

Growth and Ecology: Where are the Limits?

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Limits



Limits



Economy?

Research Method



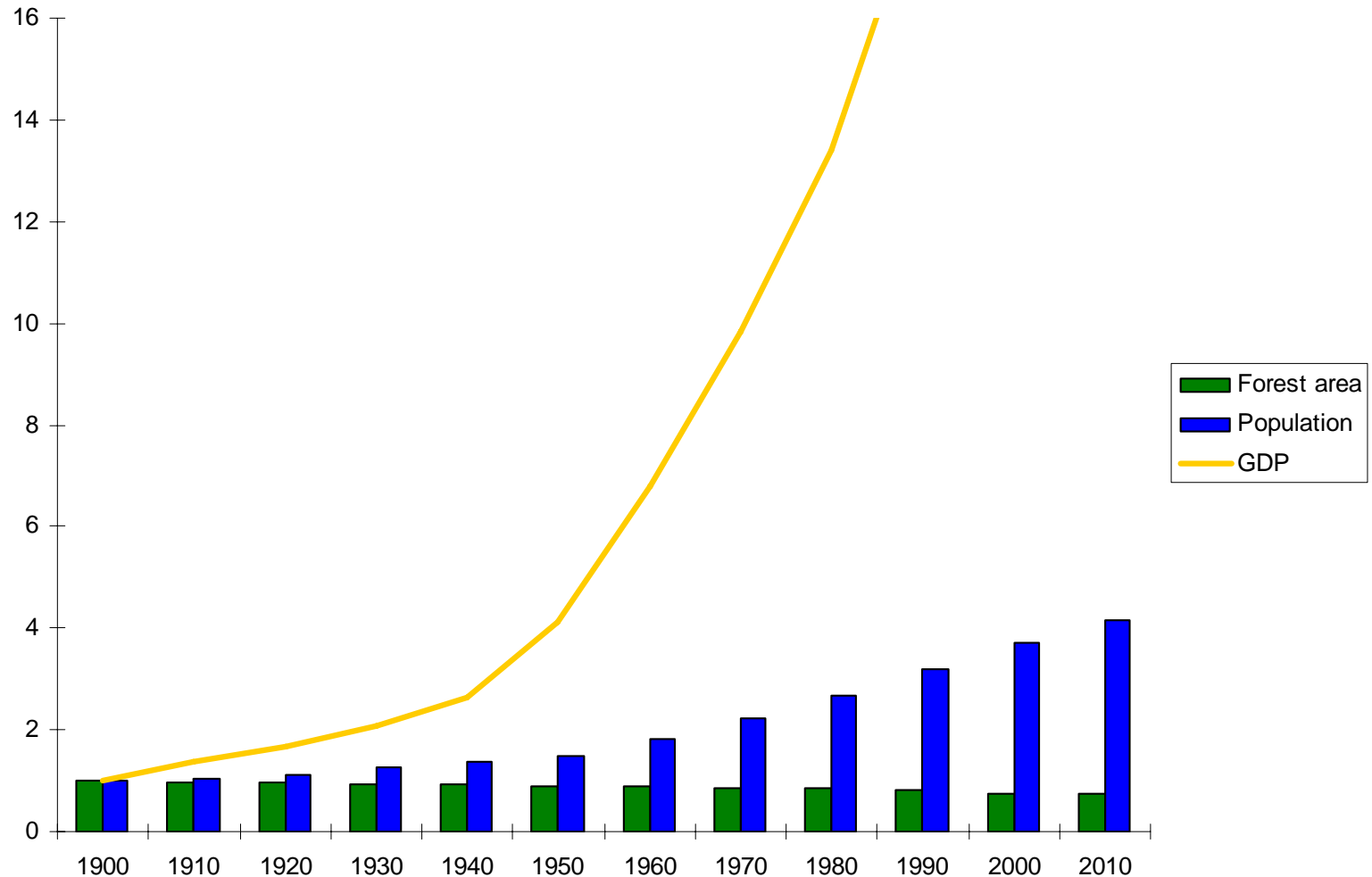
Forest or

tree research ?



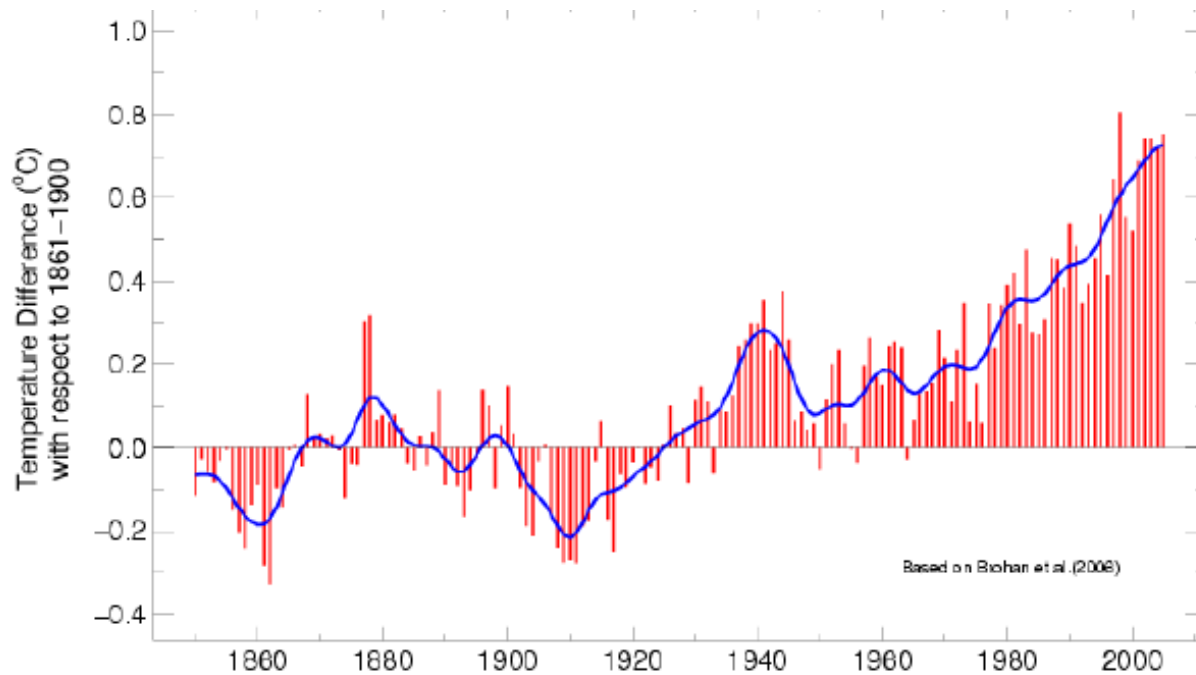
Forest Area, Population and GDP, 1900-2010

(Index, 1900 = 1)



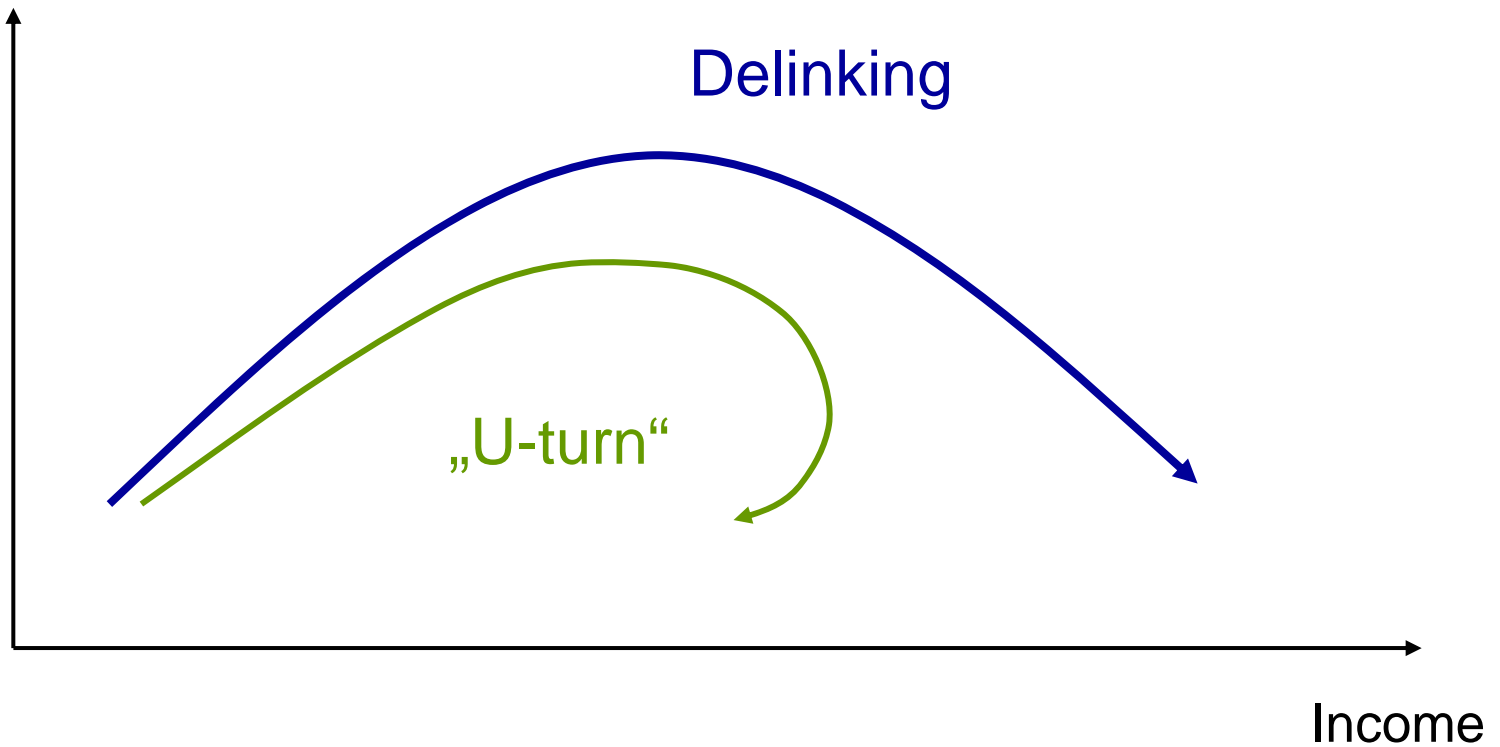
Sources: U.N. Food and Agriculture Organization (2005), World Bank, US Census Bureau, United Nations Populations division, OECD

Temperatures 1850-2005

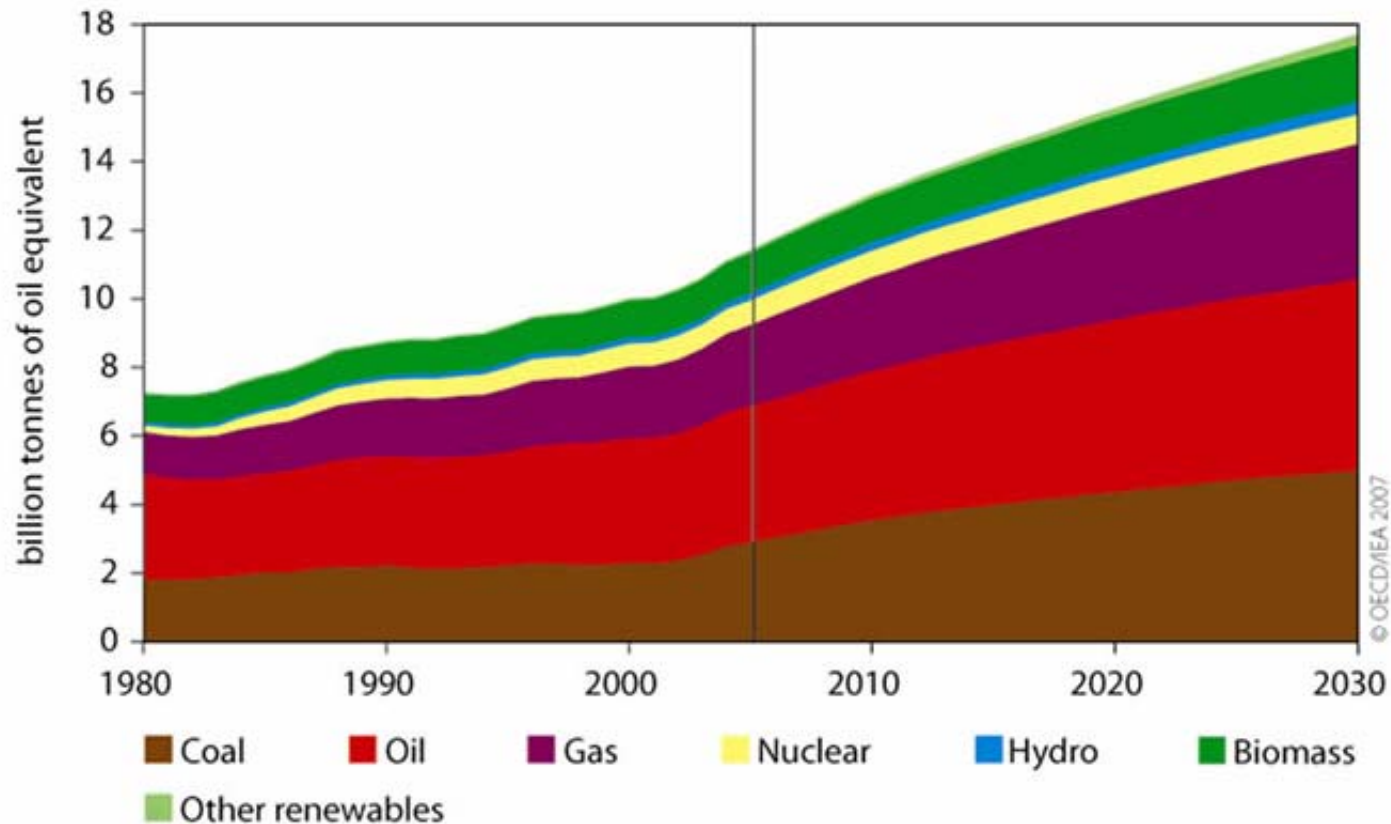


Limits to Growth?

Natural resource use

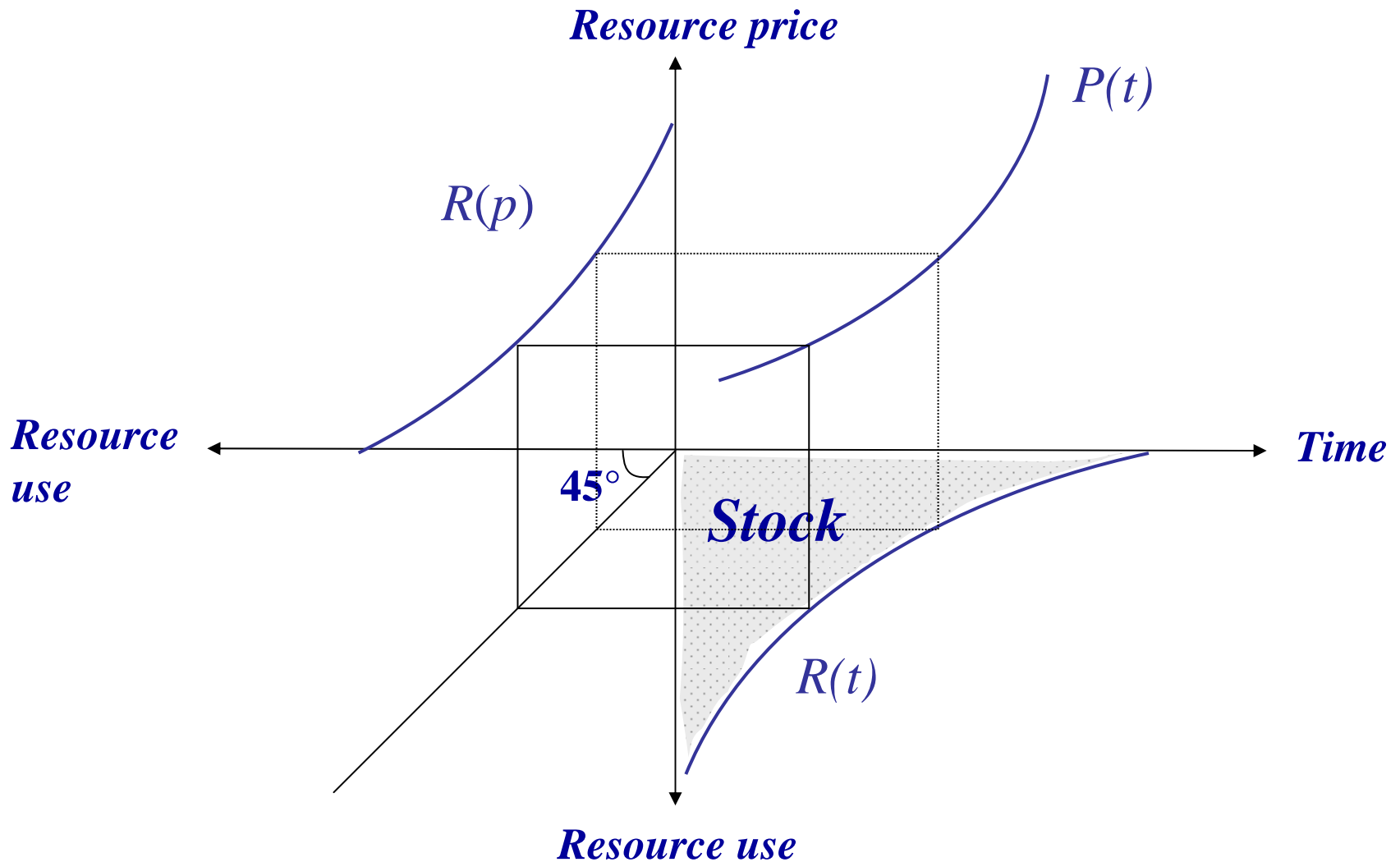


World Primary Energy Demand in the Reference Scenario



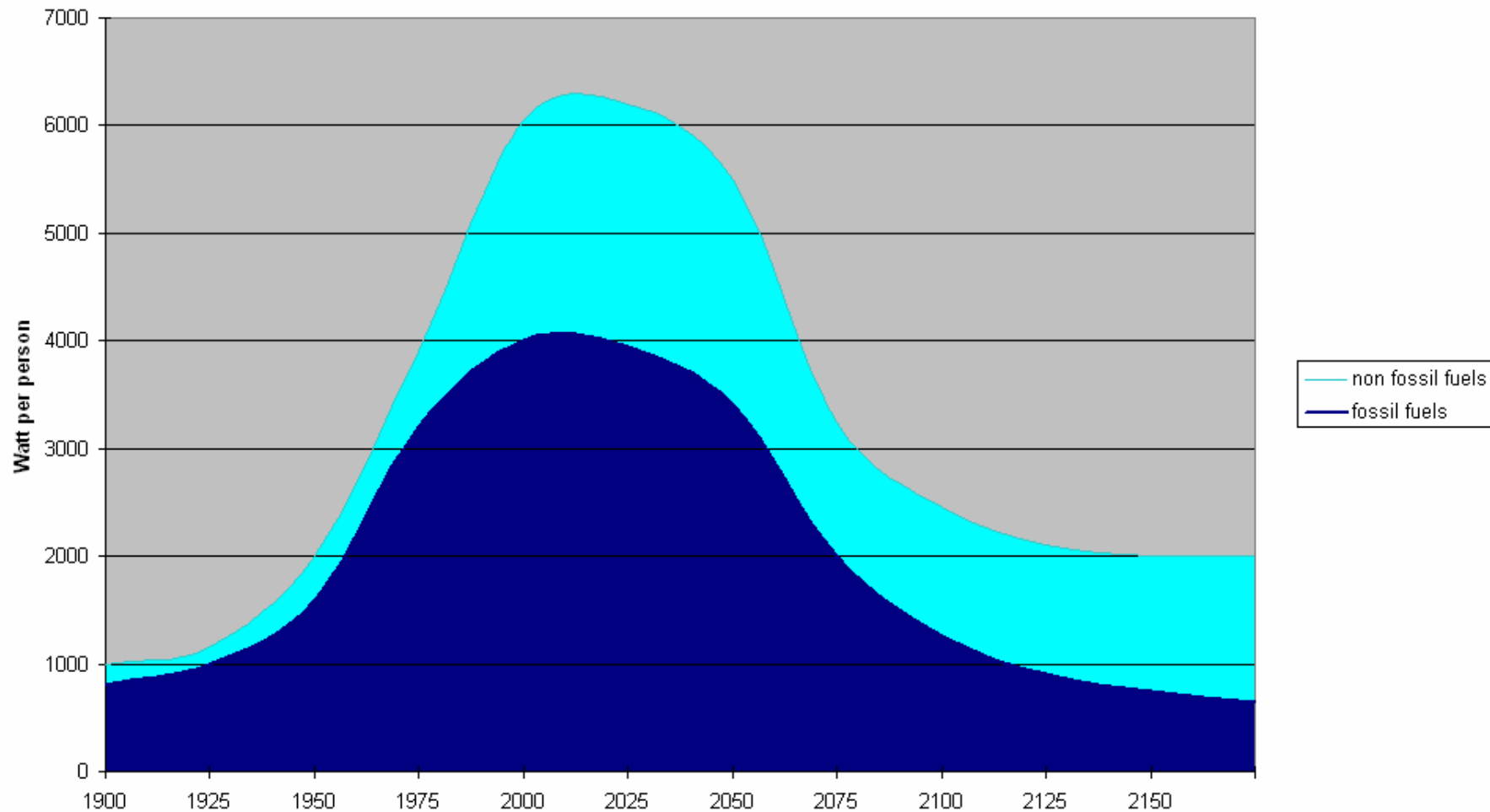
Source: IEA (2007)

Theory of Resource Depletion



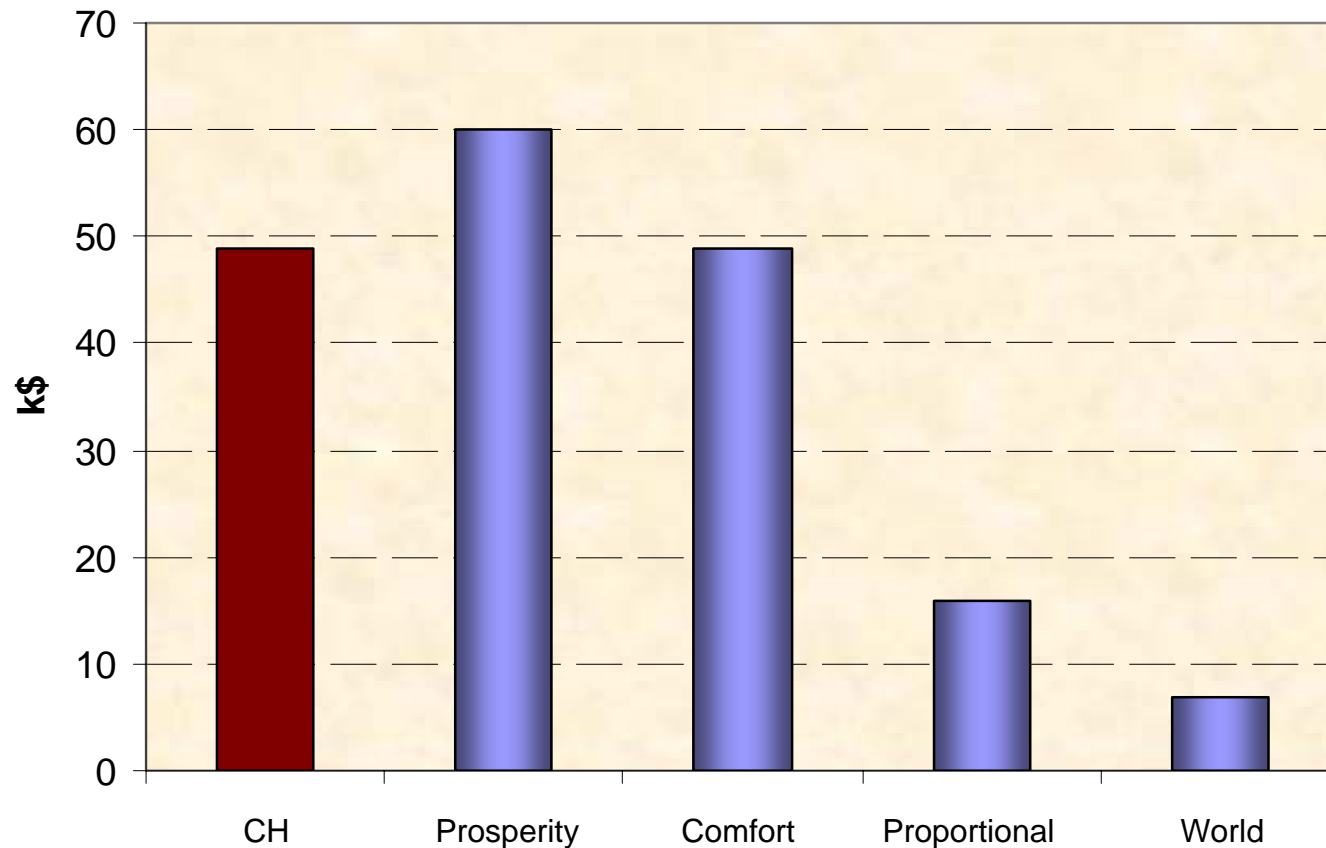
The 2 kW Society

Transition to the 2 kW Society



How Rich is the 2000-Watt Society?

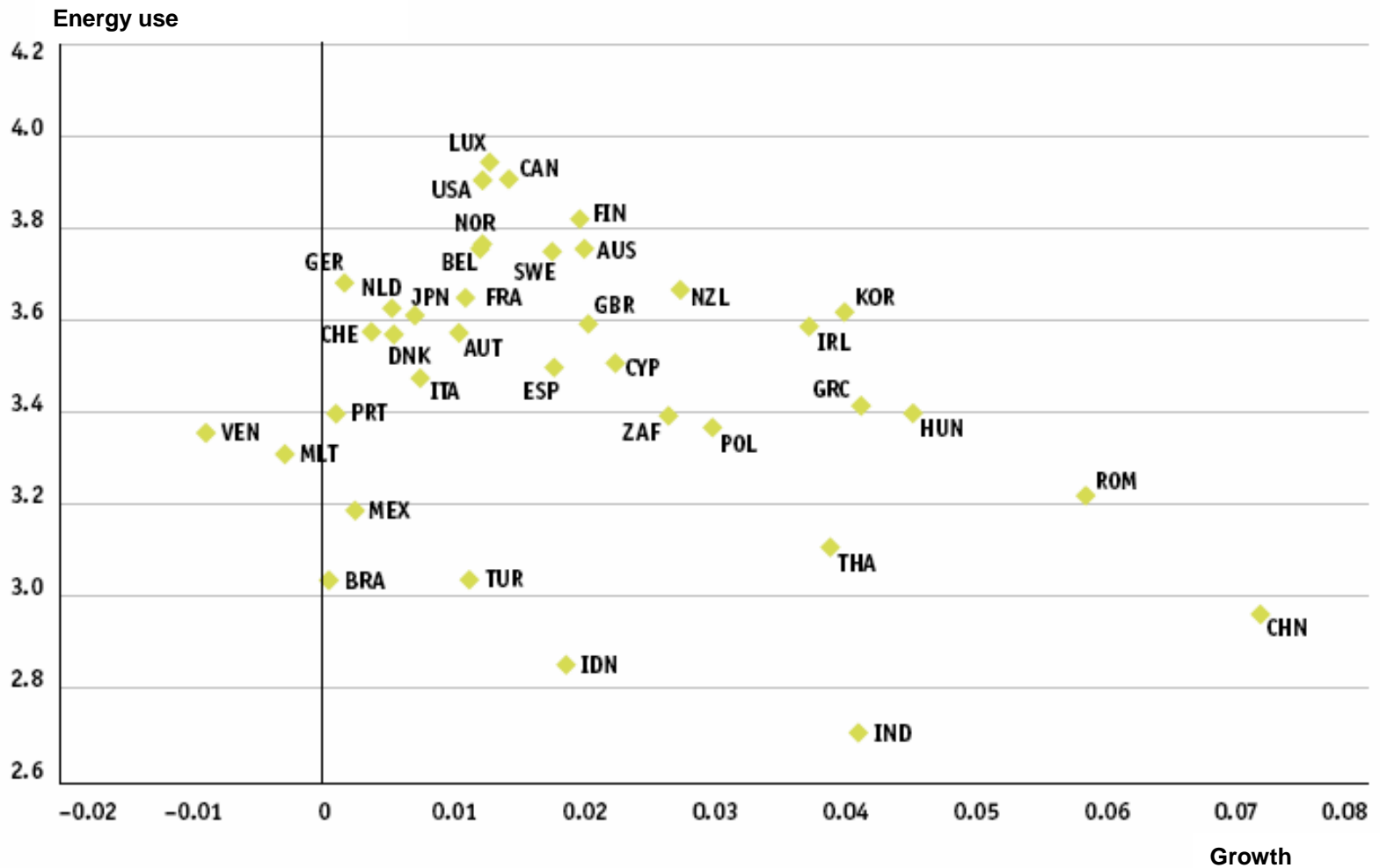
Income with 2000 Watt



■ How sustainable?

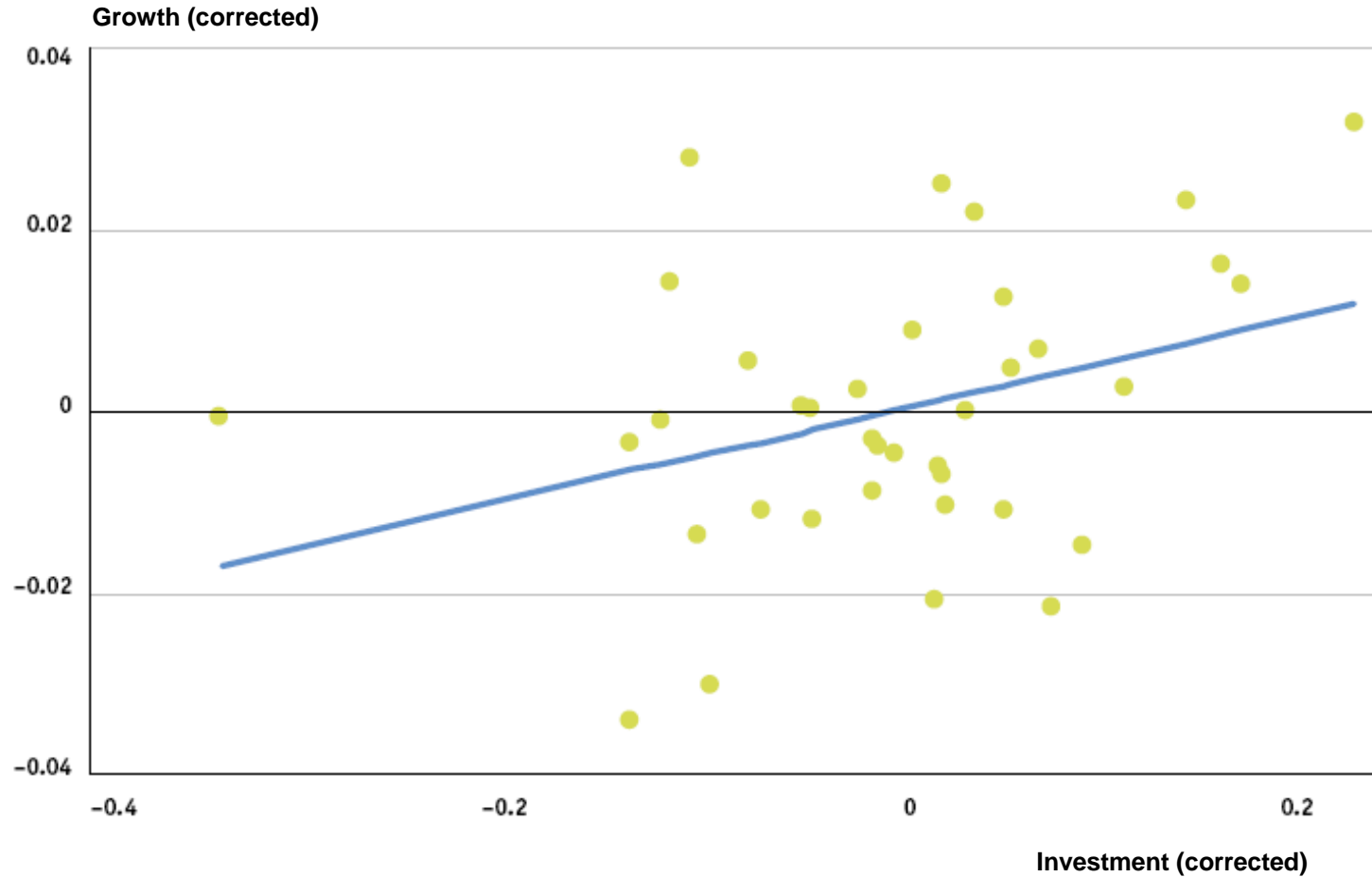
Energy Use and Growth

37 countries, 2000-04



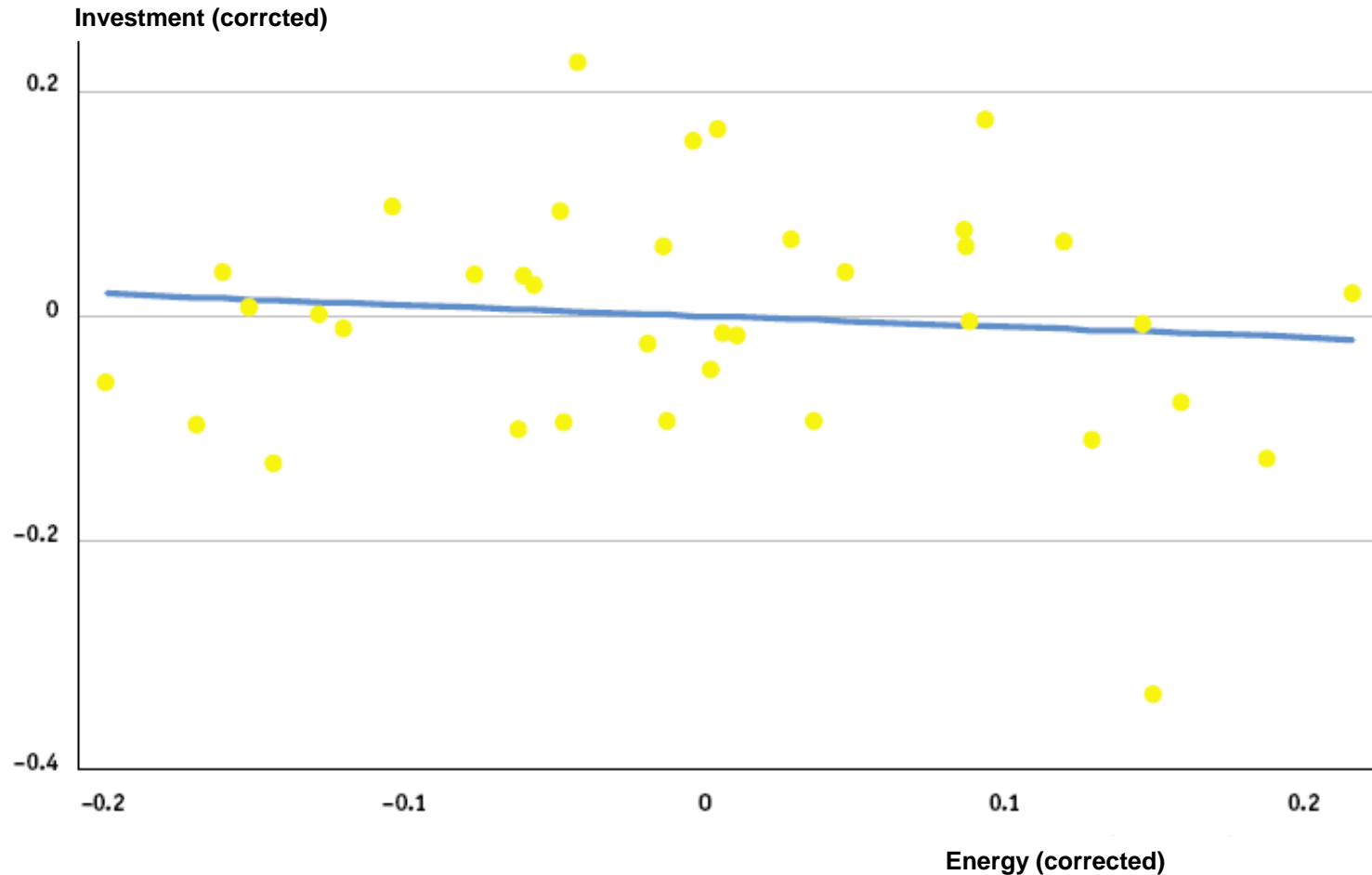
Investment and Growth

Investment shares and growth rates; 37 countries, 1975-2004



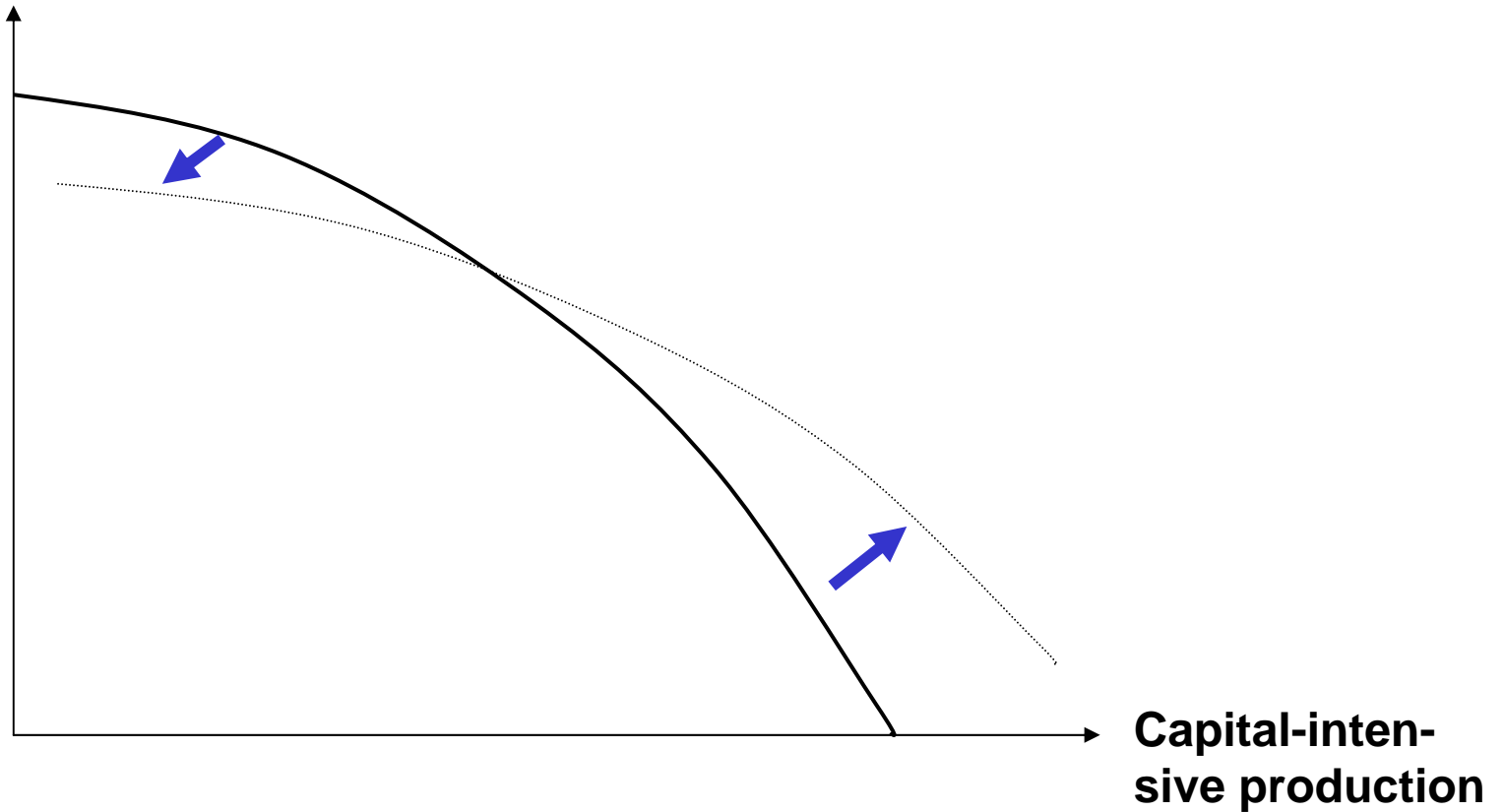
Energy and Investment

Energy use and investment share; 37 countries, 1975-2004



Growth of the Limits

Resource-intensive production



Impact

- $\% \Delta$ energy use / $\% \Delta$ energy price --
- Δ growth rate / $\% \Delta$ energy use --

→ 10 percent increase in energy prices increases growth rate *ceteris paribus* by 0.3 percentage points

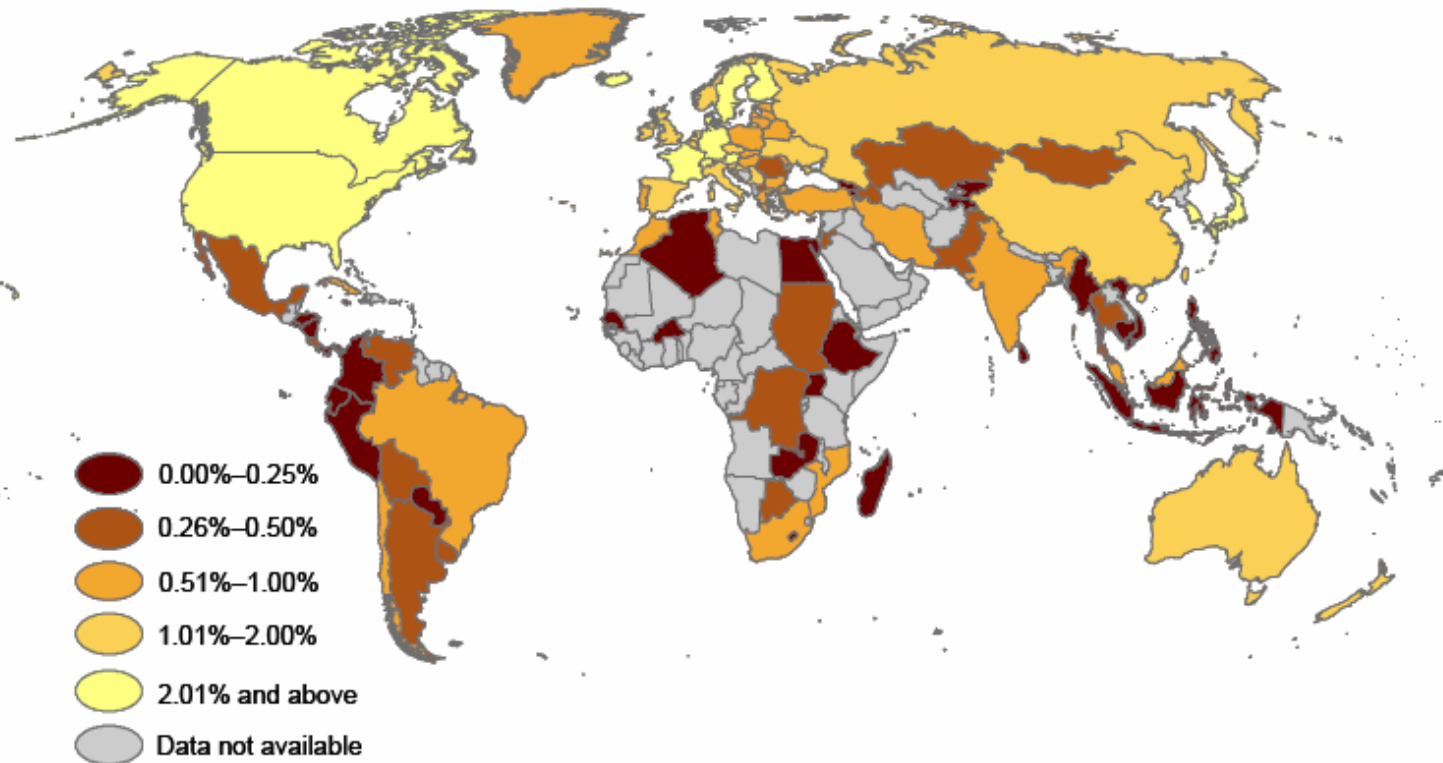
Based on 37 countries 1975 – 2004

Directed Technical Change

- Resource-augmenting technical change → economically attractive
- Technical change in resource-intensive sectors → economically attractive
- Research is labour-intensive → different view on population growth

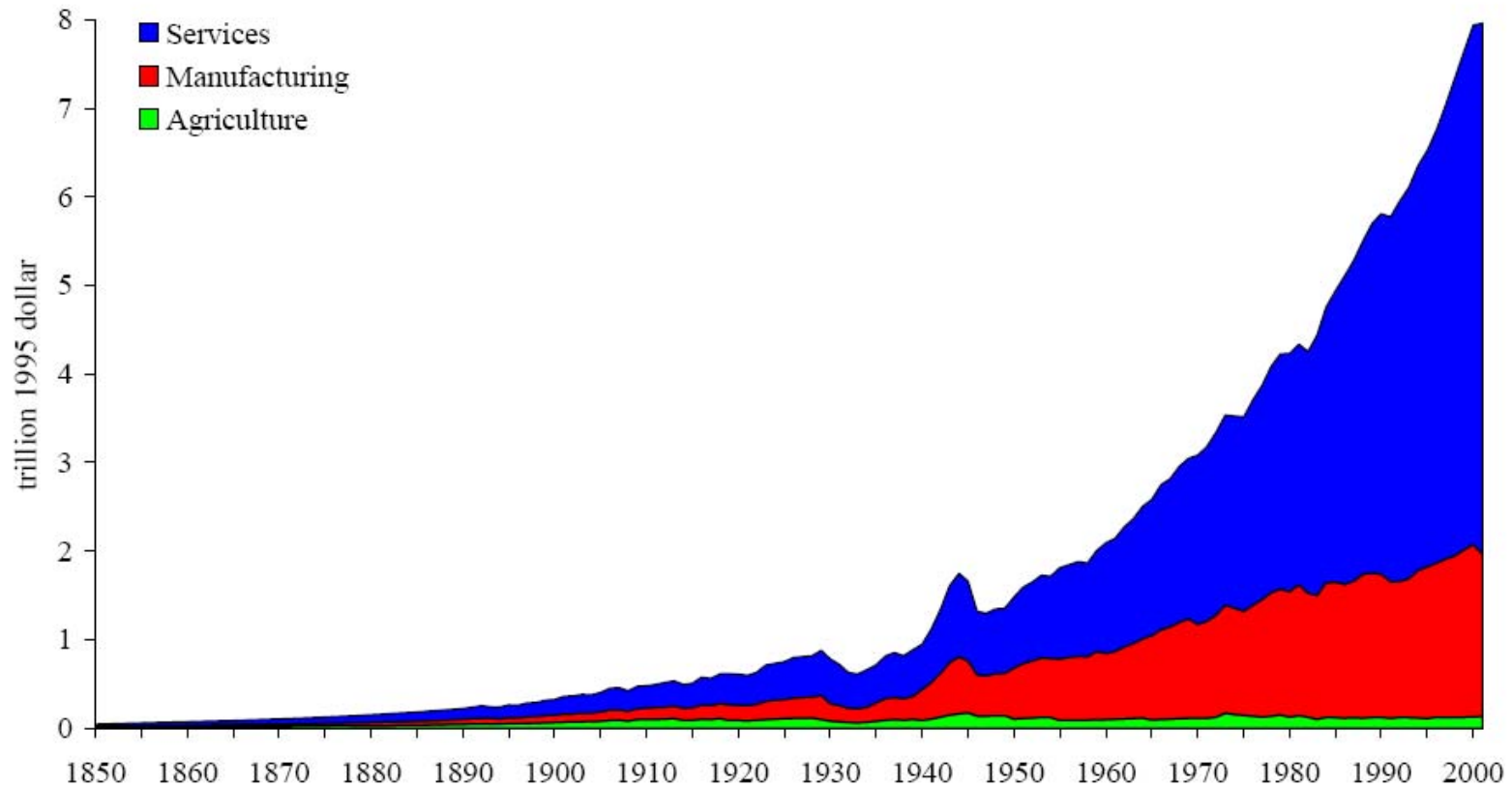
Research Geography

Figure 3: A snap-shot of R&D intensity
Gross domestic expenditure on R&D (GERD) as a percentage of GDP, 2005 or latest available year



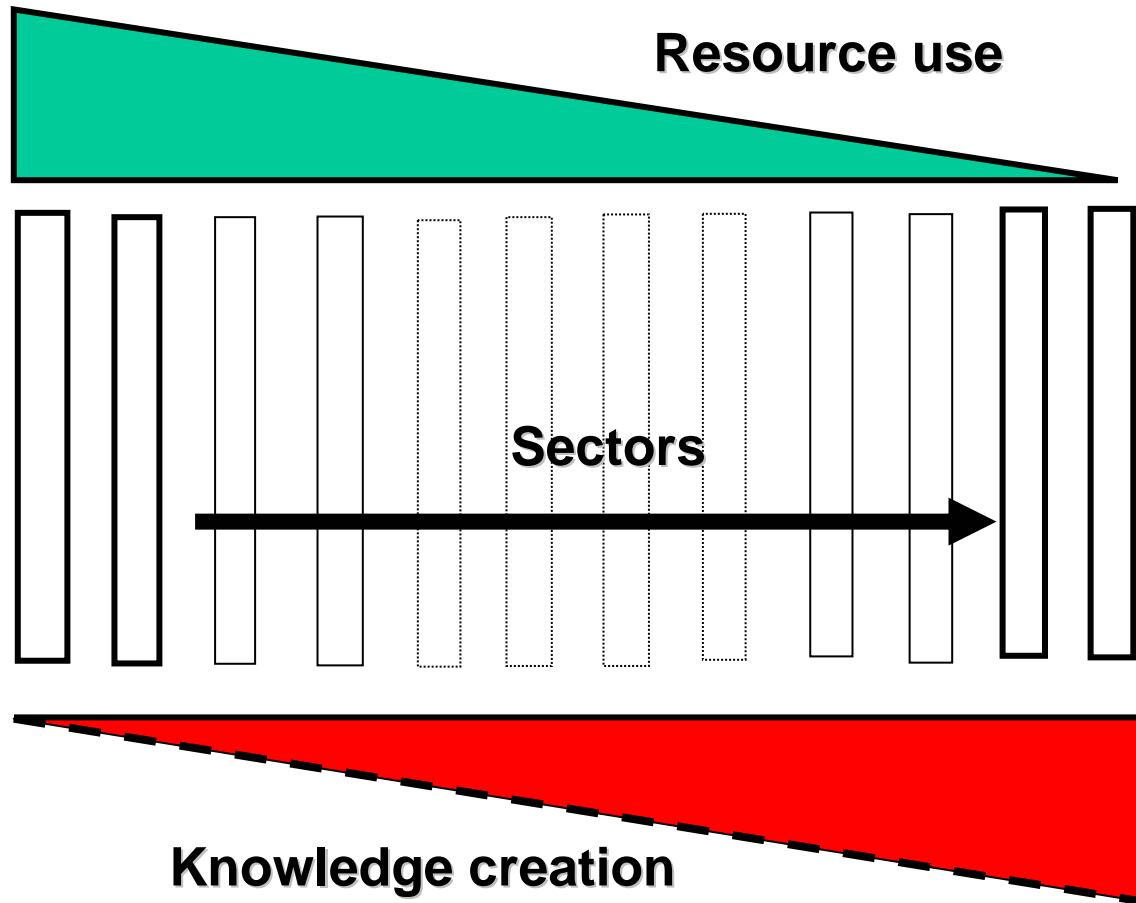
Source: UNESCO Institute for Statistics, September 2007

Structure of GDP (USA)



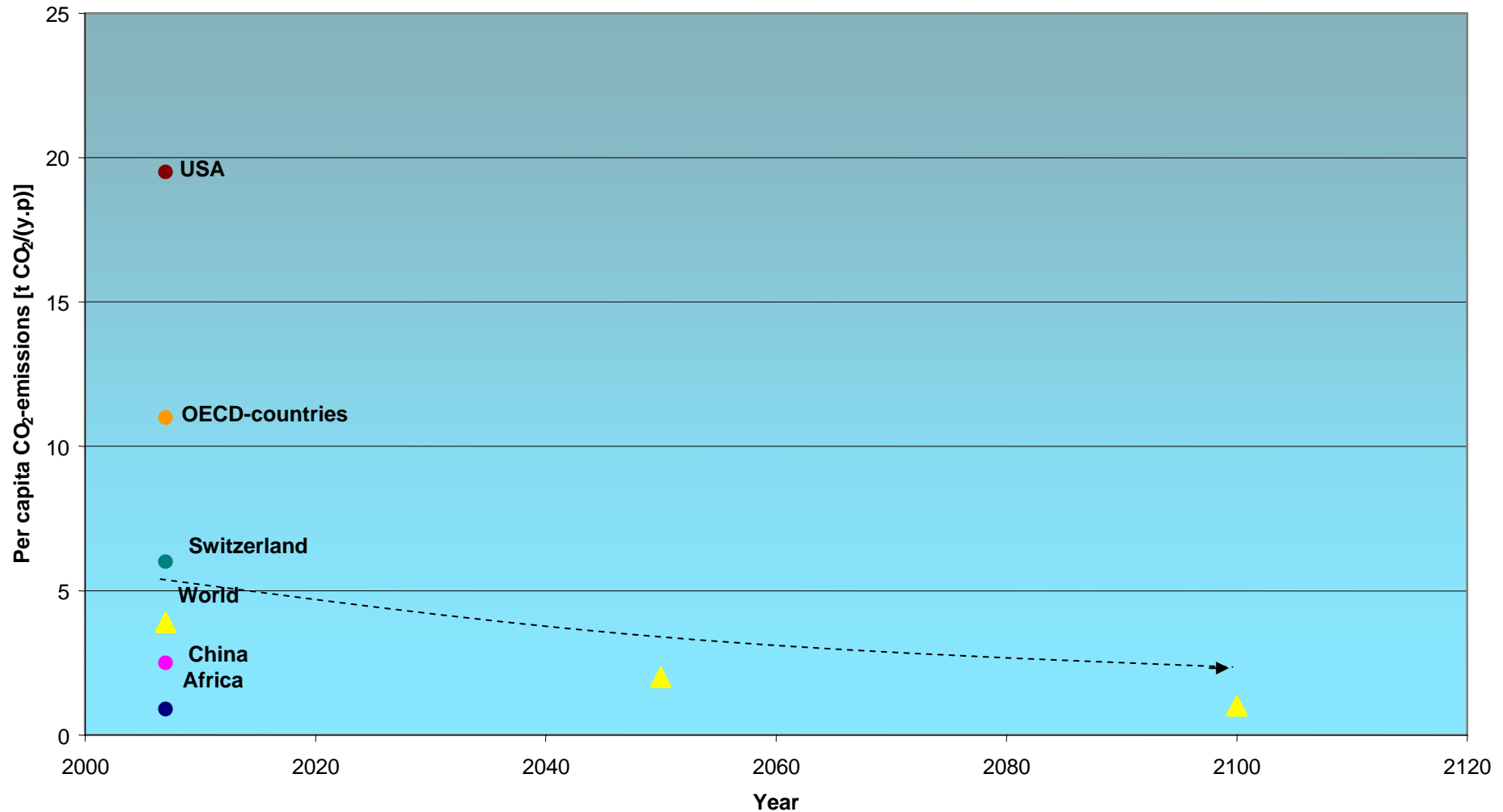
Tol et al.(2006)

Structural Change



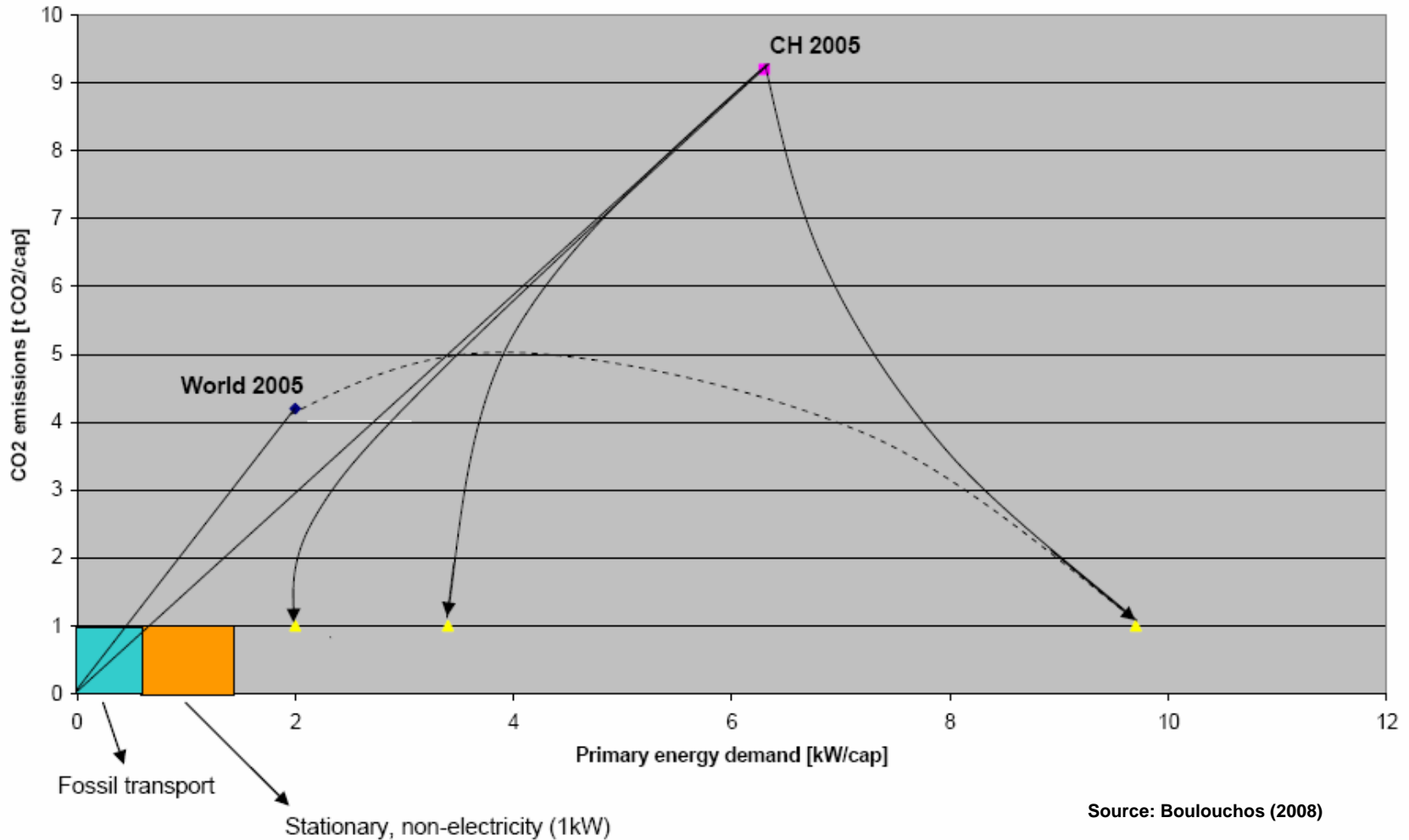
The 1 Ton Carbon Society

Transition to the 1 T Carbon Society



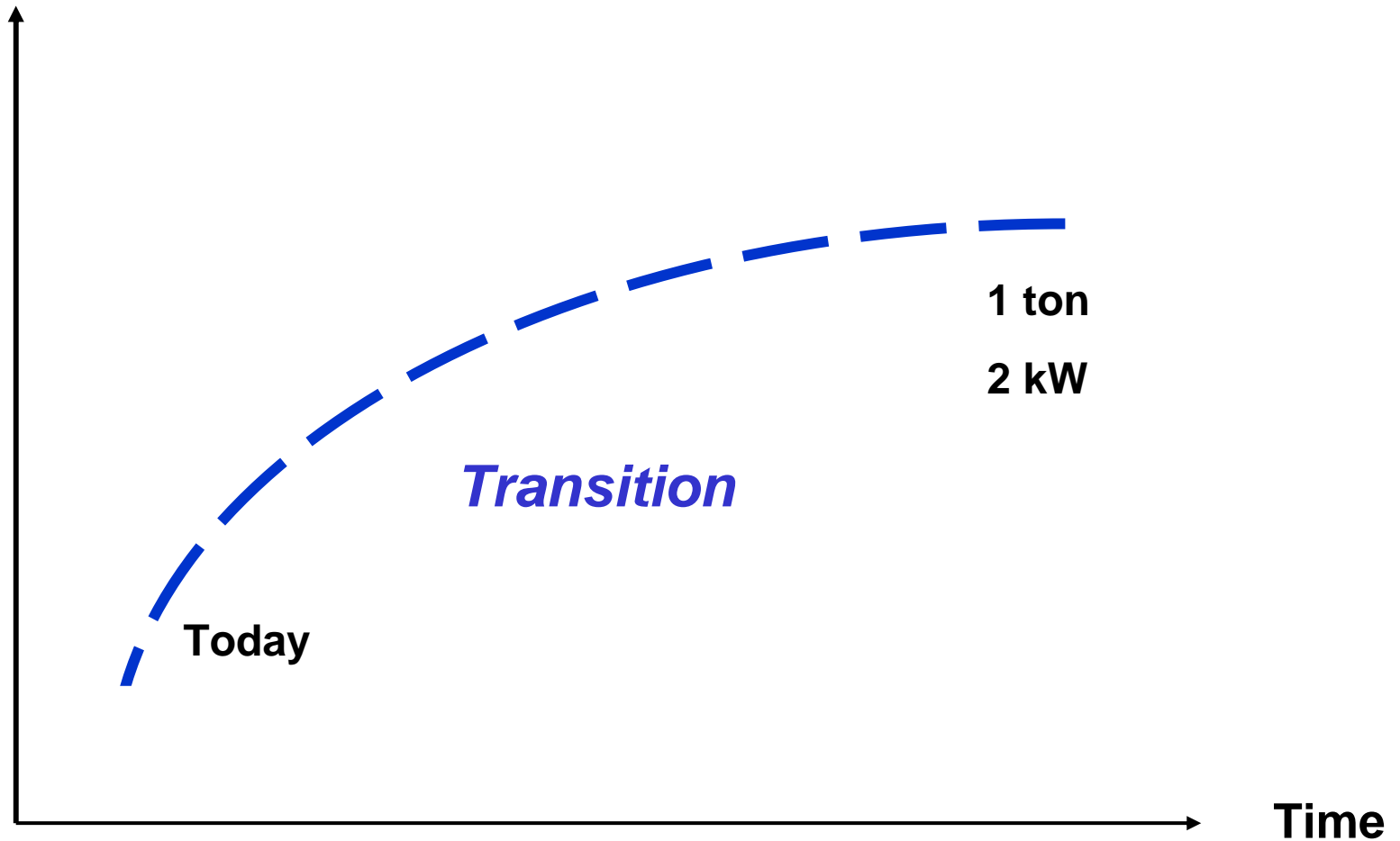
Combining ..

Combining 2 kW and 1 T



Welfare

Individual welfare



Where are the Limits?

- Transition:
 - Price development, policy
 - Induced capital build-up and technical change
 - Structural change
- Long run:
 - Renewable energy supply