Green Innovations

Presentation at ESBRI seminar

081014

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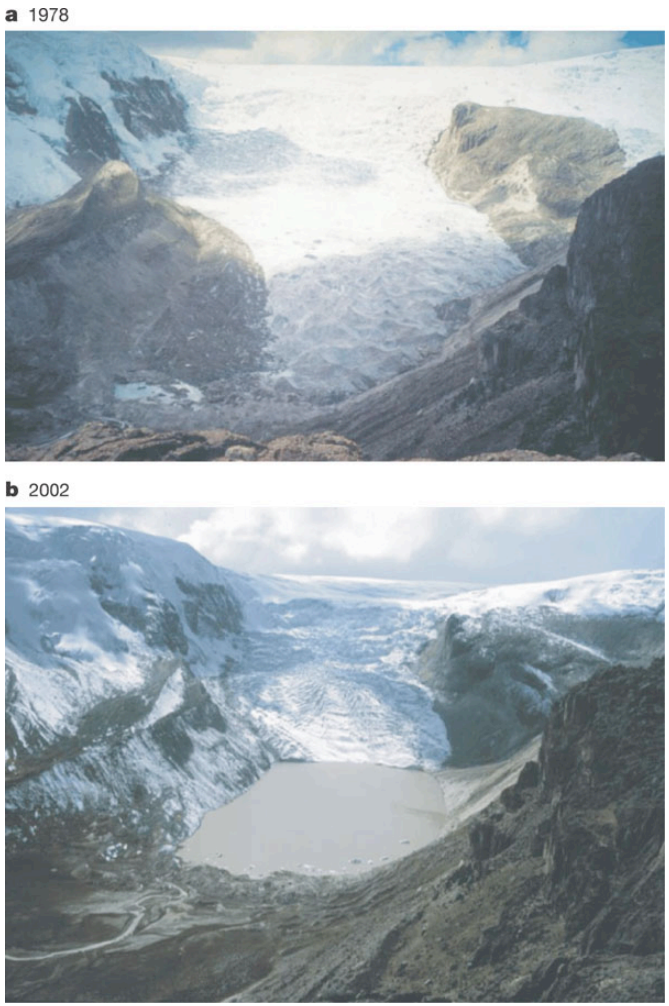
Structure of the presentation

- A The challenge
- B Industrial and technical implications
- C Perspective on innovations
- D Green innovations
- E Short conclusion

A The Challenge: Climate Change

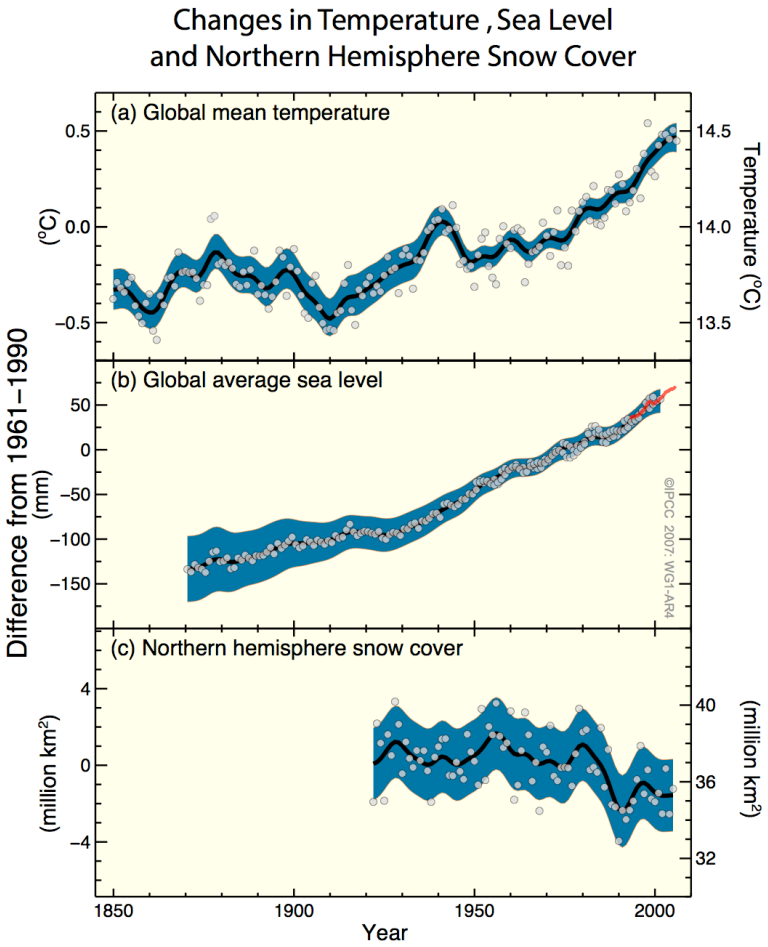
- Let us be clear - this is not a seminar on global warming
- I am professor in industrial dynamics - not in meteorology or geophysics
- CC is probably the most important condition/ challenge for economic/ industrial activity for the decades ahead
- Part of the solution is in cleantech/green innovations



Climate Change, contd –

sources & structure for/of this section

- Sources:
  - Stern, Nicholas, 2006, The Economics of Climate Change, Cambridge
  - IPCC, AR4 Reports 2007
  - SMHI
  - Global Carbon Project
- Structure
  - symptoms
  - mechanisms

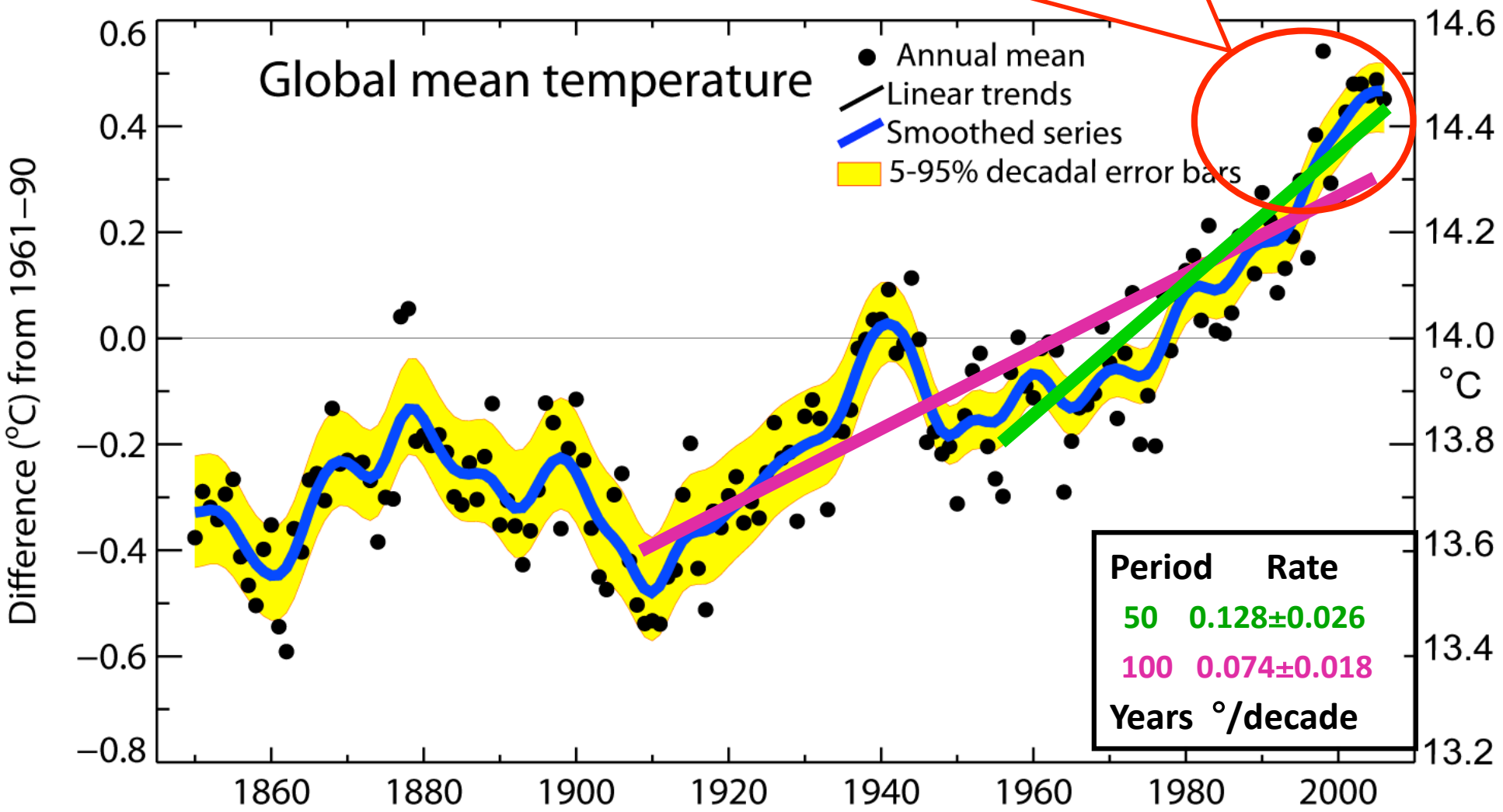


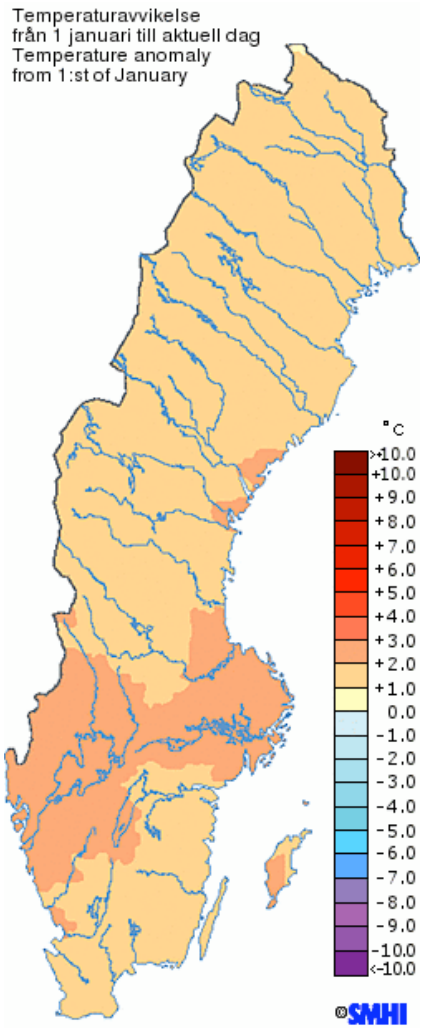
1 Some of the symptoms

- Temperature increases
- Sea cover decreases
- Glaciers and frozen ground are receding
- Drought increases
- Sea level increases
- …….
- …….

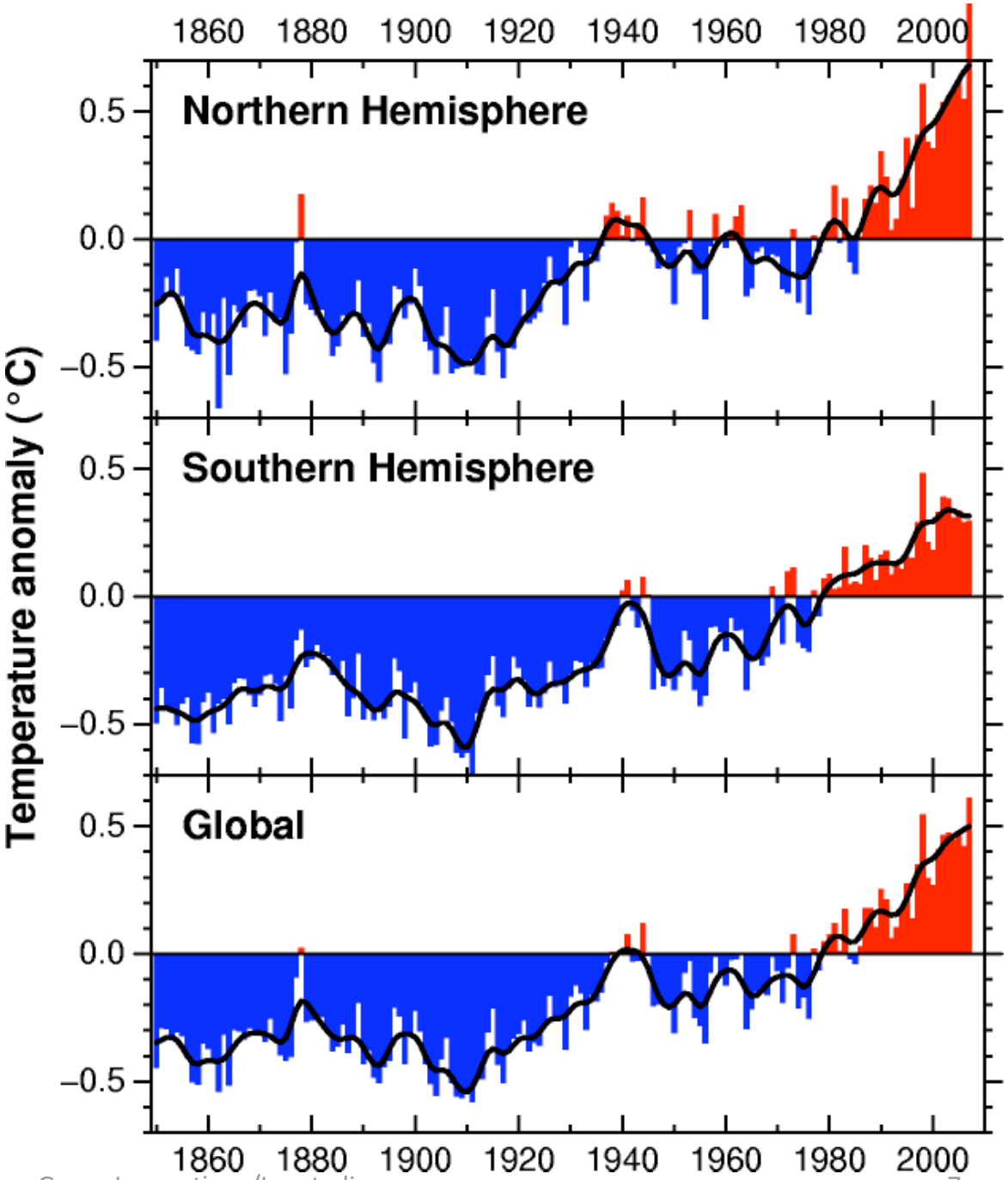
Global mean temperatures are

Warmest 12 years:
1998,2005,2003,2002,2004,2006,
2001,1997,1995,1999,1990,2000



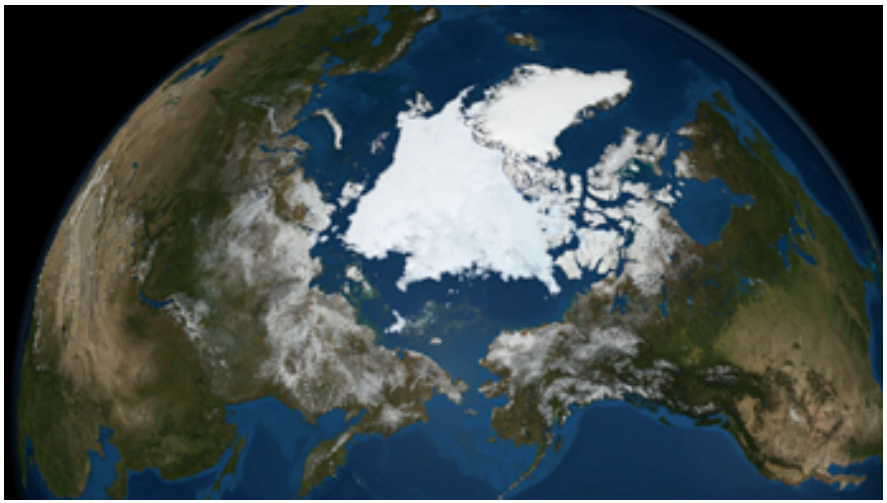


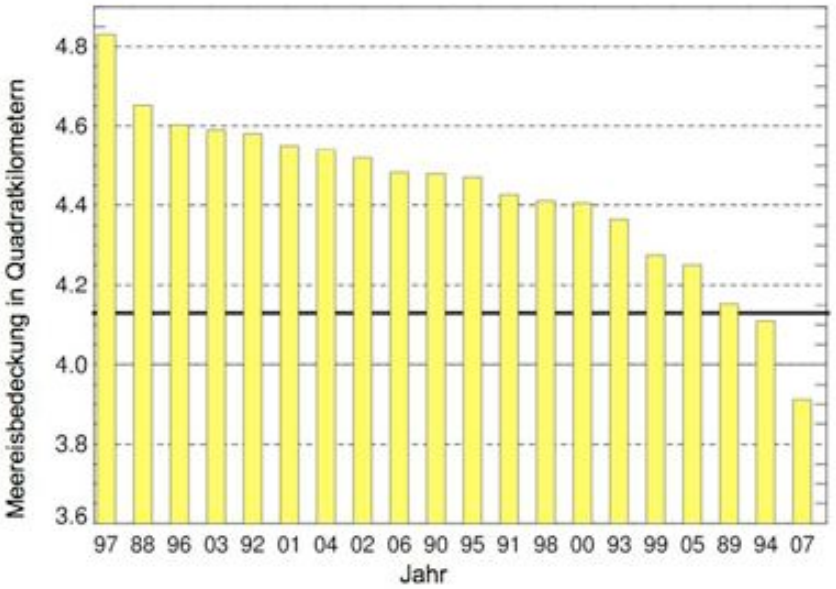
Temperature anomaly
1/1 – 10/10 2008

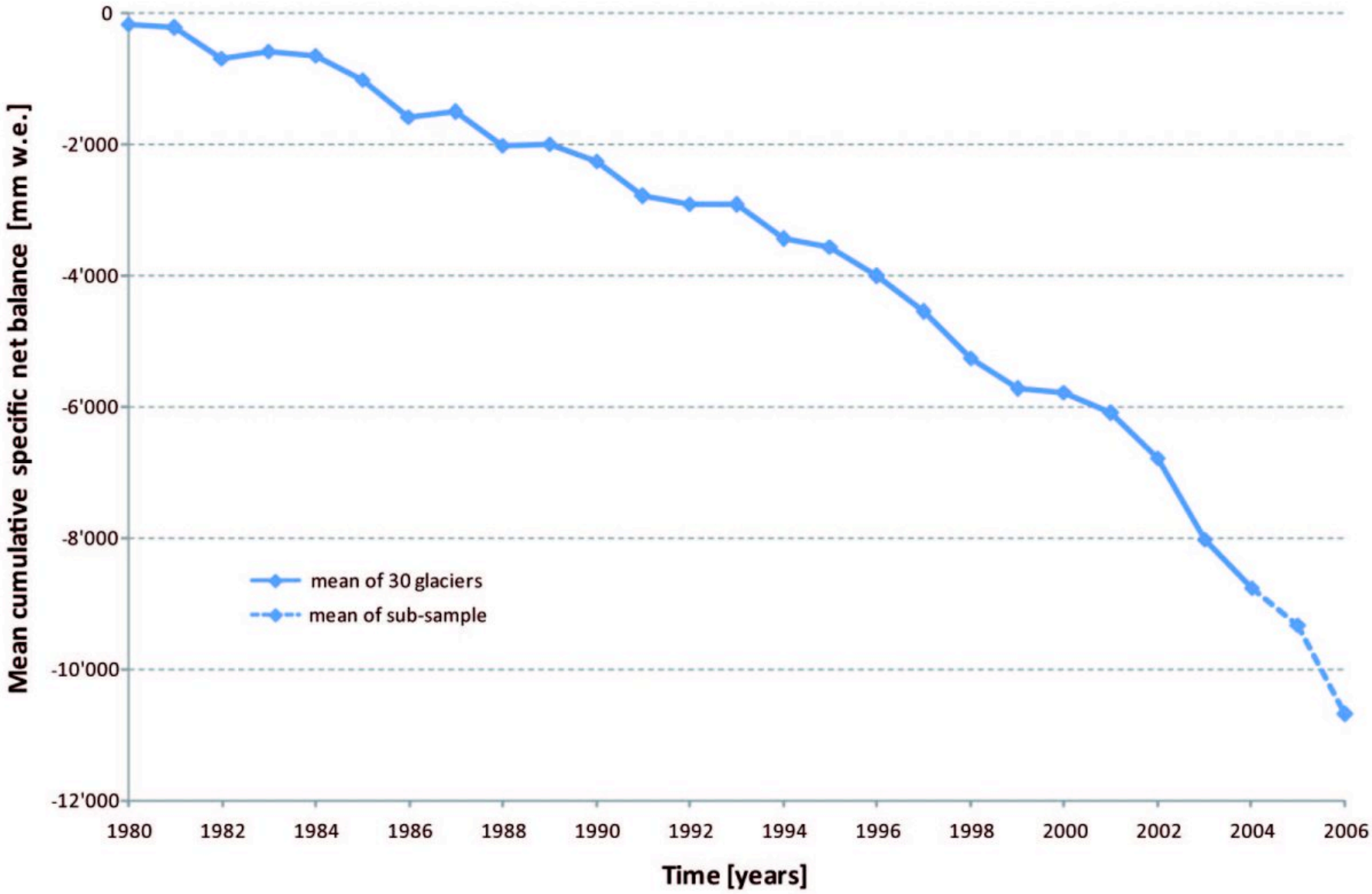


Arctic sea cover

- 2008 – next lowest registered






Mean cumulative specific net balance [mm w.e.]
0
-2'000
-4'000
-6'000
-8'000
-10'000
-12'000
mean of 30 glaciers
mean of sub-sample
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Time [years]

2 The mechanisms

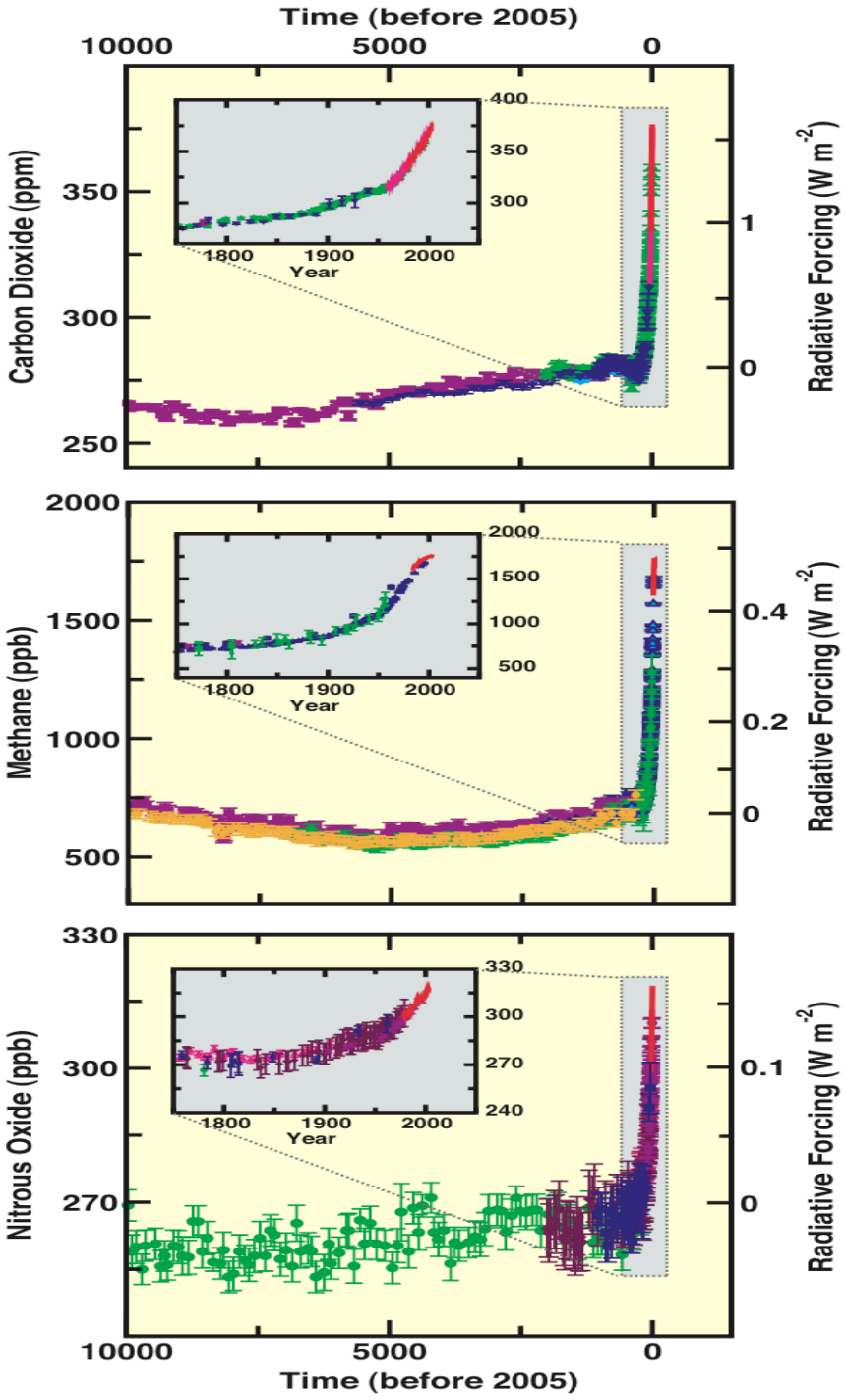
- Annual fossil CO_2 emissions increased from an average of 6.4 GtCper year in the 1990s, to 7.2 GtC per year in 2000-2005

Human and Natural Drivers of Climate Change

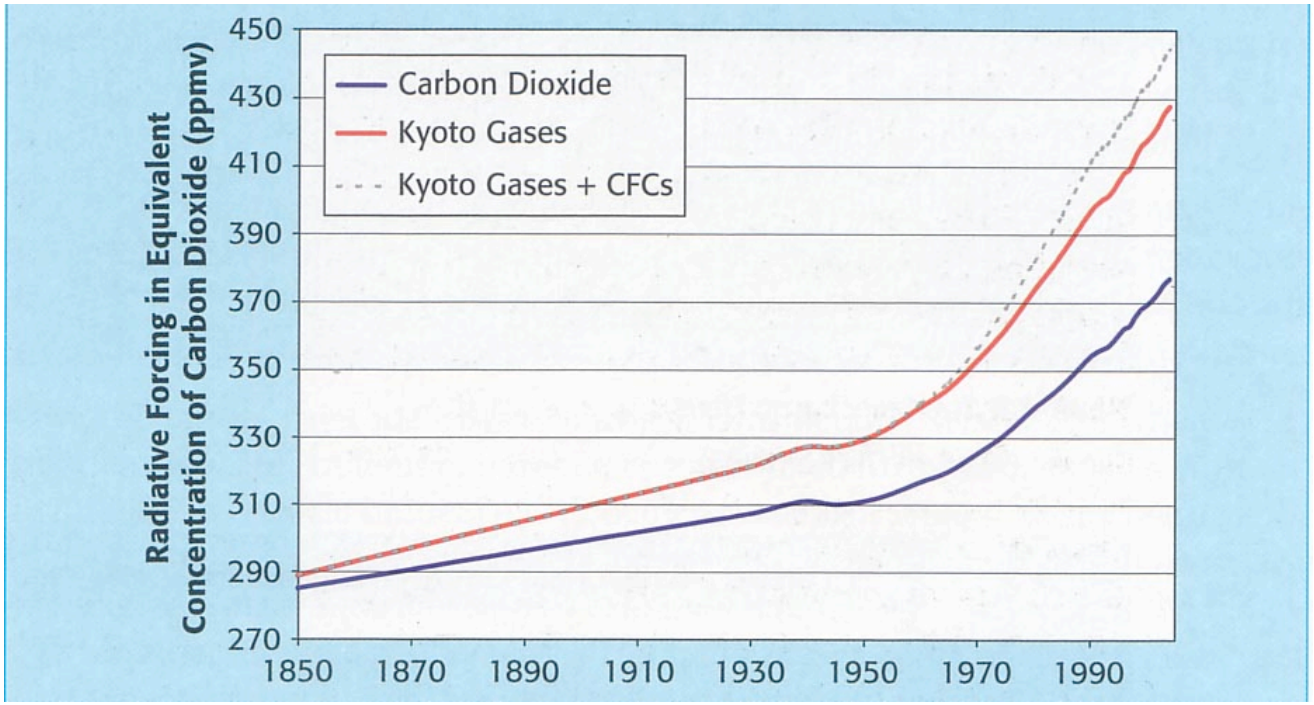
CO_2, CH_4 and N_2O Concentrations

- far exceed pre-industrial values
- increased markedly since 1750 due to human activities

Relatively little variation before the industrial era



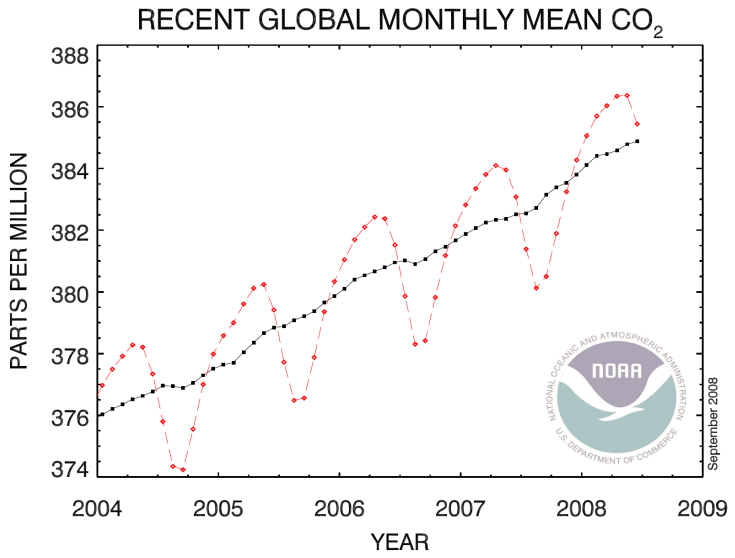
A shorter time perspective



Year 2007
Atmospheric CO_2
concentration:

383 ppm

37% above pre-industrial



1970 – 1979: 1.3 ppm y^{-1}
1980 – 1989: 1.6 ppm y^{1}
1990 – 1999: 1.5 ppm y^{-1}

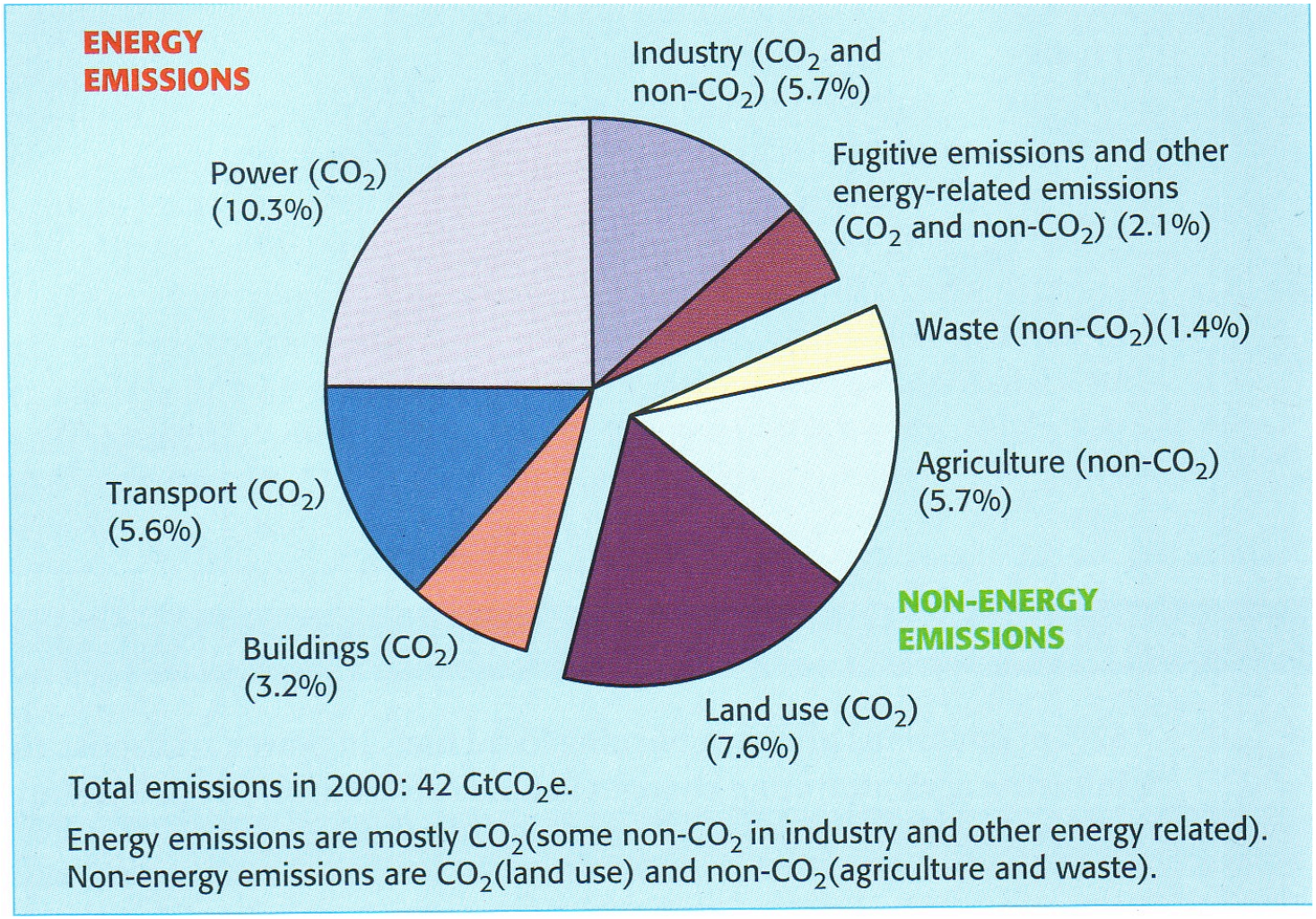
2000 - 2007: 2.0 ppm y^{-1}
2007: 2.2 ppm y^{-1}

Data Source: Pieter Tans and Thomas Conway, NOAA/ESRL

B Industrial and technical implications

- Climate challenge: reduce CO2 emissions with at least 80 %. We can argue on the time horizon (2030, 2050, 2070, 2100). Longer time perspective => higher equilibrium temperature.
- Increase/restore economic activity after the crisis
- In short: doing it in another way =>
- => GREEN INNOVATIONS

Interpretations I
– the domains for change



Interpretation II

- Half of half – and half of that
  - i.e.reduction to approx 10 - 20% of present emissions
- A systems perspective
  - Reduce systems *activity* – first half
  - Increase systems *efficiency* – second half
  - Additional innovative behaviour – third half
- An illustration
  - Reduce car use 10000 km => 4000 km (=> on other systems!!)
  - Reduce fuel consumption 0.8 => 0.4 l/10 km
  - But that is not enough!!!

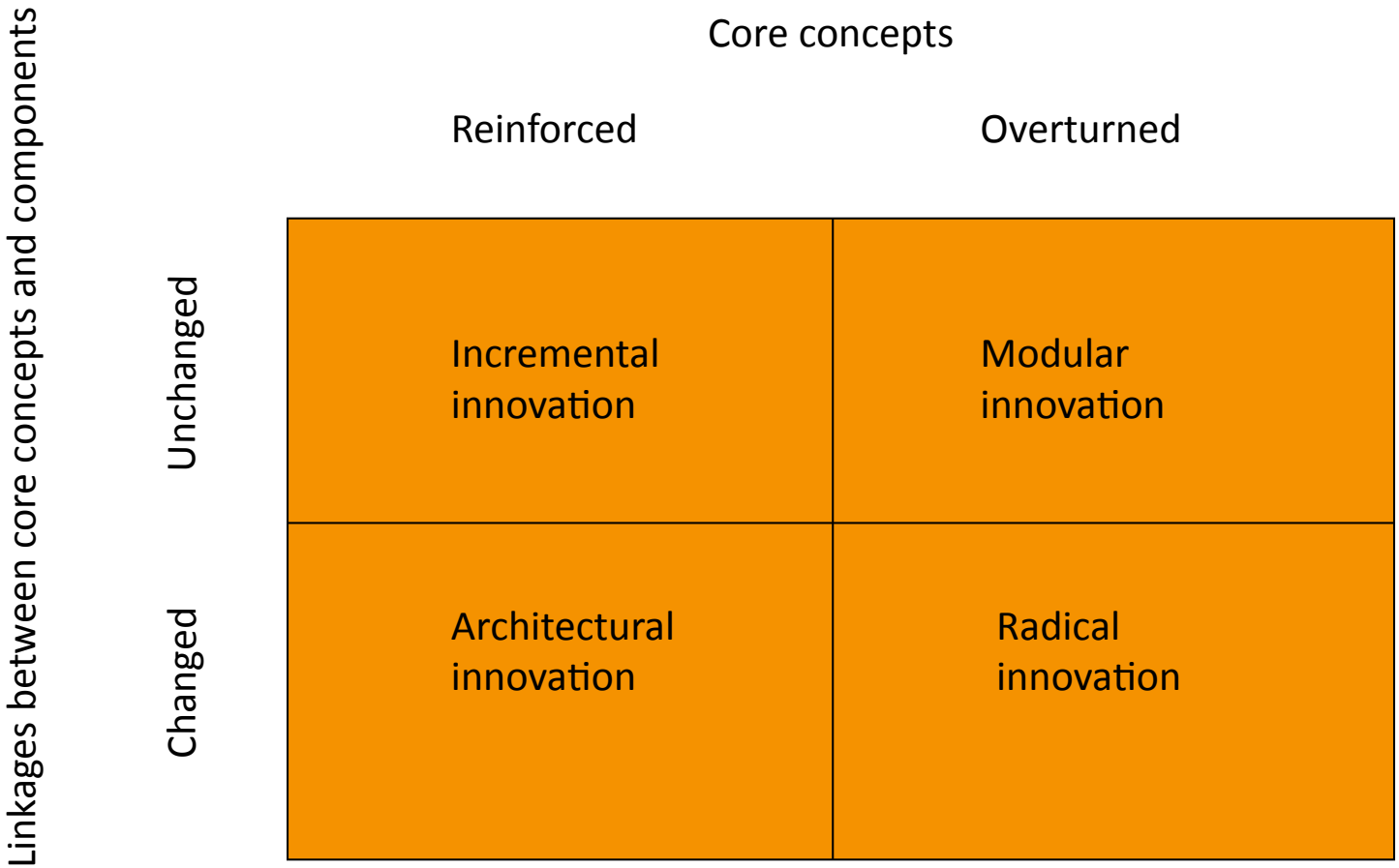
Interpretation III

- Low hanging fruits (LHF) – maybe half??
  - Technology fix
  - Incremental innovations
  - Fine tuning
- High hanging fruits - far reaching innovations!

C Perspective on Innovation – back to basics

- **Innovation** = new (creative) combinations of phenomena which may be old or recently learned/developed/invented
- **New combinations** = markets, technologies, artefacts, raw materials, work organization, architectures ……
- **Entrepreneur** = the introducer of innovations – this is the classic Schumpeterian use of the term!
- (there are no innovators - that concept reduces the role of the entrepreneur!!)
- The **Henderson-Clark perspective**
- The **development bloc perspective**
- The **salient – reverse salient perspective**

The structure of innovations – Henderson - Clark



Dahmén - and Hughes!

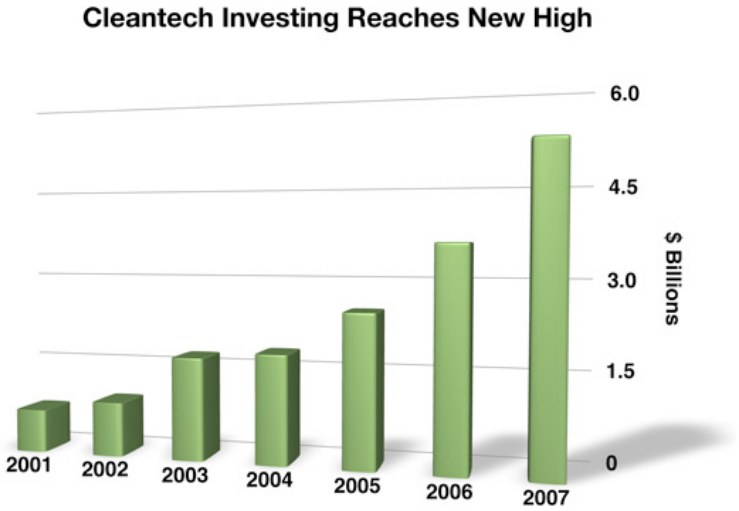
- Erik Dahmén´s development bloc (industrial focus)
  - Systems imbalances
  - Opportunities
  - Necessities
- Thomas Hughes´ (on technologies)
  - Salients
  - Reverse salients
  - Critical problems
- The non equilibrium dimension

D Green innovations

- a all cleantech does not classify as GI
- b LHF - HHF
- c Need for more R&D?
- d Need for institutional innovations?
- e Need for life style innovations?
- f Departing from the complexity path?

a) green innovations – all cleantech does not qualify

- small footprint in itself (first order impact)
- significant reduction of footprints in/from other systems (second order impact)
- contribute to global long term reduction of footprint (third order impact)



b) LHF - HHF

- LHF typically
  - **incremental** innovations
  - some architectural
  - some modular
- HHF typically
  - **radical** (shift of system, paradigm)
  - some architectural
  - some modular

c) Need for more R&D?

- The Schumpeterian perspective
  - We ”know” a lot already
  - There are many low hanging fruits
  - We know enough for ”new and creative combinations”
  - Not allow GI:s to be delayed while waiting for the best of all worlds!
  - R&D is always needed – more in some sectors than in others.

d) Need for institutional/policy innovation?

- We have advanced tool boxes already
- Activating existing tools – rather than waiting for new ones
  - Target levels
  - Limit levels
  - Taxes, fees, subsidies etc
- Simplifying regulation
- Too cheap to emit CO2 – 2nd & 3rd order GI necessitates more policy!

e) Need for life style innovations?

- Shopping/consumption styles
- Innovations in family related logistics
- Housing styles
- Vacancy styles
- Non-technical innovations
- Our understanding of modernity!

f) Departing from the complexity path?

- Are green machines more or less complex?
- Do incremental GI:s lead towards more complexity?
- Do radical GI:s lead towards reduced complexity?
- The systemic dimension
  - the persistence of old systems
  - lubricating (supplementary) innovations – often small
  - the complexity of the catalytic converter (David Bauner)

E Short conclusion

- A gigantic global challenge: > 80% CO2 reductions
- Half of half & half of that
  - Systems activity
  - Systems performance
  - The third reduction
- Incremental innovations not enough => radical innovations necessary
- We know a lot of the technologies already => non-technological innovations necessary to open for the alternatives
- Need for policy

Thank you for listening!

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