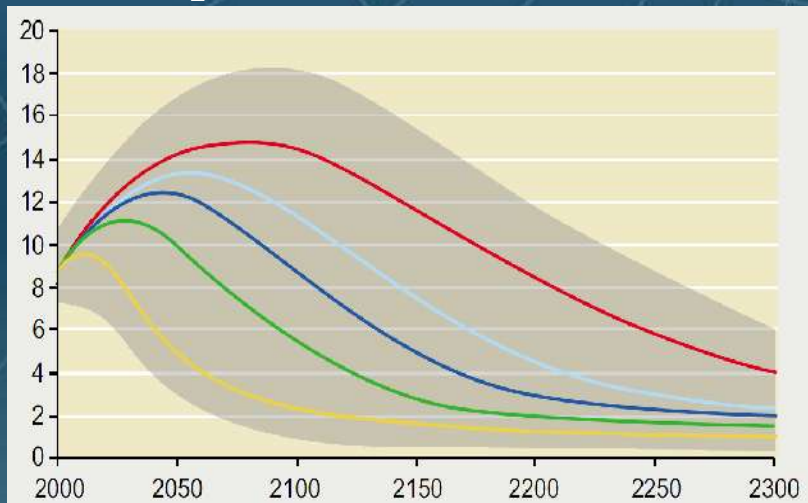
# Tipping Points in the Earth System



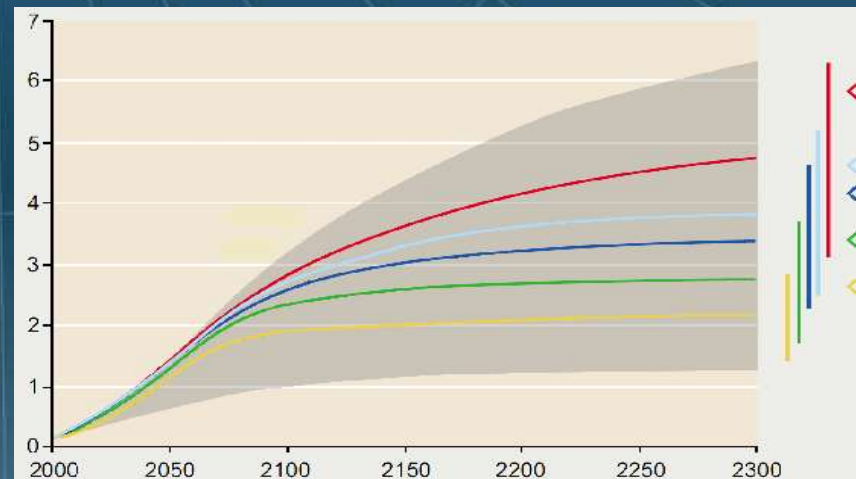


# Outlooks

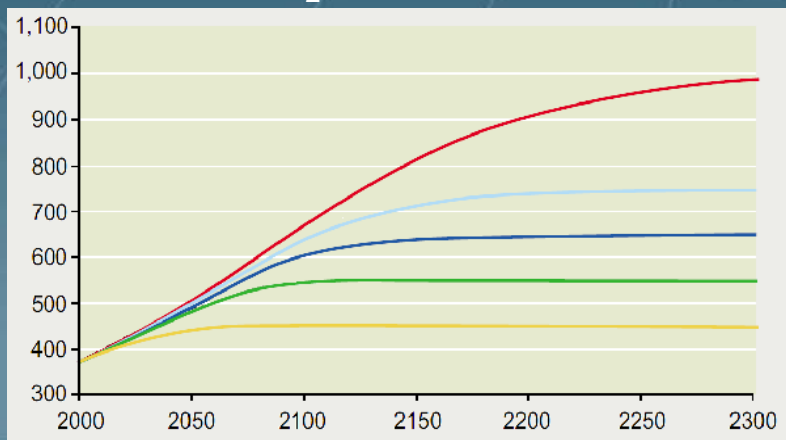
## CO<sub>2</sub> emissions (GtC/yr)



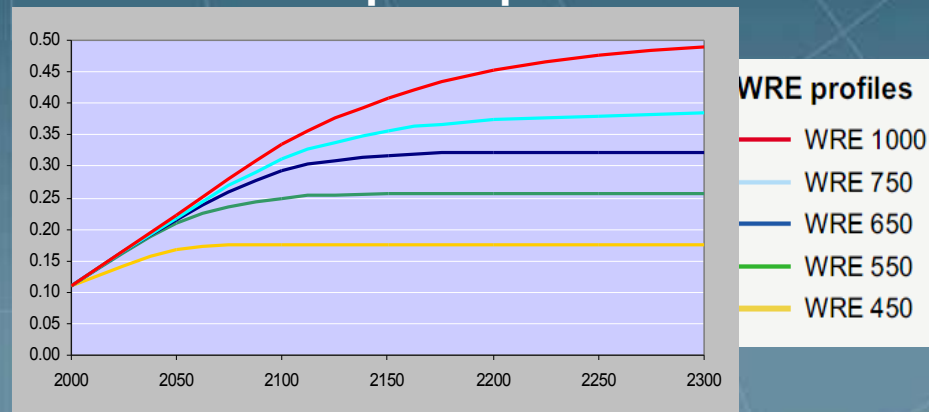
## Temperature trajectories (°C)



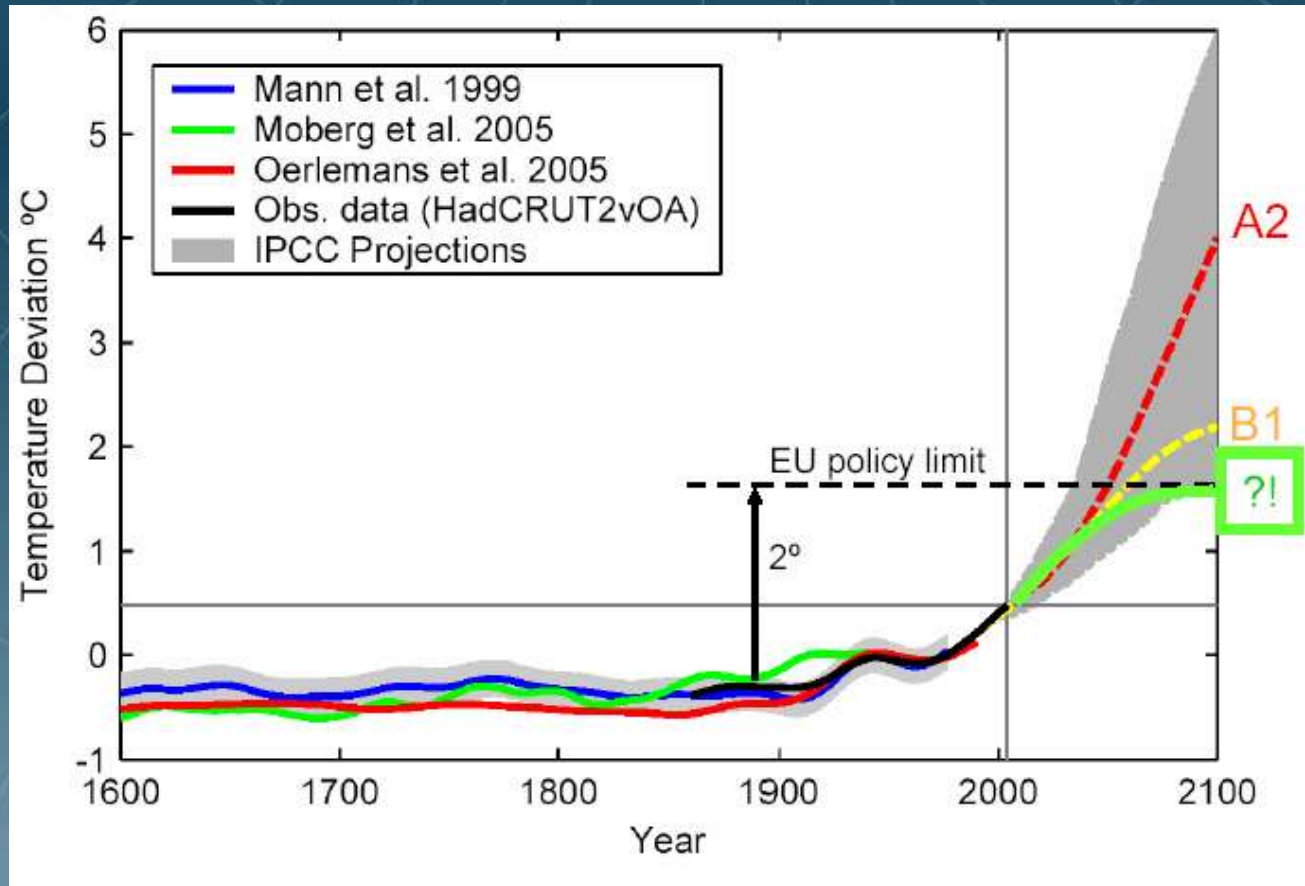
## Atmospheric CO<sub>2</sub> concentrations (ppm)



## Surface ocean pH depression



# A model world ?



# Controlled Draining of Tsho Rolpa Glacial Lake (Nepal)

**Vulnerable Situation in the Past**

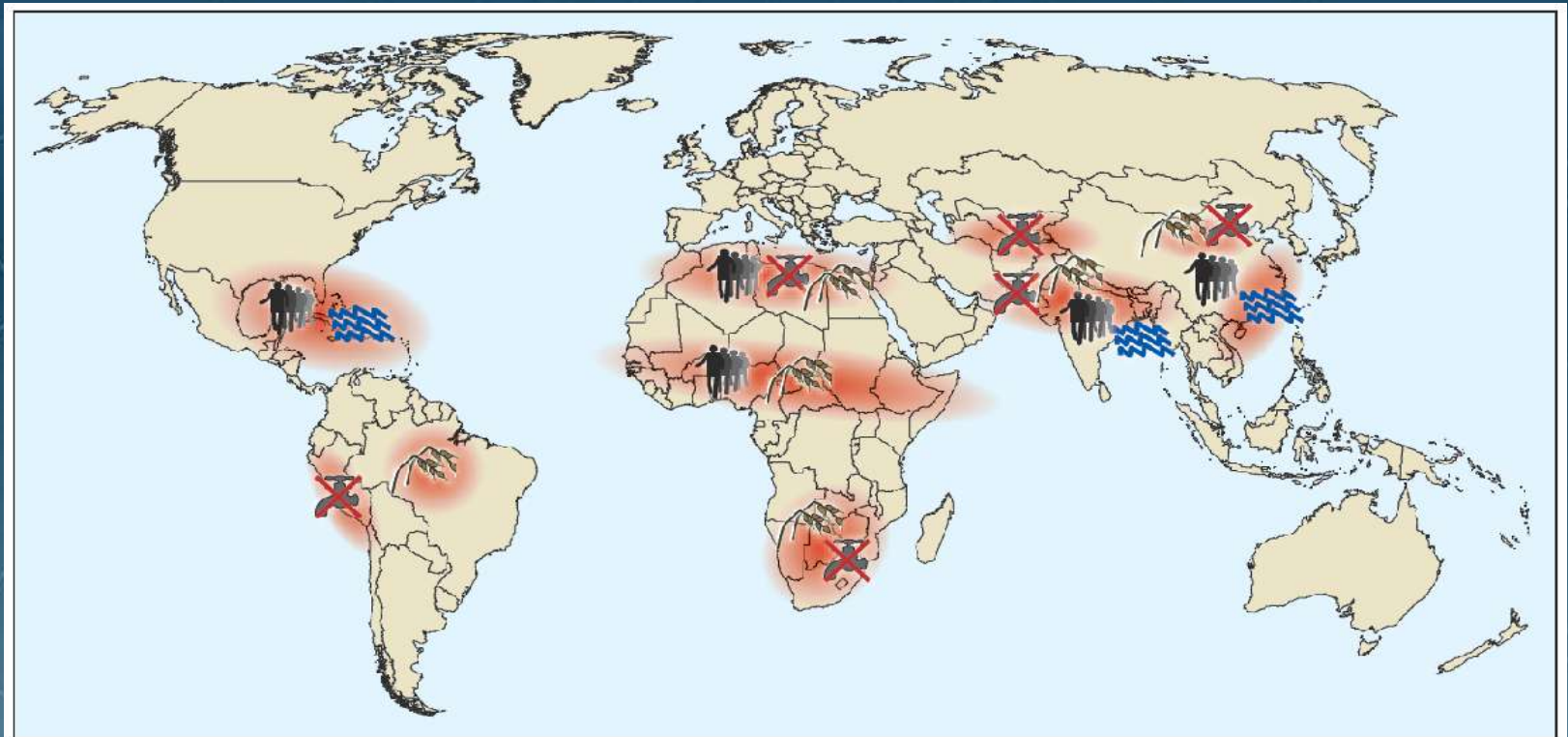


**Anticipatory Adaptation**





# Security Risks & hot spots caused by climate change



Degradation of  
Freshwater Resources



Decrease of  
Food Production



Hot Spot



Increase of Storm and  
Flood Catastrophes



Migration



# East Greenland's local environment



Kangerdlussuaq Glacier in East Greenland. Iceberg production is a major form of mass loss from ice sheets into the Semiliak Fjord - Dowdeswell /McGlade



# Climate neutrality - Denmark?

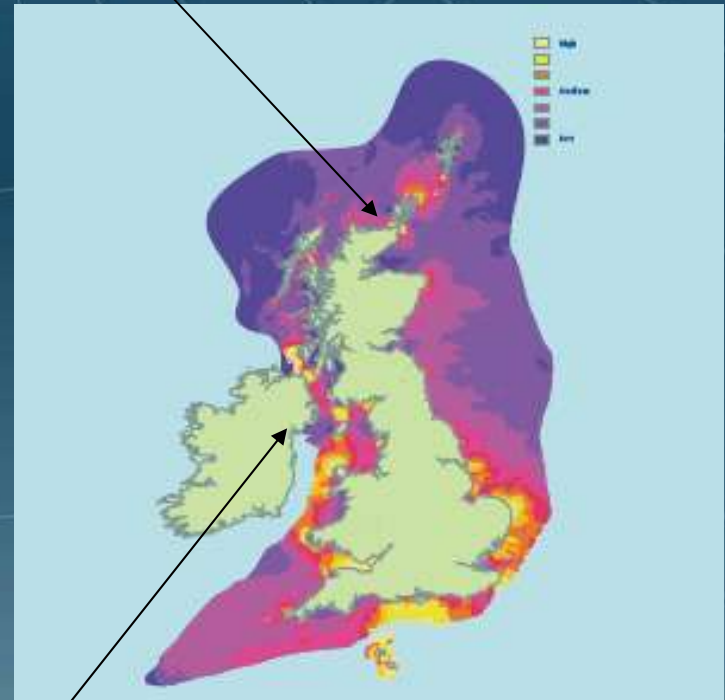




# SeaGen - tidal generation



Pentland Firth



Strangford Lough



# *Entente formidable*



# Centralisation of power





# Democratisation of power



# The economics of a post-carbon society

