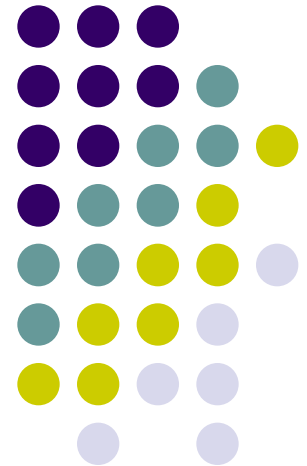


Peak Oil, Climate Change & the Global Sustainability Emergency

Engineers Australia
Southern Highlands & Tablelands Group
Mittagong
26th June 2008

Ian T. Dunlop
Governance & Sustainability Advisor
Deputy Convenor, Australian Association for the Study of Peak Oil
Sydney, Australia



Global Drivers → Strategic Risks



- Population Growth
 - 6.5 billion rising to 9 billion by 2050.
 - all aspiring to improved quality of life.
- Market Economy
 - economic growth has delivered untold wealth & power - to some !.
 - made humanity a planetary force.
 - but under current rules, it may destroy the planet.
- Poverty & Inequality
 - 15% of world population enjoy 80% of world GDP.
 - 43% live on less than \$2 per day.
 - inequality in the developed world is increasing.
- Globalisation & Technological Change
 - essential for our survival & prosperity.
 - increasing connectivity & specialisation.
 - dissemination of power & awareness to the global community.
 - decreasing resilience to weather macro-shocks.

The Immediate Convergence

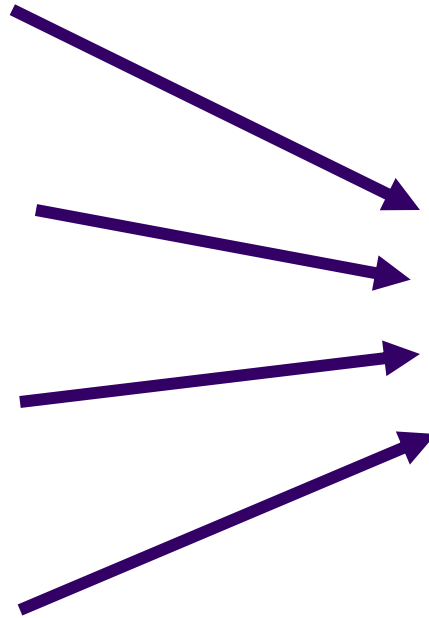


Peak Oil

Climate Change

Water

Food



**An Unsustainable
World ?**



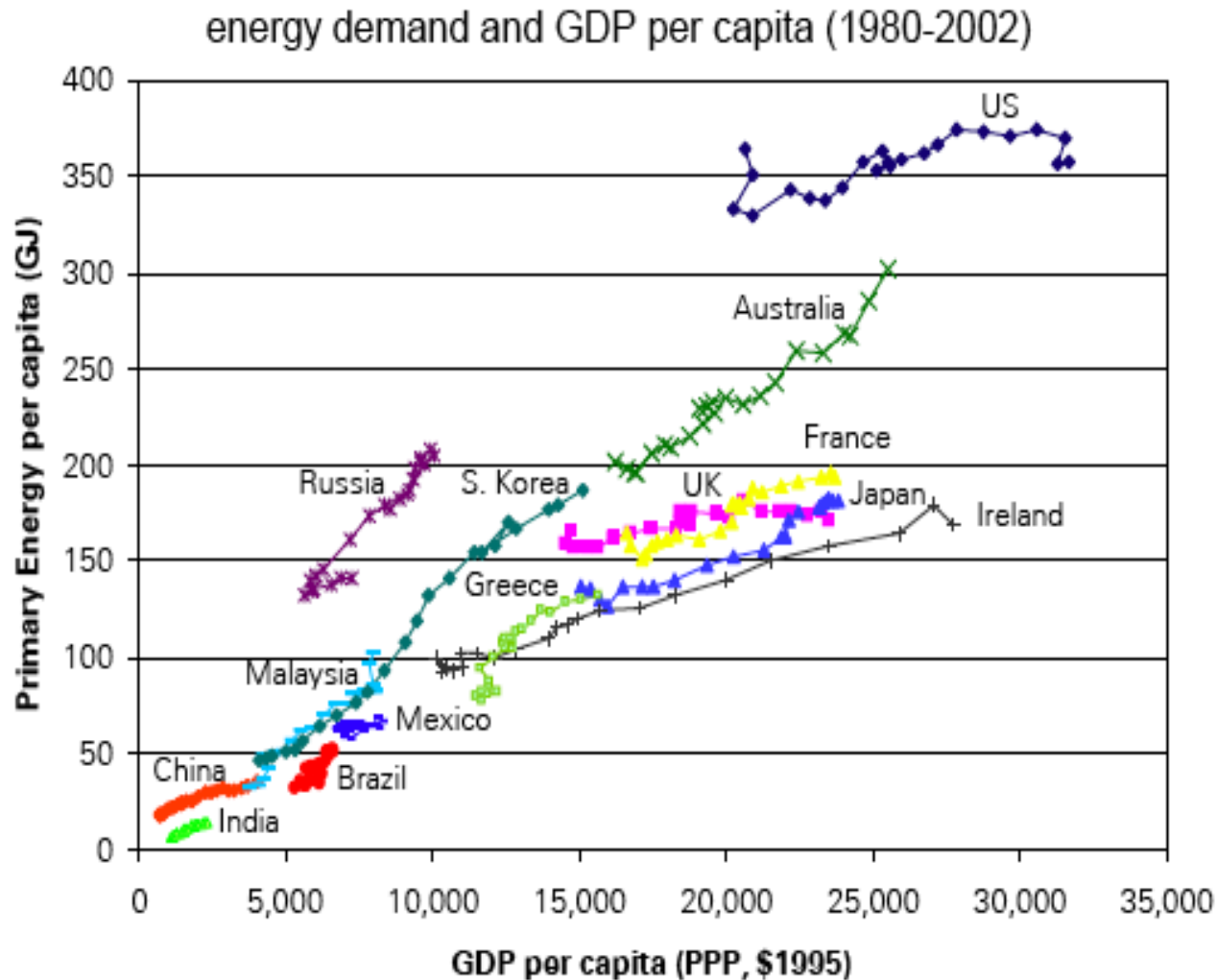
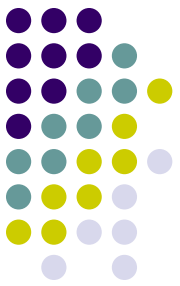
Other Peaks Follow

- Grain
- Wild Fish
- Fresh Water per capita
- Arable land in production
- Uranium
- Gas
- Coal
- Some metals

But the Energy Transition, to a low-carbon economy, is critical

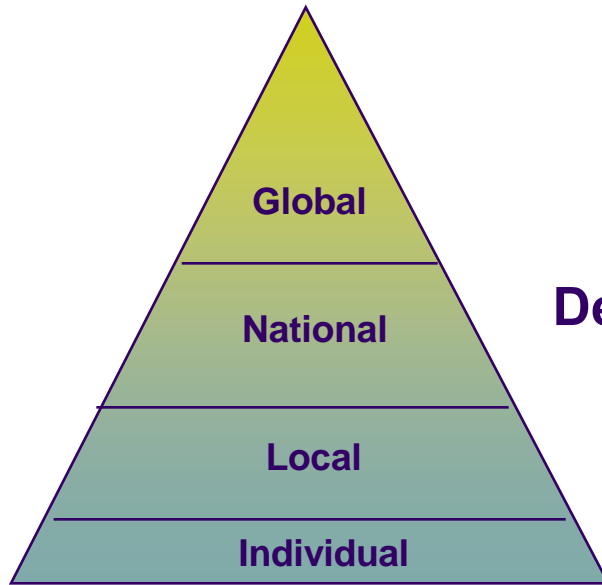
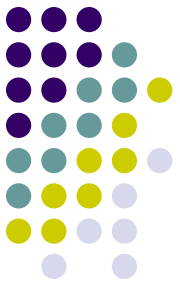
Economy is based on Cheap Energy

- our prosperity depends upon it



Climate Change

- the ultimate “Tragedy of the Commons” -

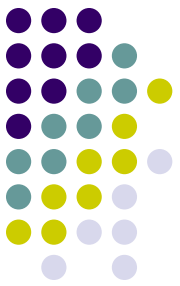


Decreasing concern for the “ Commons ”

“ What is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest ”

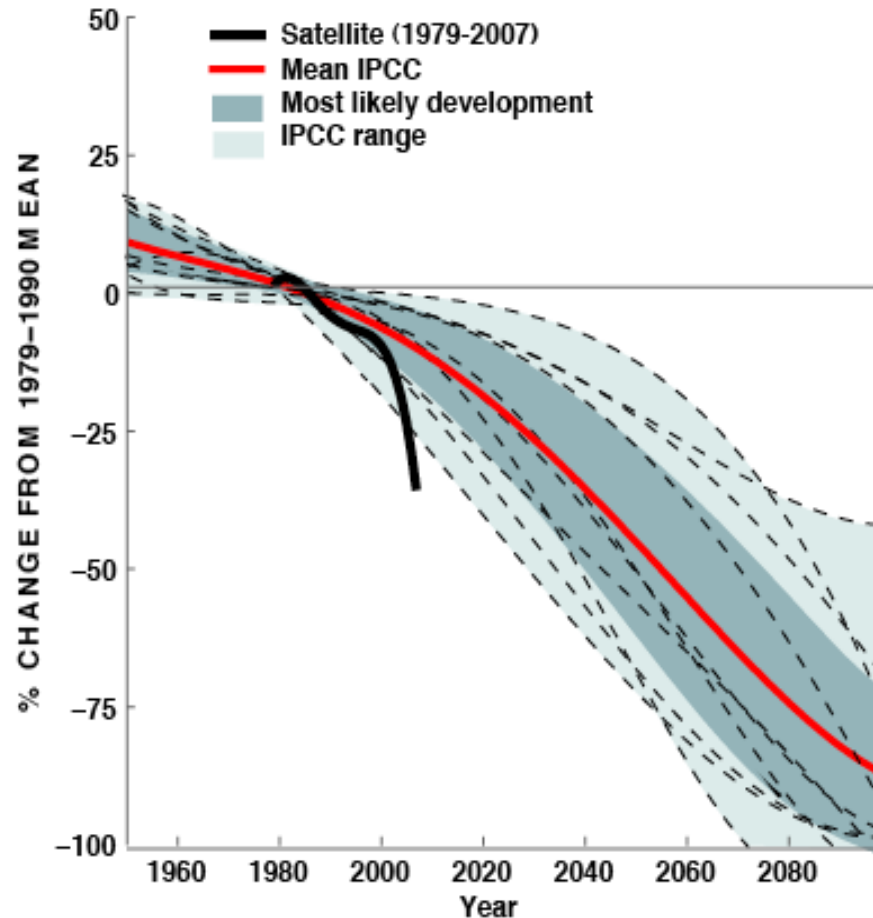
Aristotle, Politics, Book II ch.3

Arctic Sea Ice Melt Accelerating



September
2007
compared to
IPCC
modelling

- far faster
than
predicted -



Arctic ice loss compared to IPCC models

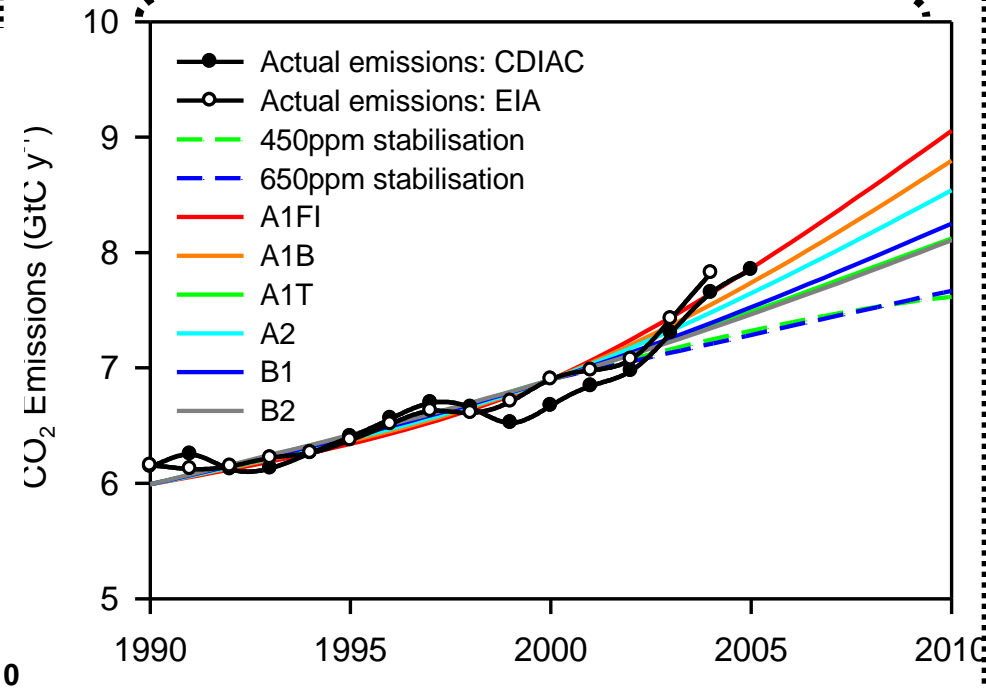
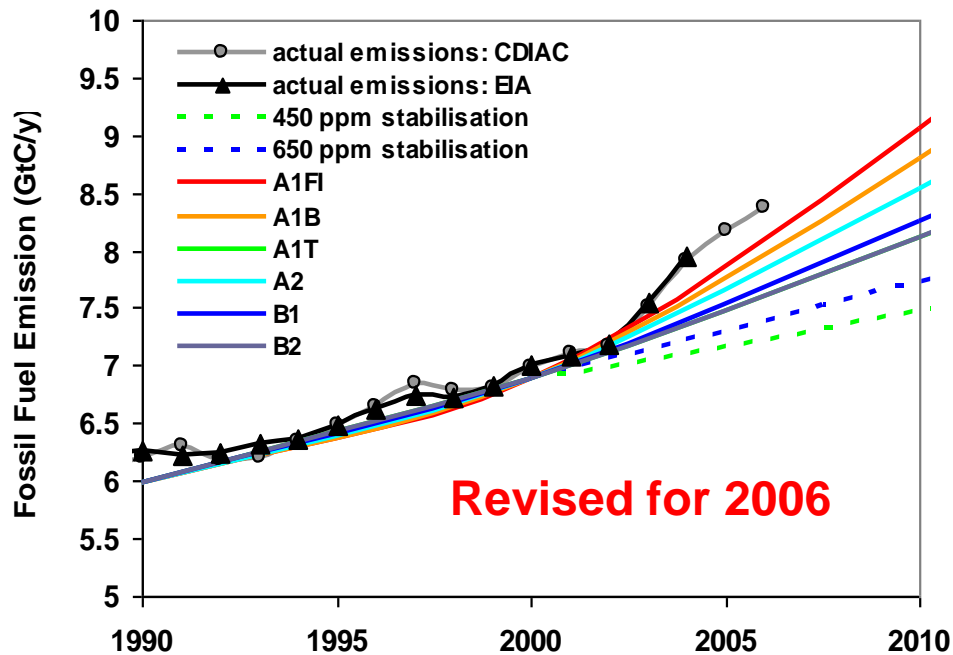
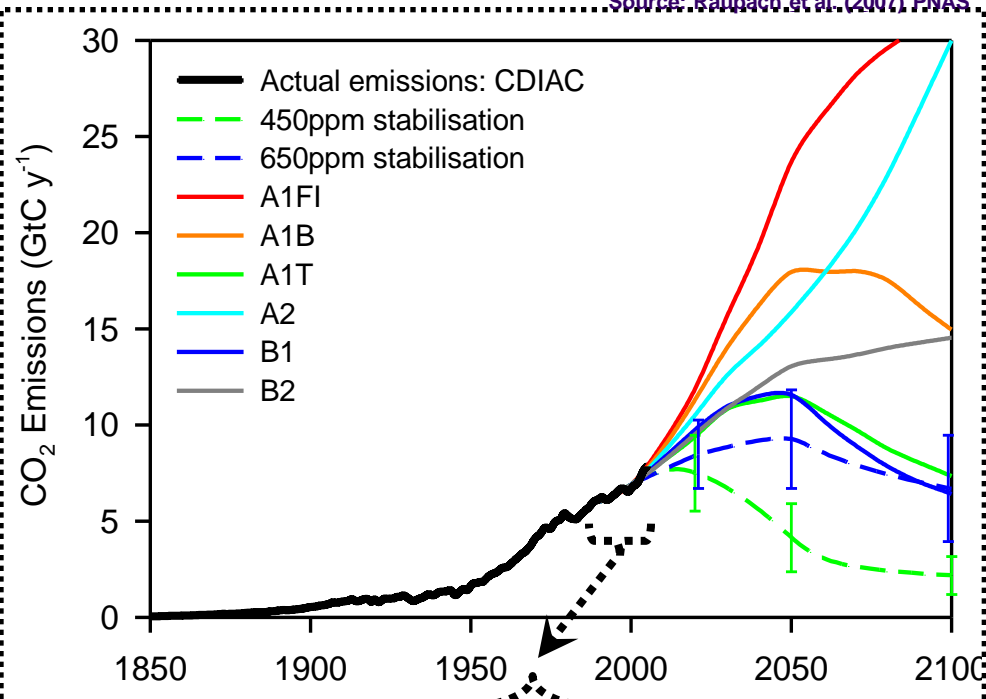
Arctic ice extent loss to September 2007 compared to IPCC modelled changes using the SRES A2 CO₂ scenario (IPCC high CO₂ scenario). Extent loss data from US National Snow and Ice Data Center satellite observations. Data smoothed with a 4th order polynomial to smooth out the year-to-year variability.

Chart courtesy Dr Aageir Sorteberg, Bjerknes Centre for Climate Research and University Center at Svalbard, Norway.

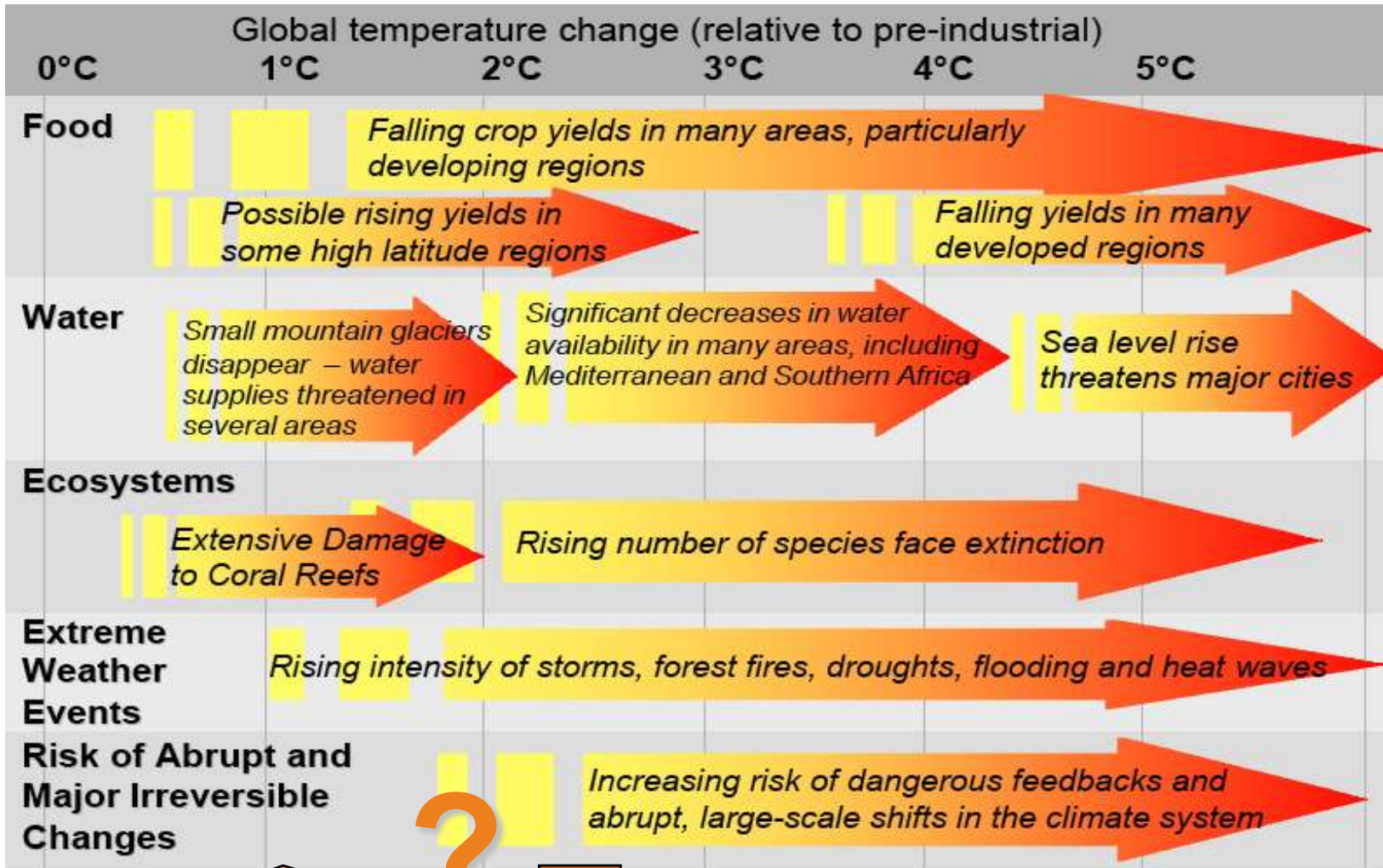
Global CO₂ emissions from fossil fuels

- Growth rates:
 - 1990-1999: ~1% pa
 - 2000-2005: ~3% pa
- IPCC Scenarios underestimate actual emissions since 2000

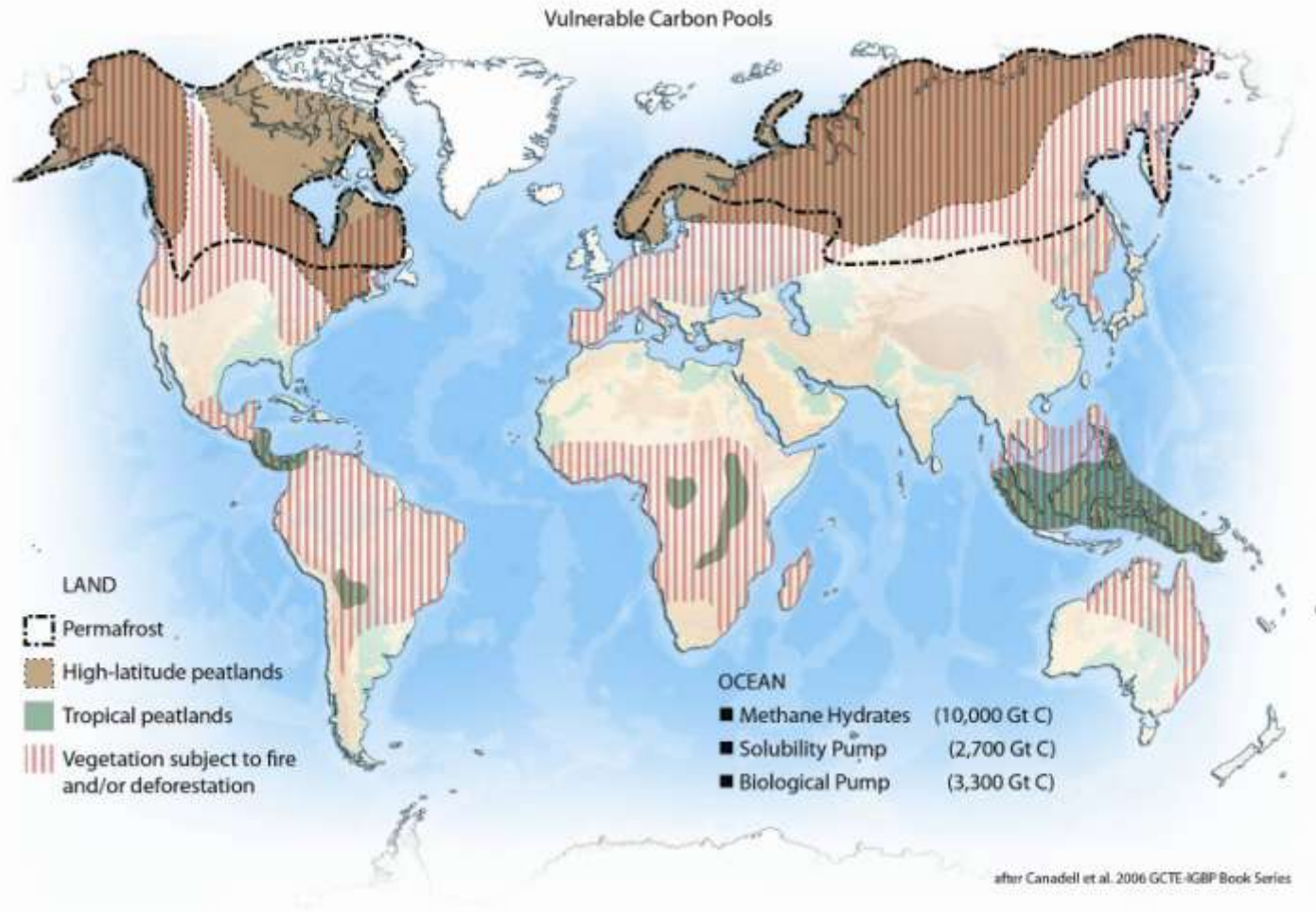
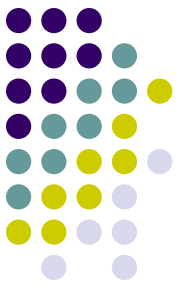
Source: Baunach et al. (2007), PNAS



Re-calibrating Risk



Vulnerable Carbon Pools in 21st C



Source: Global Carbon Project 2006

Ian Dunlop 2008

Urgency

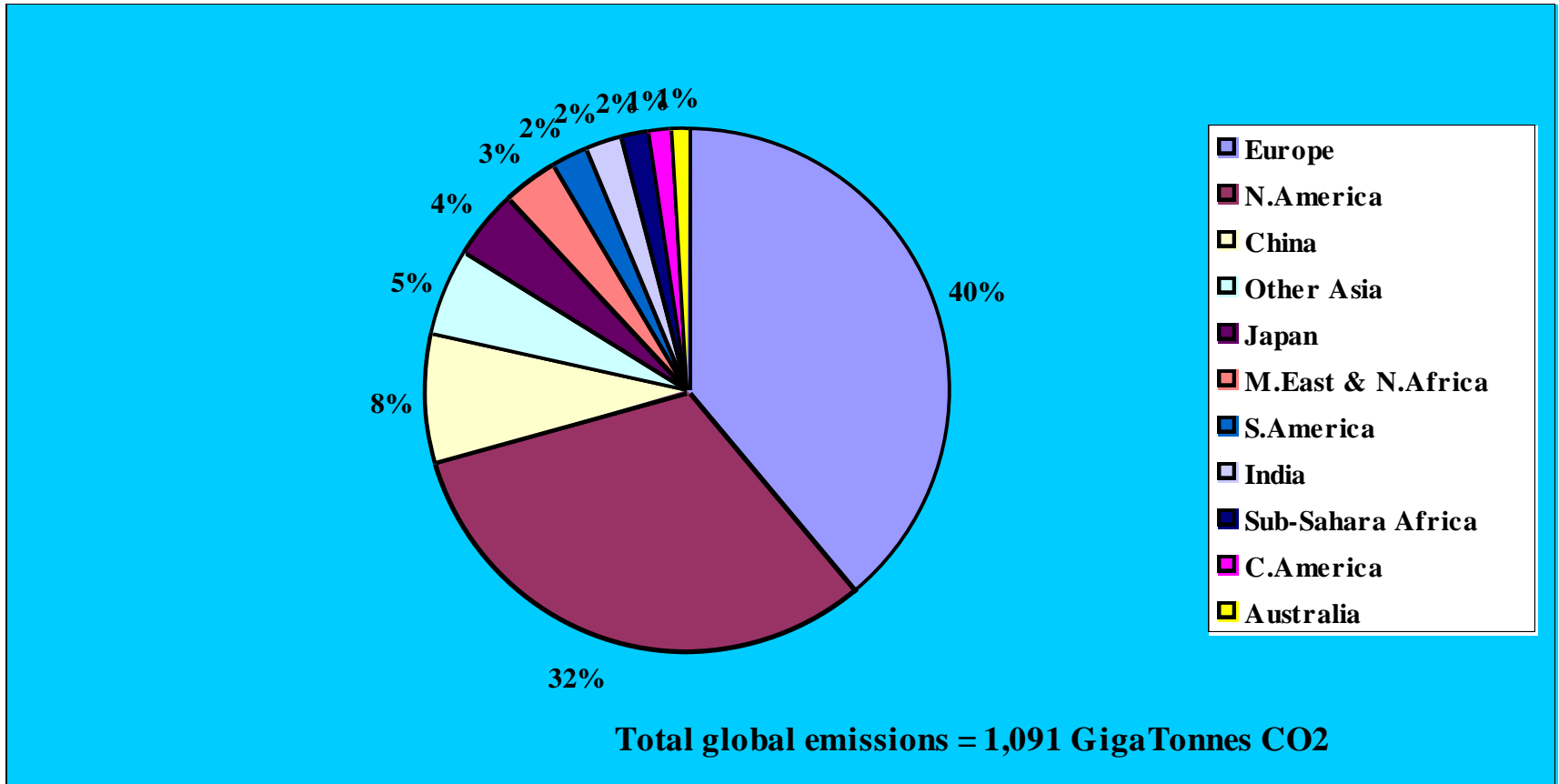
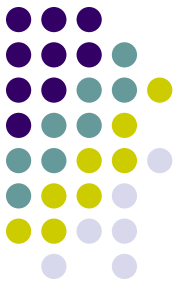


- Current global greenhouse gas concentration is:
 - 380 ppm CO₂
 - 430 ppm CO₂e - including other gases
 - increasing at 3ppm per annum
- Dangerous climate change was thought to occur above:
 - 450 ppm CO₂e (2°C above pre-industrial times)
- Latest science suggests this may be far too high:
 - non-linear effects are already occurring
 - 350ppm CO₂ may have to be the target
 - if so, we are well into the danger zone already

Who Caused the Problem ?

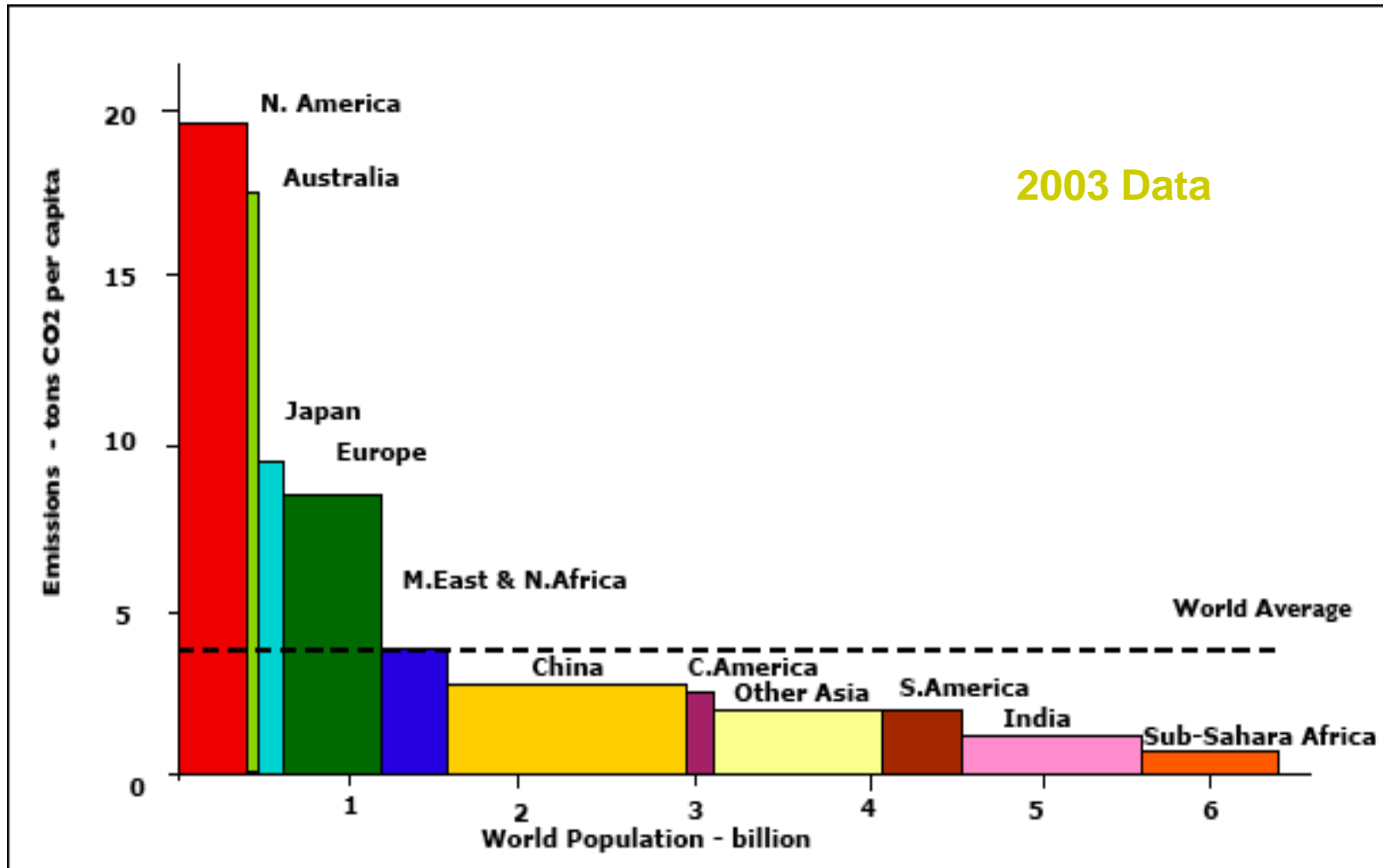
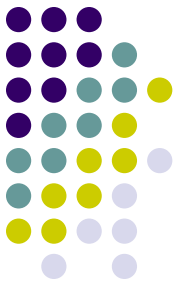
Cumulative Global CO2 Emissions 1850 - 2003

- 80% from the developed world



Who should fix it ?

Current emissions - tons CO2 per capita



Climate Change Solutions

- Global



- **Stabilise** global atmospheric carbon concentrations below 350 ppm CO₂ by:
- **Contracting** annual global carbon emissions from 8 Gtc today to 2.0 Gtc in 2050 - 75% reduction
- Allocate the contraction task between nations by **converging** from today's unequal per capita emissions to **equal per capita emissions** by, say, 2040
- Accelerate the second stage of the **Kyoto Protocol** to provide:
 - the international framework for **Contraction & Convergence**
 - international emissions trading

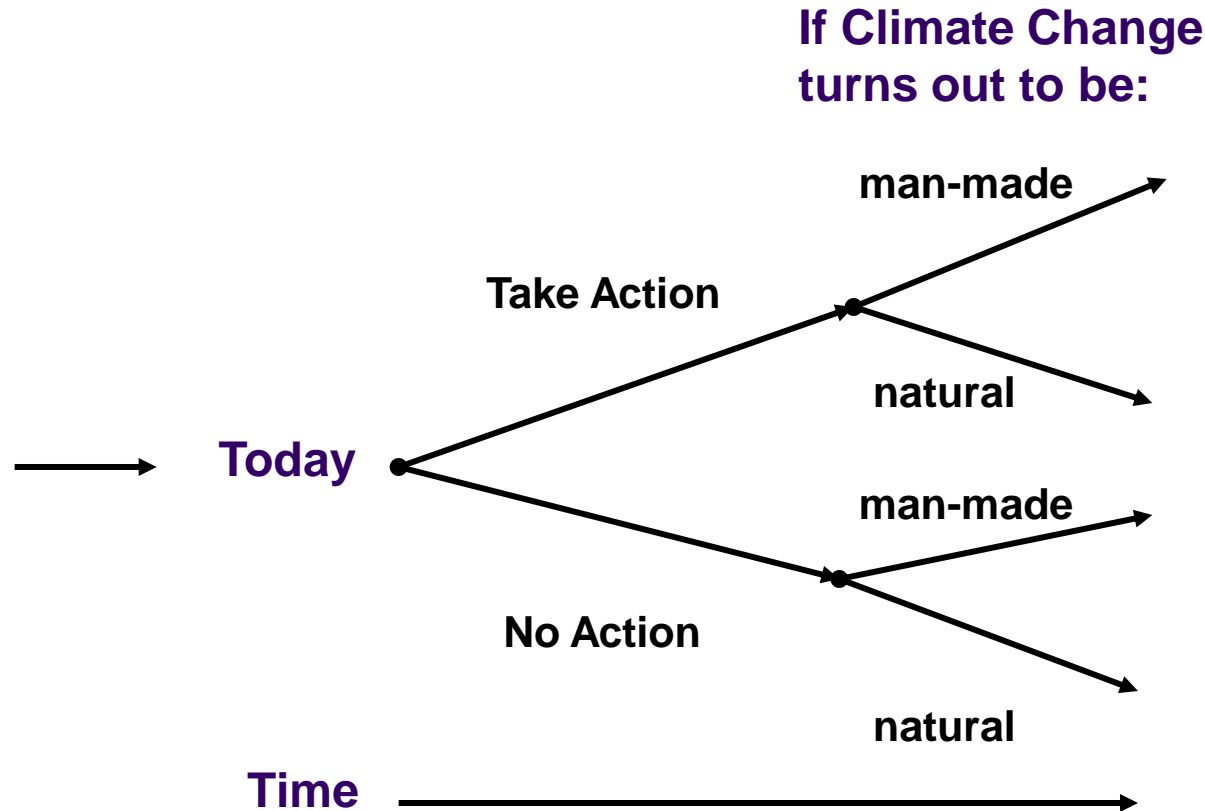
Climate Change Solutions

- Australia



- Reduce emissions by at least:
 - 55% by 2025
 - 95-100% by 2050
- Emissions Trading is best method
 - it will only work with strong binding targets
 - extend ETS with personal carbon trading
- Other measures
 - energy efficiency & conservation
 - directional incentives for renewables etc - 30% MRET.
 - no expansion of fossil-fuel exports and domestic carbon-intensive projects without carbon sequestration
 - include air travel and international sea freight in emissions trading
- High carbon price from ETS is necessary
 - it will radically change energy economics

Why Take Action Now ?



Implications & Cost:

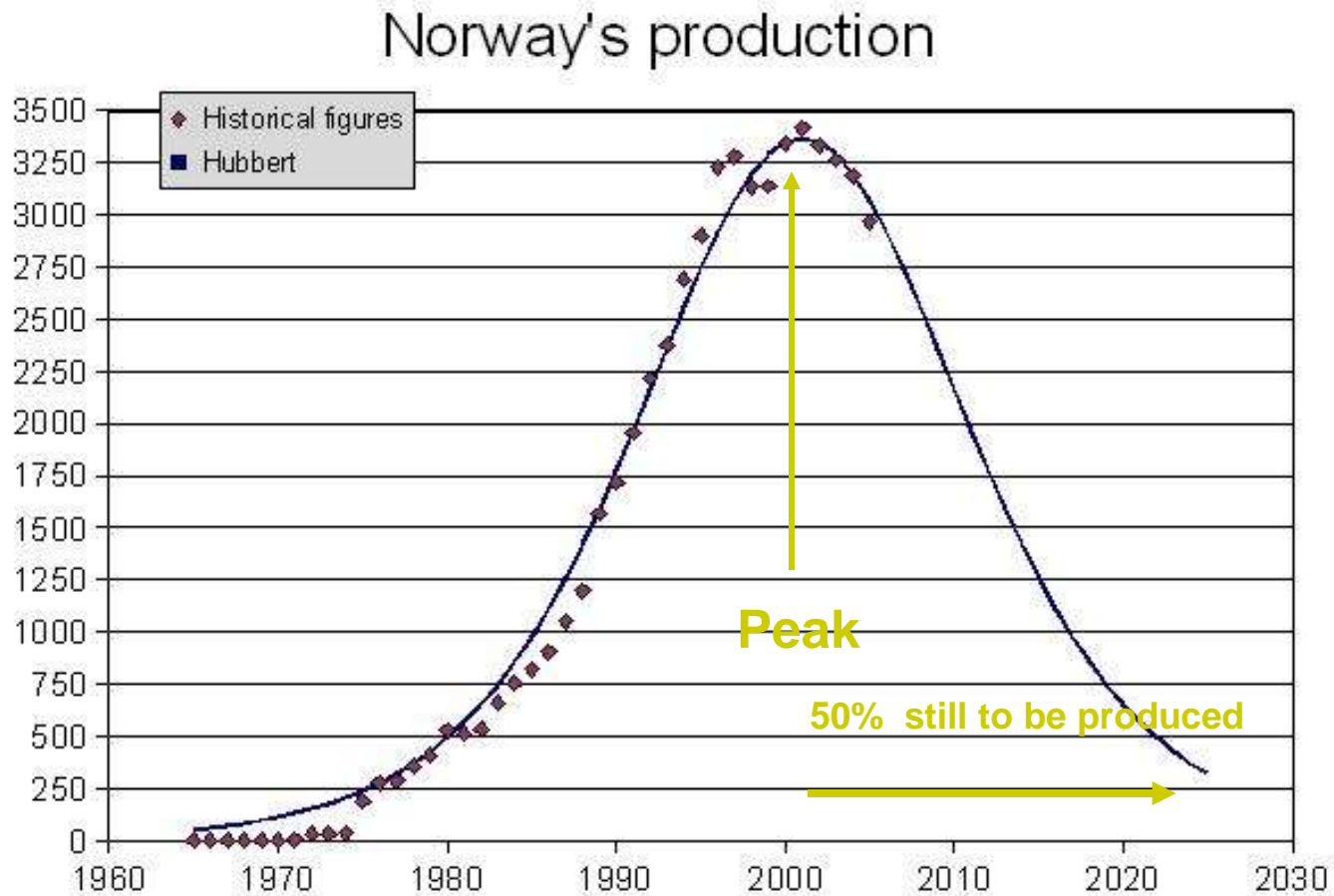
- 2.5% of GDP
- dangers minimised by mitigation
- adaptation will be needed
- more resilient society

- 5-20% of GDP
- = WW1, WW11 + GD
- a society unprepared
- potential catastrophe

Action now is a no-brainer - we only play this game once !

Peak Oil

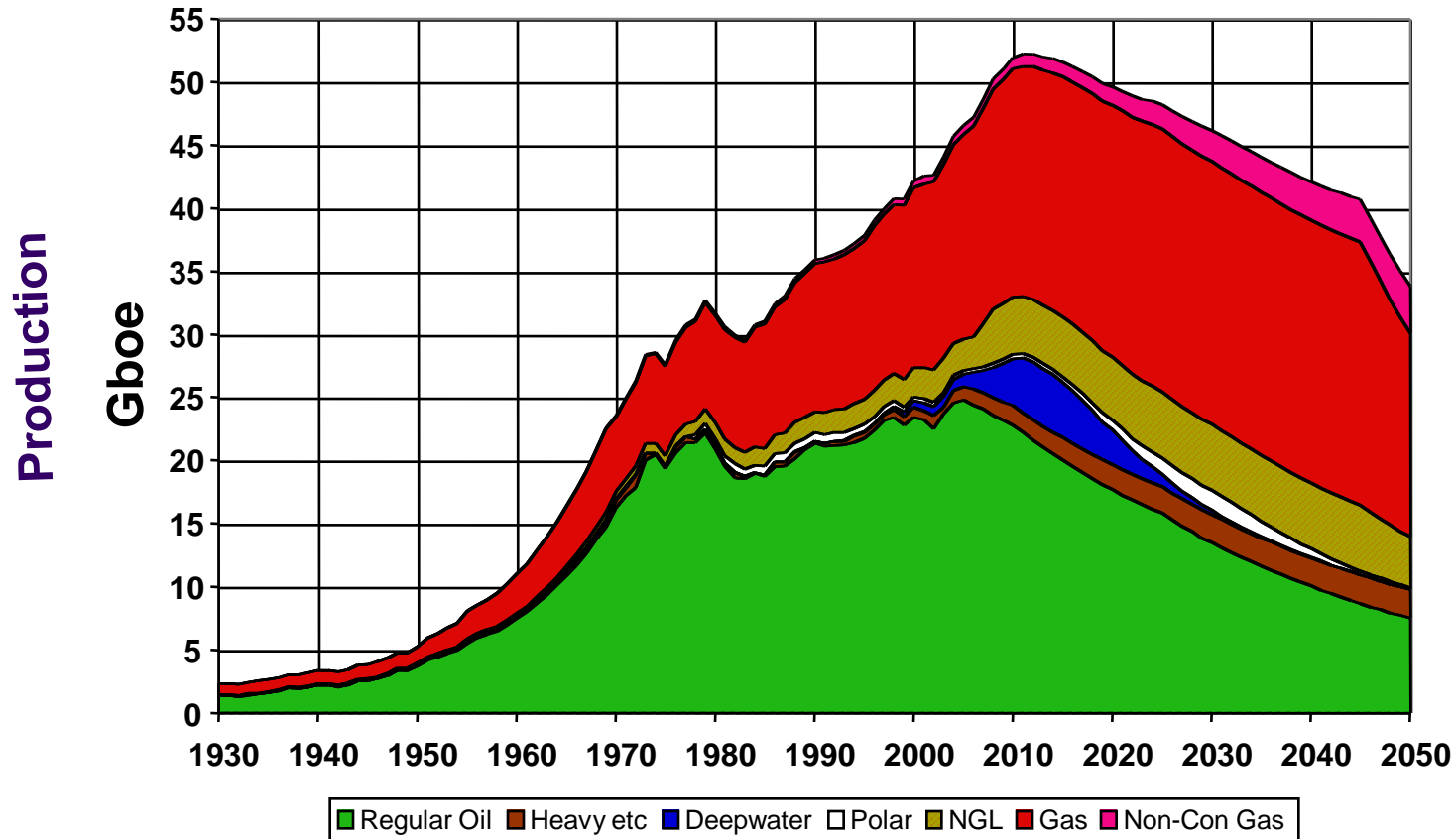
- Typical Oil Production Profile



Global Oil & Gas Depletion - ASPO



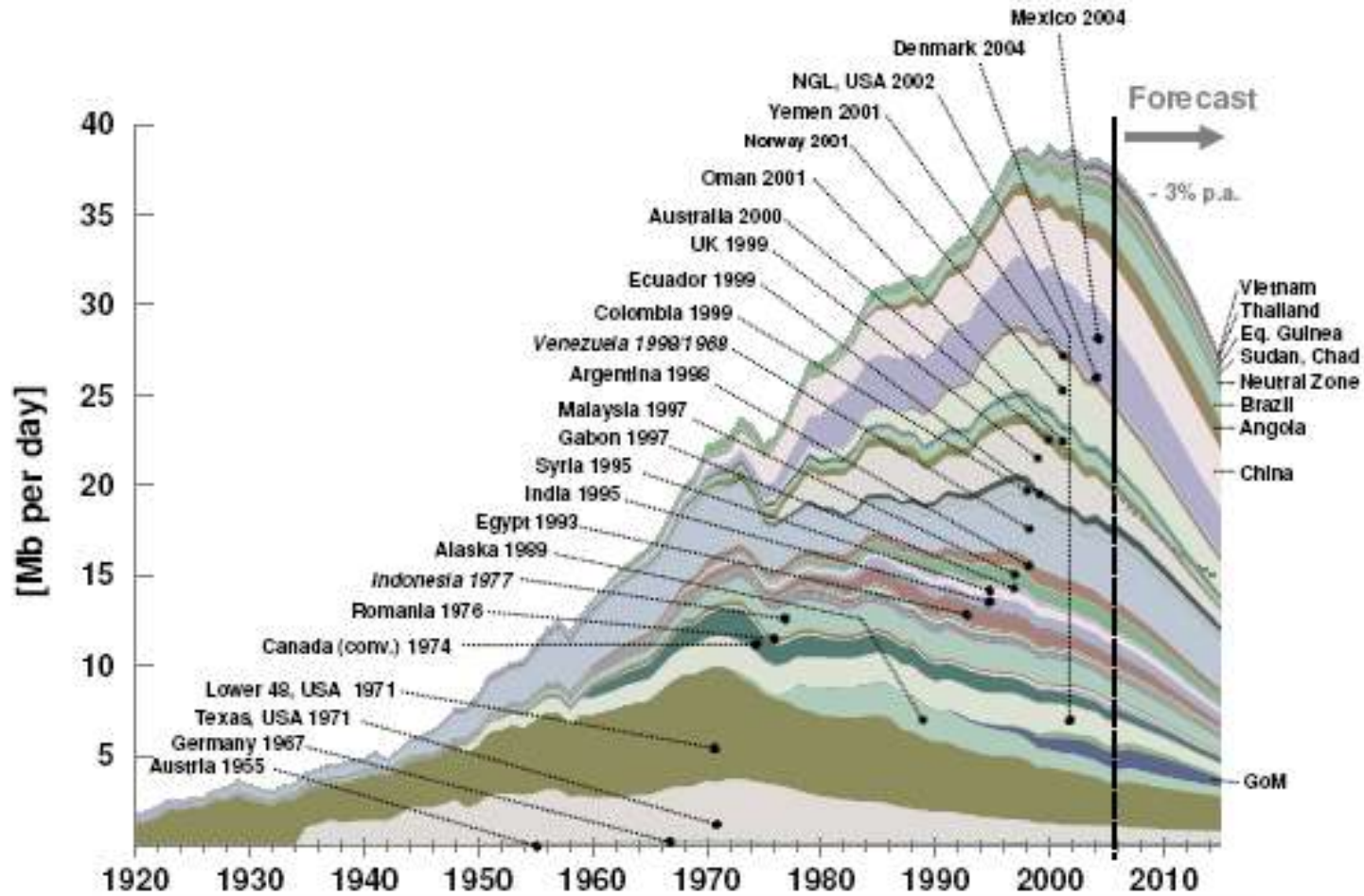
OIL & GAS DEPLETION PROFILES 2006 Base Case



Source: Association for the Study of Peak Oil

Ian Dunlop 2008

More and more countries are past their peak..



Ludwig-Bölkow-Systemtechnik GmbH, 2007
 Source: IHS 2006; PEMEX, petrobras ; NPD, DTI, ENS(Dk), NEB, RRC, US-EIA, January 2007
 Forecast: LBST estimate, 25 January 2007

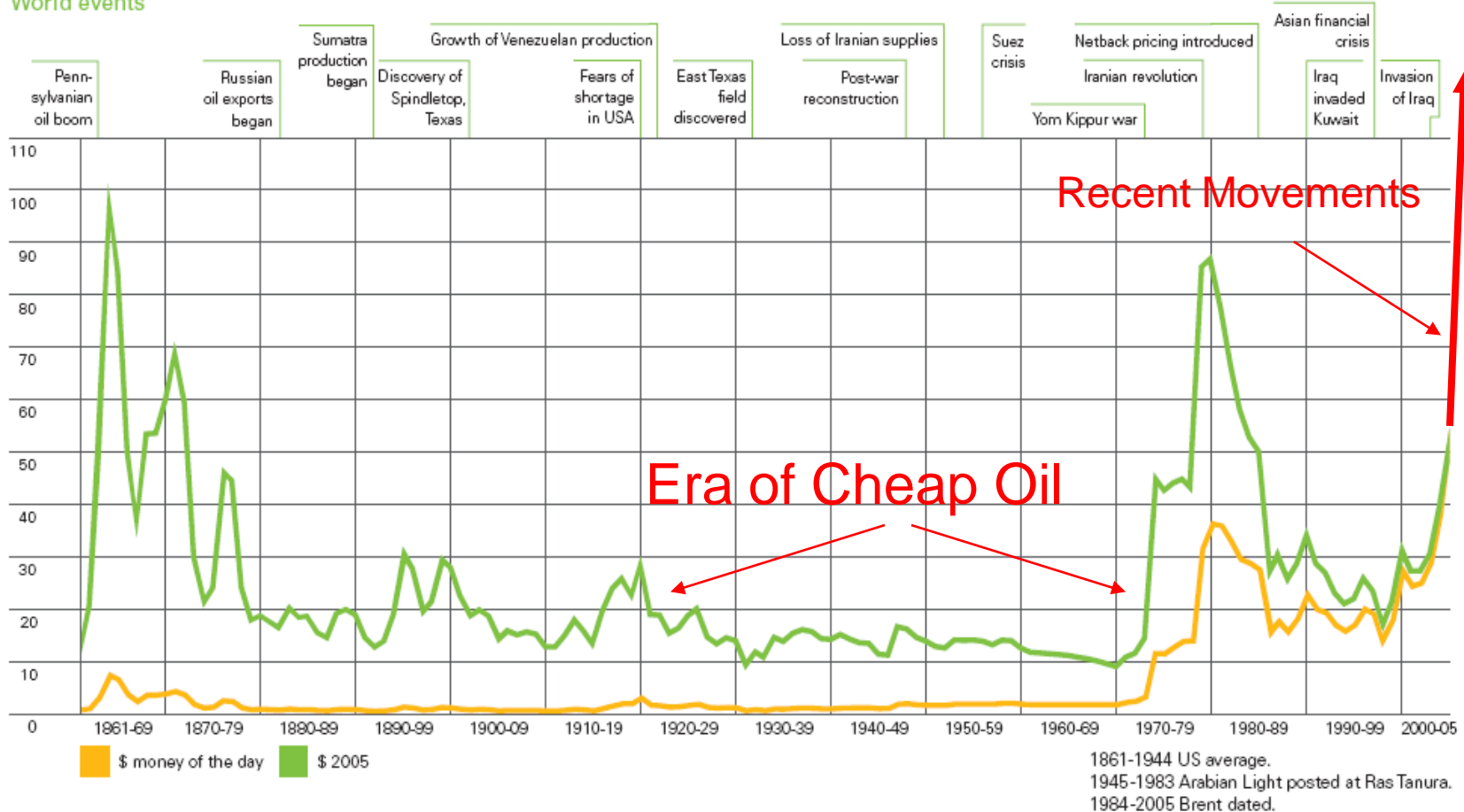
Long term oil prices



Crude oil prices since 1861

US dollars per barrel

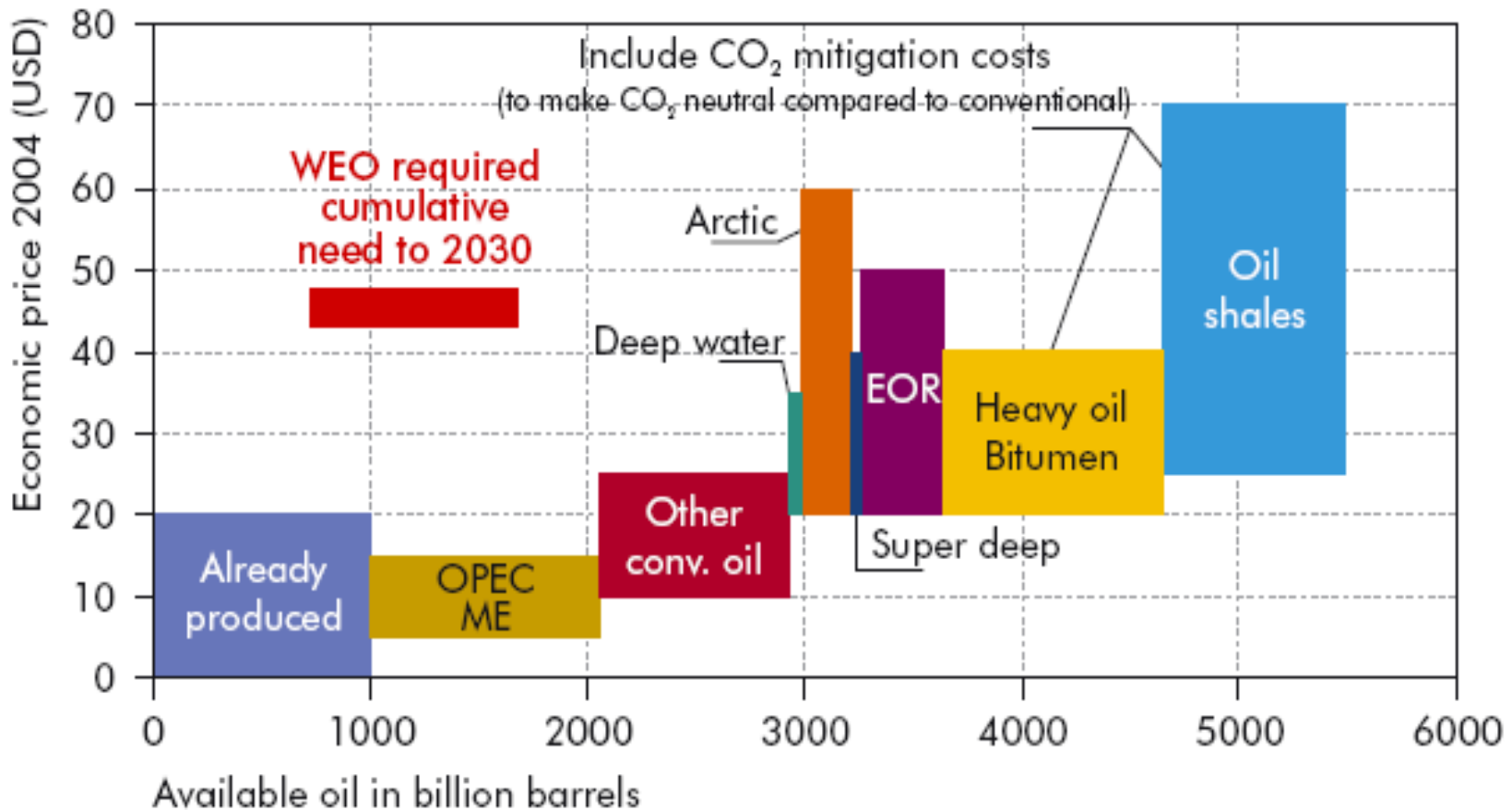
World events



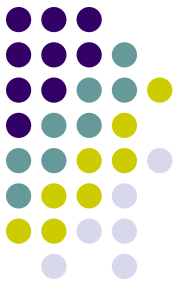
1861-1944 US average.
 1945-1983 Arabian Light posted at Ras Tanura.
 1984-2005 Brent dated.

Oil Availability “Official Future” 2005

Abundant Resources - no worries !

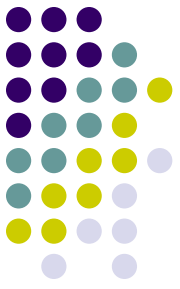


Converting resources to oil flows is proving difficult



- Not discovering new oilfields quickly enough
 - certainly no giant fields
- Data on existing oil reserves is suspect
 - particularly in the Middle East - “ the paper barrels ”
- Many established oil provinces are in decline
 - depletion rates may be more rapid than officially admitted
- Unconventional resources proving difficult to develop
 - technically and economically
- Oil producing nations using more oil domestically
 - exporting less

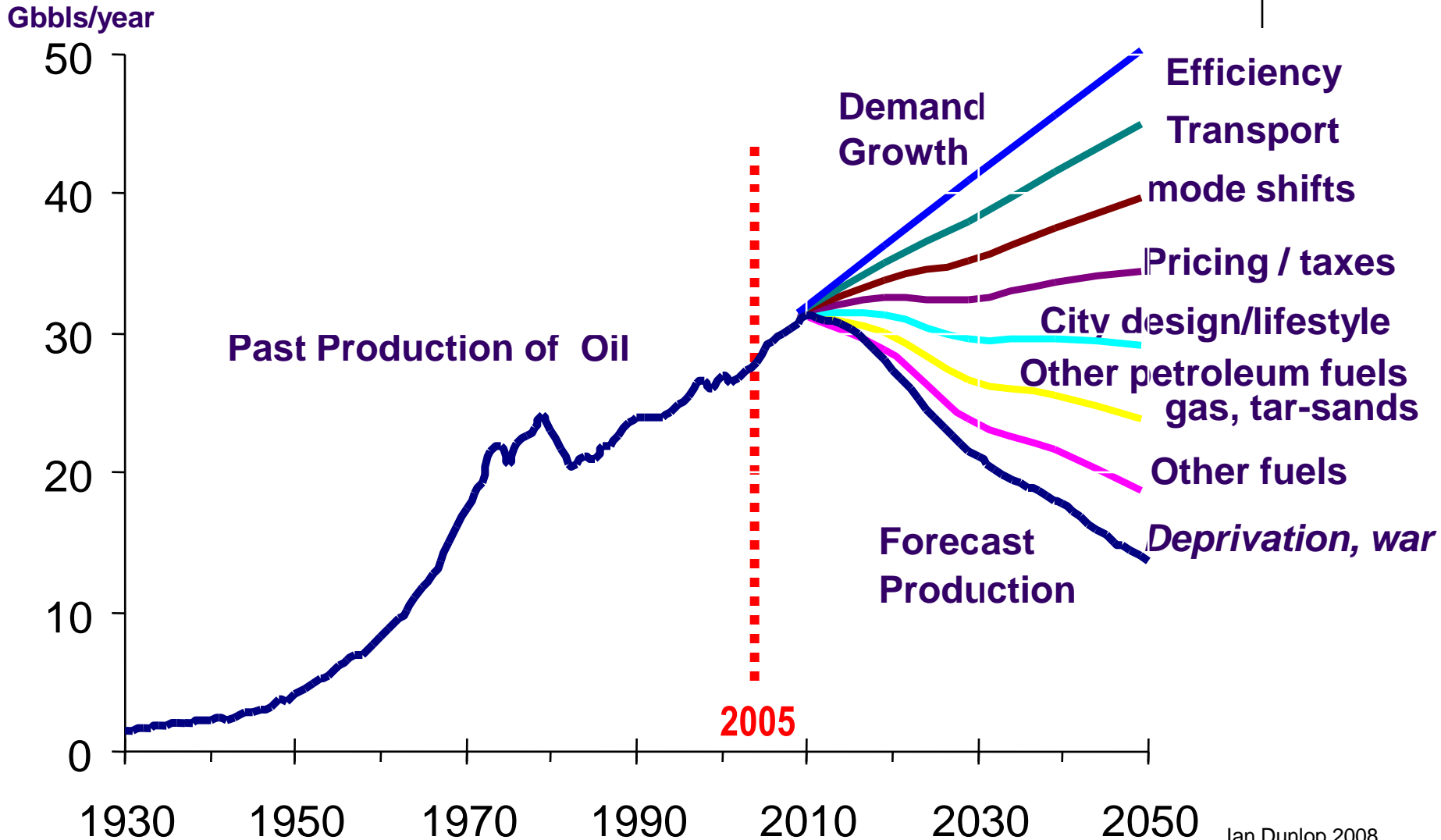
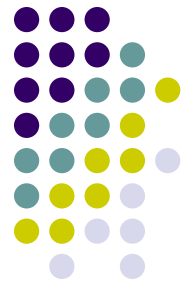
What will the Peak look like ?



- It could be sharp and nasty
 - geopolitical supply disruption / constraint
 - major oilfield depletion acceleration
 - producing countries consume more oil internally
 - climate change impact - Hurricane Katrina
- It could be an “undulating plateau”
 - demand destruction
 - developing world cannot afford high prices
 - climate change emissions constraints
 - extra supply accelerates
 - to balance depletion
- We will probably only see it in the rear-vision mirror
 - we may already be there

Global Oil Solutions

- Filling the gap -

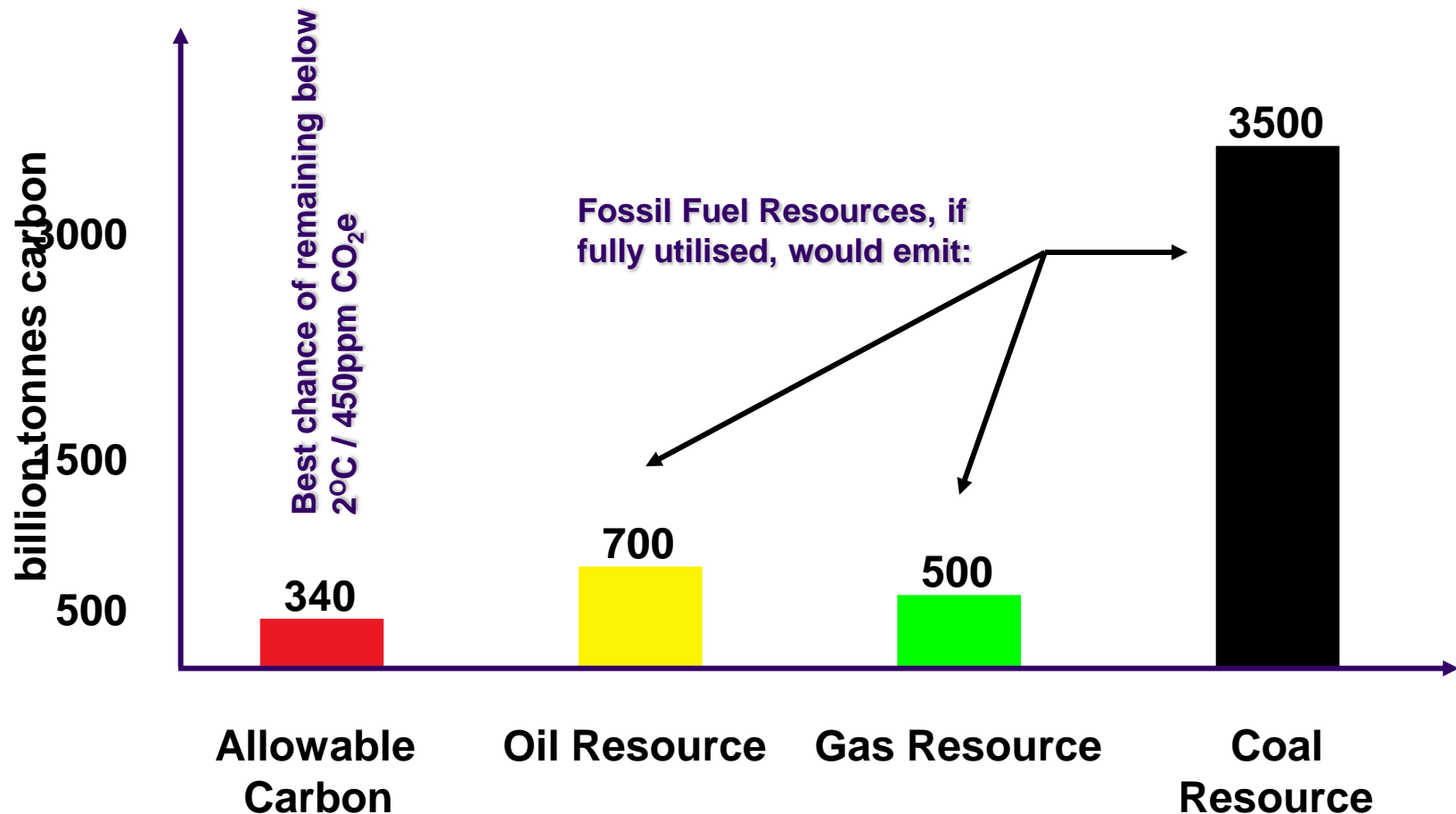


Global Carbon Budget



Maximum Future Emissions to avoid Dangerous Climate Change must be below 340 billion tonnes carbon

How should the budget be allocated ?



Allocation of Carbon Budget

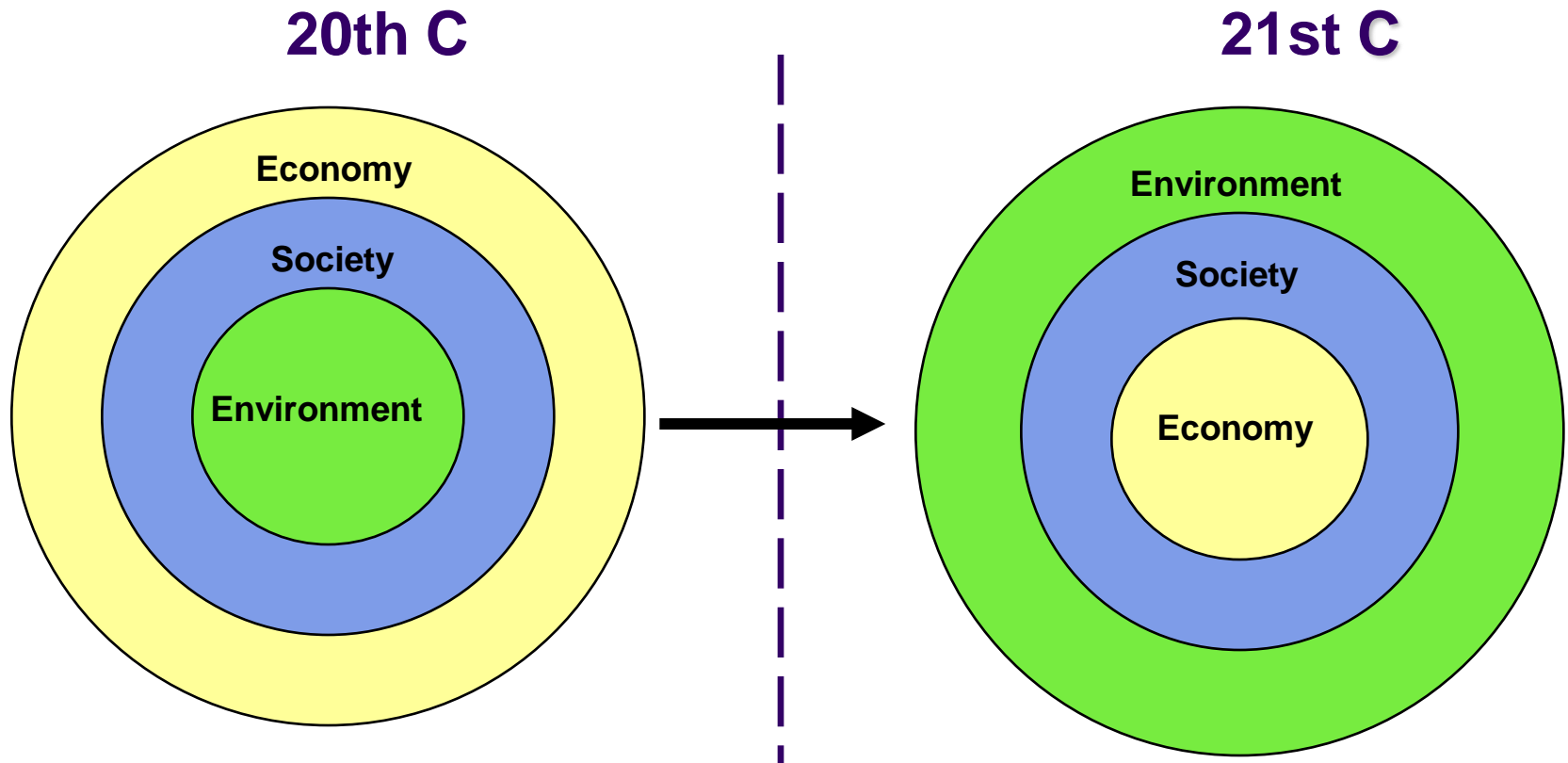


- First
 - oil, due to transport premium
- Second
 - gas, due to lower carbon emissions than oil or coal
 - 0.5 / 0.7 / 1.0 emission ratio in conventional electricity generation
- Third
 - Coal, which must be shut down rapidly
 - unless carbon can be safely sequestered (CCS) within 5-10 years

A Paradigm Shift

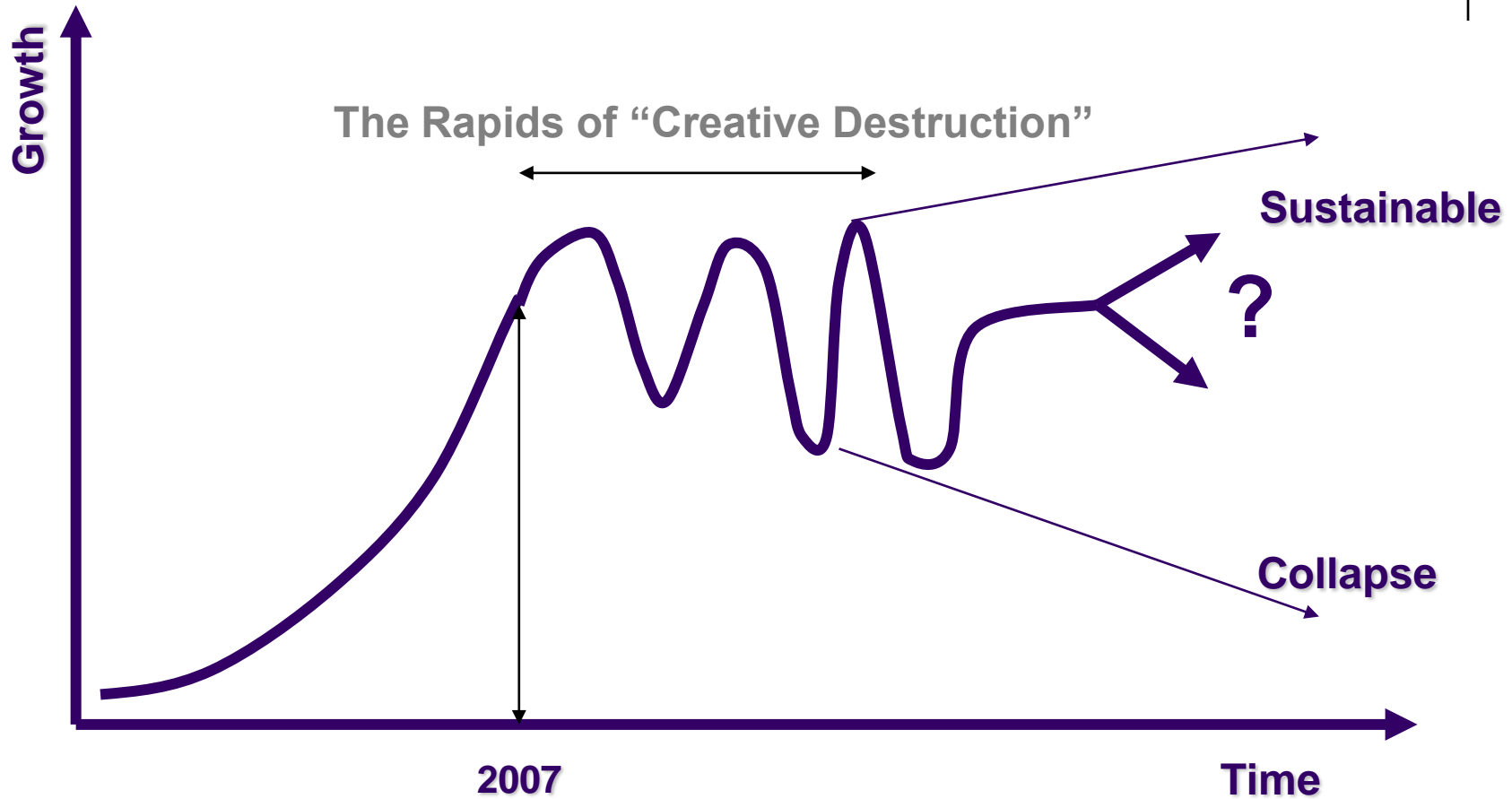


Hitting the Limits to Growth



“The 21C will be the Age of Nature. We will learn, probably the hard way, that nature matters: we are not separate from it, we are dependent on it. When there is trouble in nature there is trouble in society ”
Thomas Homer-Dixon

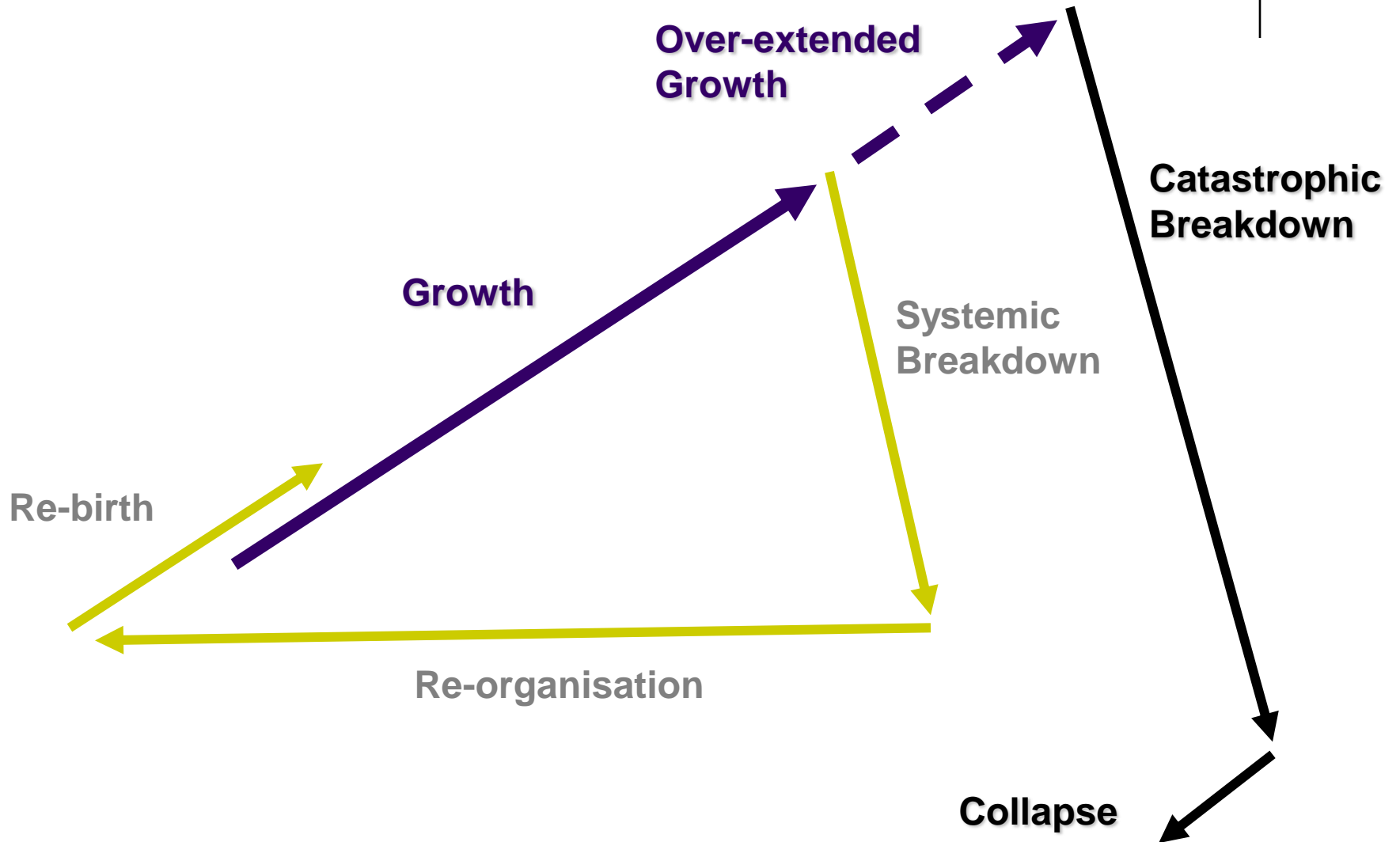
Negotiating the Rapids



"In times of change, learners inherit the Earth, whilst the rest find themselves beautifully equipped to deal with a world which no longer exists"

Eric Hoffman

Resilience Matters



Global Response Scenarios



- Continued Denial
 - “business-as-usual”
 - the market, & technology, will fix any problems that do occur
 - the wealthy win - perhaps !
- Grudging acceptance of a problem
 - but “what we have, we hold ”
 - reinforce national sovereignty
 - defend bi-lateral resource & commercial arrangements
 - if need be, military intervention
- Unreserved acceptance of the problem
 - solutions beyond the capacity of any individual nation state
 - emergence of global government
 - cede sovereignty in the interests of global stability
 - equitable sharing of burden eg:
 - Kyoto Protocol Stage 2 & onwards
 - Oil Depletion Protocol
 - global per capita carbon, and perhaps oil, allocations

Increasing
recognition
of the
“Global
Commons”

We face a Global Sustainability Emergency



“ This is an emergency and for emergency situations we need emergency action”

*Ban Ki-Moon, UN Secretary General
7th November 2007*

FT.com
FINANCIAL TIMES

FT Home > Comment & analysis > Columnsists > Gideon Raskin

US optimism can benefit all

By Gideon Raskin

Published: February 4 2008 17:48 | Last updated: February 4 2008 17:48



Here is a proposal for the next American president. The US should take the lead in setting up a massive, publicly funded research project to tackle climate change. The American government has, in the past, shown that it is capable of sponsoring pioneering science – from the Manhattan project that produced the atomic bomb to the space programme. Why not apply American energy, money and know-how to a new Manhattan project on global warming?

*Financial Times, London
4th February 2008*



“ --put these two things together, if we don't do anything very quickly, and in a bold manner, our energy system's wheels may fall off -- within the next seven years ”

*Fatih Birol, Chief Economist, IEA
Financial Times, London
7th November 2007*

Emergency Action - Global & National



- A Re-construction Programme akin to:
 - Marshall Plan for re-construction of Europe post WW2
 - Apollo Project
 - Manhattan Project
 - Mobilisation of US,UK,German economies on war-footing pre-WW2
 - 21C version of the Snowy Hydro scheme
 - but much bigger !
- Rapid change can occur with the right incentive:
 - we now have that incentive

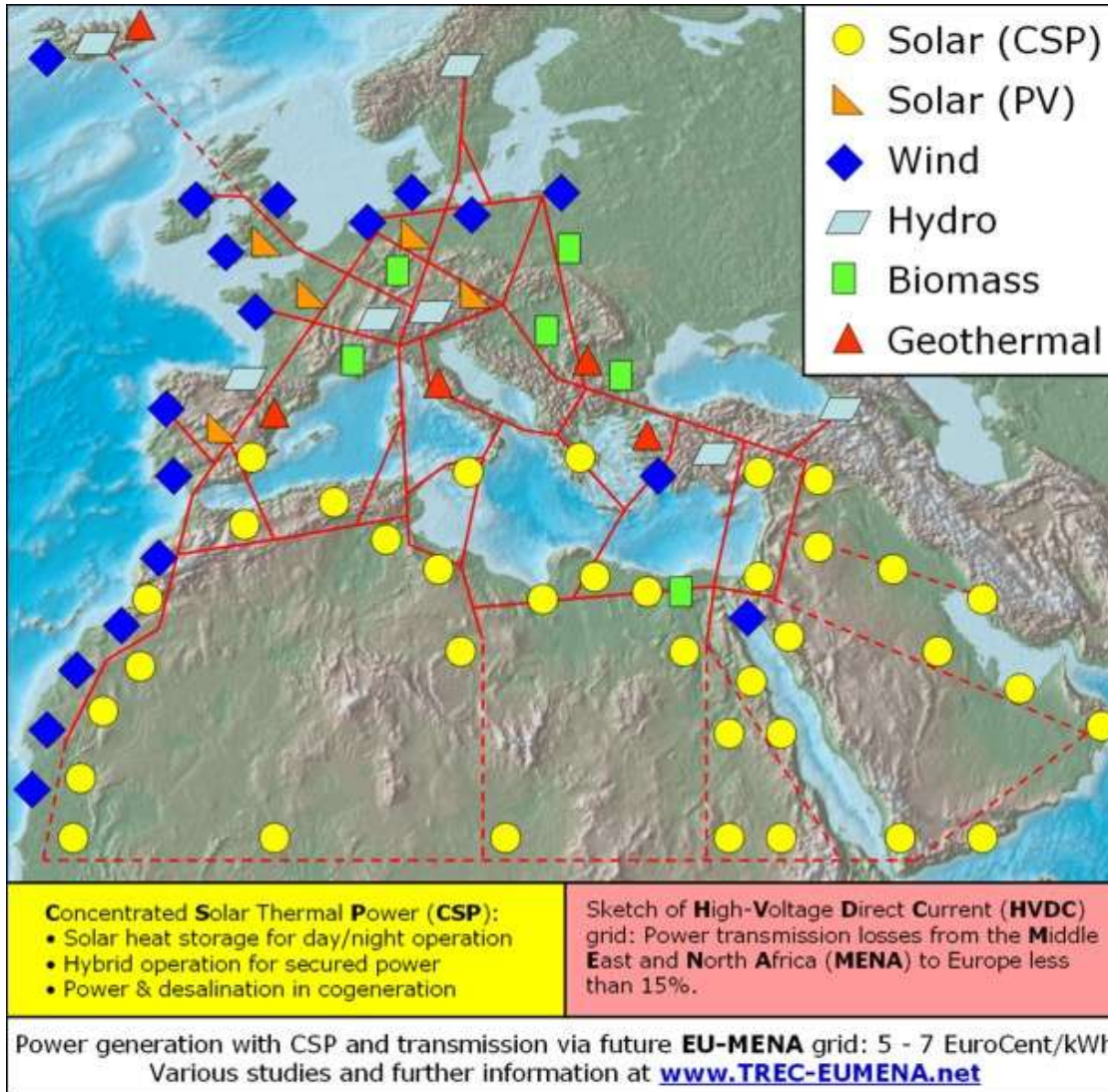
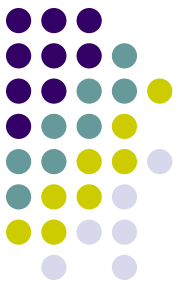
Components



- Rapid phase out of high-emission assets
 - unless carbon can be sequestered
- Major, nation-building, investments in:
 - Energy conservation & efficiency
 - Renewable energy
 - Efficient public transport
 - High-speed broadband
 - Low-emission technologies

Vision & Real Leadership

- not defence of the “status quo”



The Trans Mediterranean Renewable Energy Grid

- why not in Australia ?

Source: TREC-Australia

Thinking Outside the Box

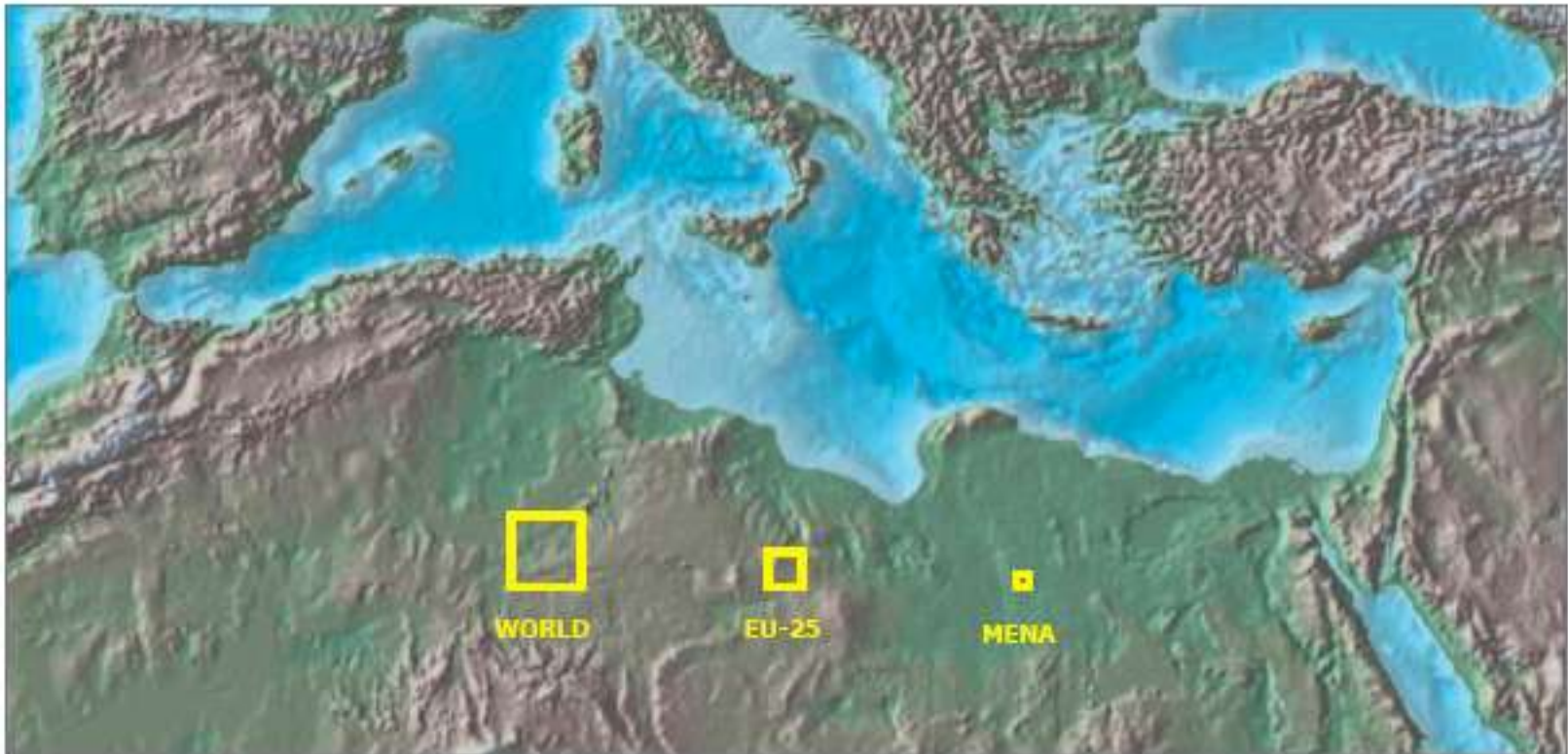


Figure 2: Areas of the size as indicated by the red squares would be sufficient for Solar Thermal Power Plants to generate as much electricity as is currently consumed by the World (17,000 TWh/y), by Europe (EU-25, 3,200 TWh/y) and by MENA (600 TWh/y) respectively.

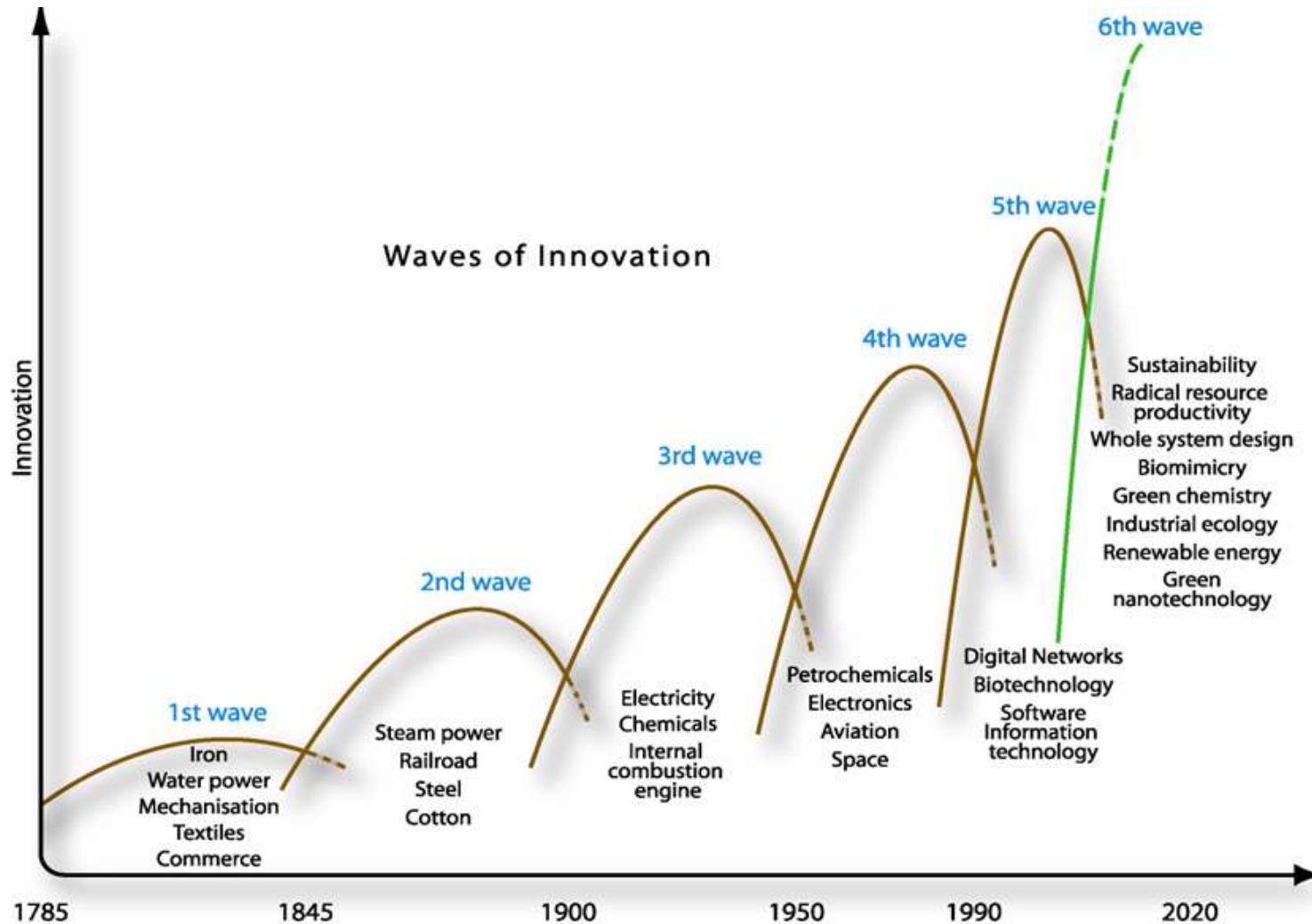
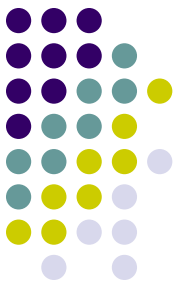


Our Great Opportunity

- stop the fatalism !

- Mobilisation to establish sustainable, resilient societies
 - conventional economic growth is untenable
- Re-defining success
 - based on long-term sustainability, not maximising consumption
- Re-designing markets
 - based on enhancing the “Commons”, not short-term profit maximisation
- New forms of community involvement & democratic structure
 - essential, given the extent of change required
- Developed / developing world cooperation
 - new paradigm built on climate / energy solutions
- Technology is critical
 - combined with changing values
- Business & governance models re-structured
 - incentives re-focused

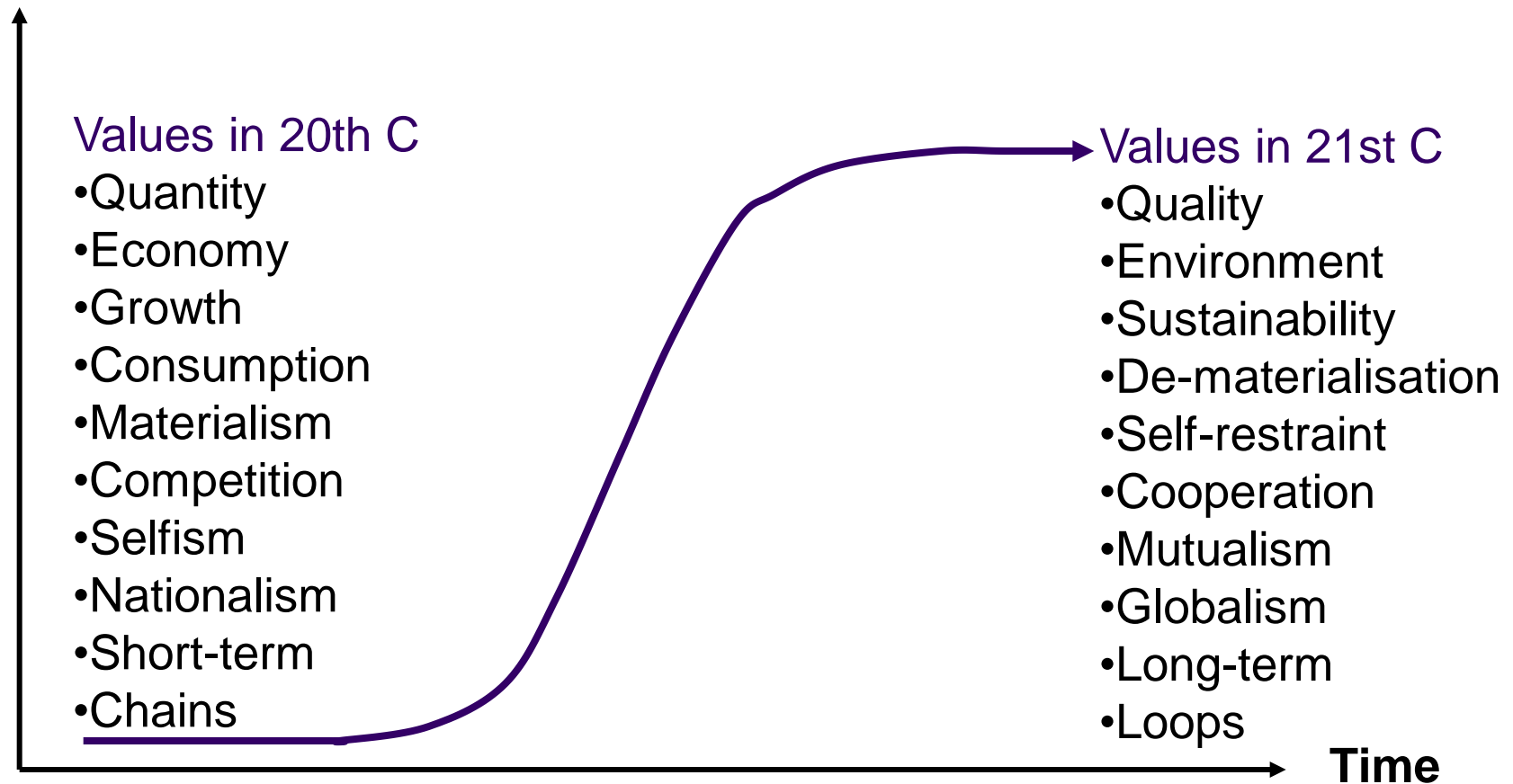
Technology is Critical



21st Century Value Shift



Population





Can It Be Done ?

- Yes - indeed it must !
- But not by incremental tweaking of “business-as-usual” !
- A new paradigm is needed:
 - honest articulation and acceptance of the sustainability emergency
 - primarily risk management, not economics
 - genuine leadership in addressing the “unthinkable”:
 - environment takes precedence over the economy
 - transition from conventional growth to steady-state sustainable economy
 - corresponding re-design of business models and governance
 - long-term takes precedence over the short-term
 - pro-active focus on opportunities, not reactive defence of the “status quo”
- Change of this magnitude requires:
 - maximum cooperation between community, government & business
 - dispensing with “politics-as-usual”



“ It all looks beautifully obvious - in the rear vision mirror. But there are situations where one needs great imaginative power, combined with disrespect for the traditional current of thought, to discover the obvious ”

Arthur Koestler
The Sleepwalkers
A History of Man's Changing Vision of the Universe

Thank you

www.aspo-australia.org.au

itdunlop@ozemail.com.au