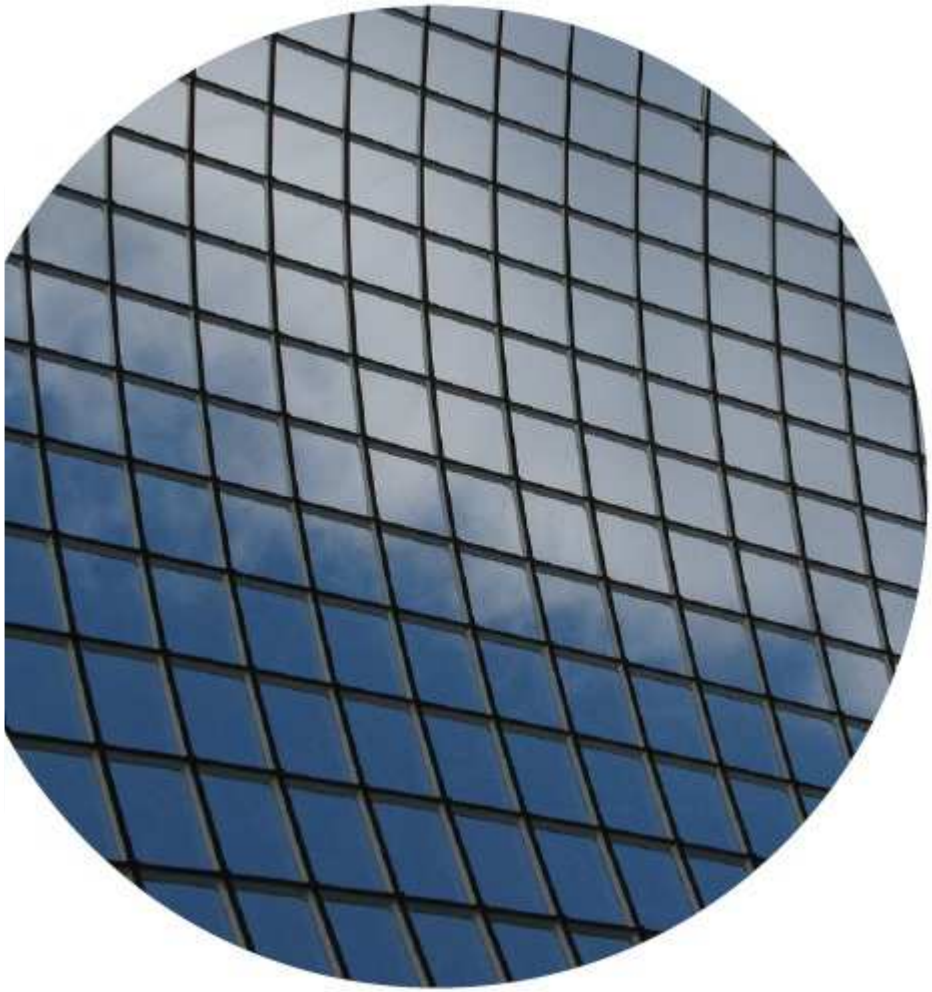

The Economics of Oil Dependence
A Glass Ceiling to Recovery

Dr Victoria Johnson
nef (the new economics foundation)

Peak oil and its consequences for Europe
Brussels, 15th November, 2012

Report summary #1

- IEA, IMF and G7 all warned that high oil prices have likely been constraining economic growth and economic recovery from the current recession.

  'The current high oil prices have the potential to strangle the economic recovery in many countries', IEA Chief Economist Fatih Birol, 2011

- Growth in oil production has plateaued over the past decade yet consumption in non-OECD countries continues to grow. Yet, no new sources of low-cost supplies are known.

- Recent optimism about unconventional sources of oil and gas fails to recognise that the additional supplies represent a higher cost.

- Slowing the rate of decrease in oil production can only be achieved by a potential doubling of the price of oil over the next decade.

- Significant falls in oil prices can only occur if there is a major recession or depression, similar to that seen in the second half of 2008.

Report summary #2

- Sustained high oil prices are likely to usher in ‘economic peak oil’

The point at which the cost of incremental supply exceeds the price economies can pay without significantly disrupting economic activity at a given point in time.

- Mature high oil-consuming economies like the USA and UK suffer major economic impacts at oil prices >$90 per barrel
- Industrialising economies like China and India should tolerate prices in the $100-$110 per barrel range
- The higher price tolerance of developing economies suggests that by paying above the comfort level of richer nations for oil, they could render those richer economies stagnant.

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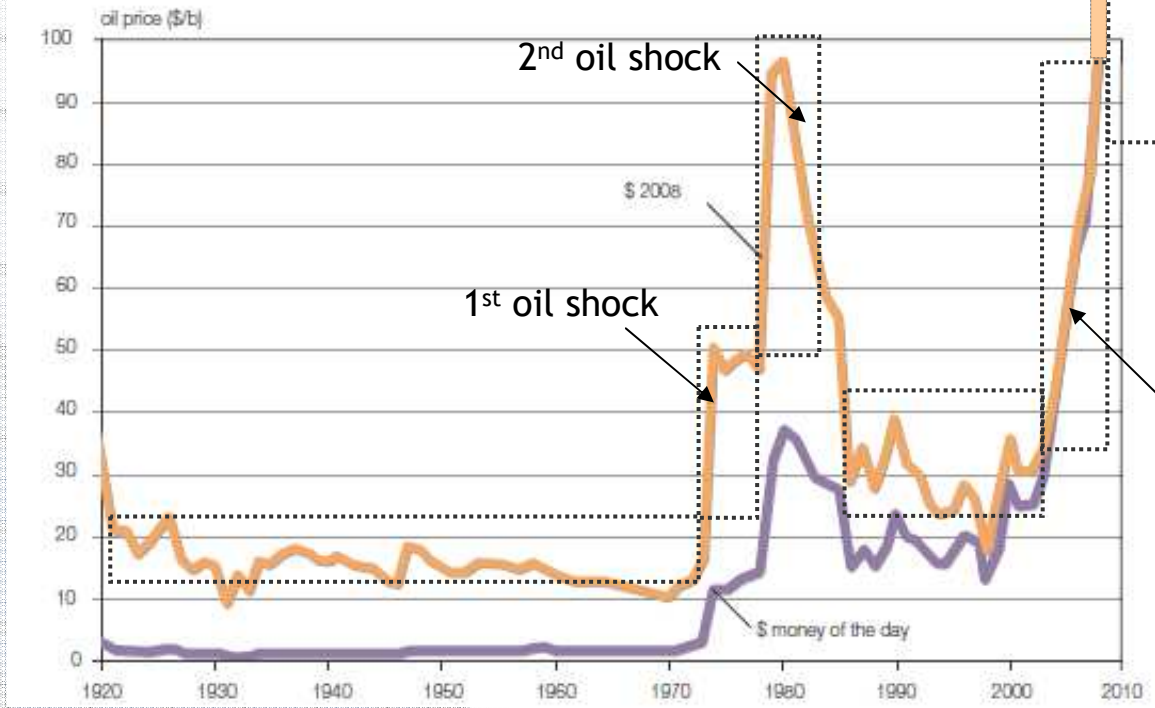
Section 1

Energy and the economy

The end of cheap oil?

Oil prices 1920-2009, actual and inflation adjusted

Oil price spike leading into global recession



'Last oil shock?'

The end of cheap oil

Commodities 'super-cycle'

BP Statistical Review of World Energy 2009, from ITPOES (2010), commentary by **nef**

Production costs exert a strong influence on the price of oil

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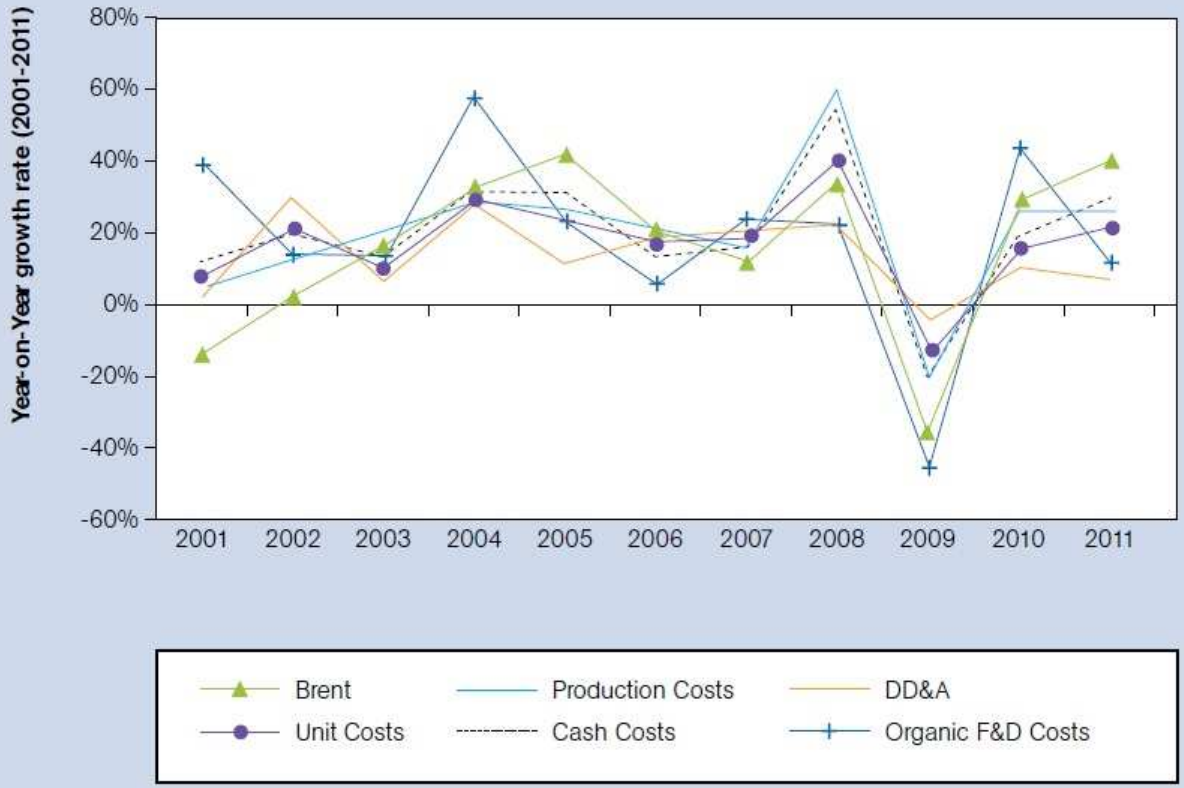
Figure 1. Relationship between Brent oil price and the marginal cost of production, cash costs, production costs, unit costs and finding and developing (F&D) costs.[55]

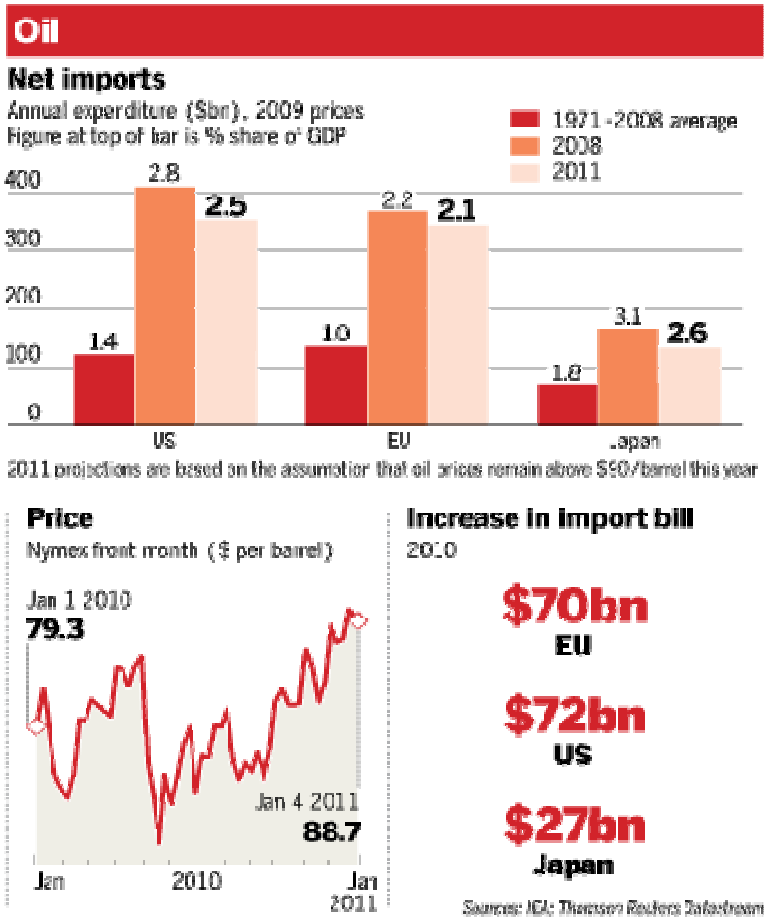


It's not just about prices

"Oil prices are entering a dangerous zone for the global economy"
Fatih Birol, IEA chief economist (4 Jan 11)

Direct energy costs are important, but not the whole story

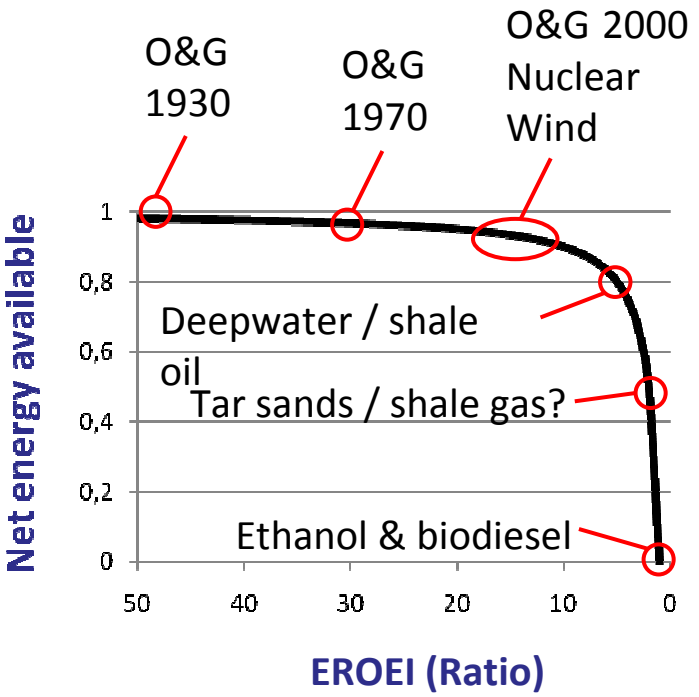
- Economic output (GDP) is the financial measure of 'work done'
- Work is energy: Energy is central to all economic activity
- What productive activity is energy free?
- Energy return on energy invested (EROI) is the key metric



Graphics from 'Rising oil price threatens fragile recovery', Financial Times, 4 January 2011

Heading for the cliff?

- EROI is declining over time
- When EROI = 1:1 it is no longer a source of net energy
- Quantities of reserves are **irrelevant** if extraction cannot yield positive net energy
- Are we already scraping the bottom of the fossil fuel barrel?



Sources: See Murphy (2010) for a good summary with list of references
http://www.theoildrum.com/node/3810

Contributions to growth of the US economy

The productivity of land, capital and labour are **transformed** by energy

Work by Robert Ayres & Benjamin Warr and other has illuminated the link between **GDP & Energy**

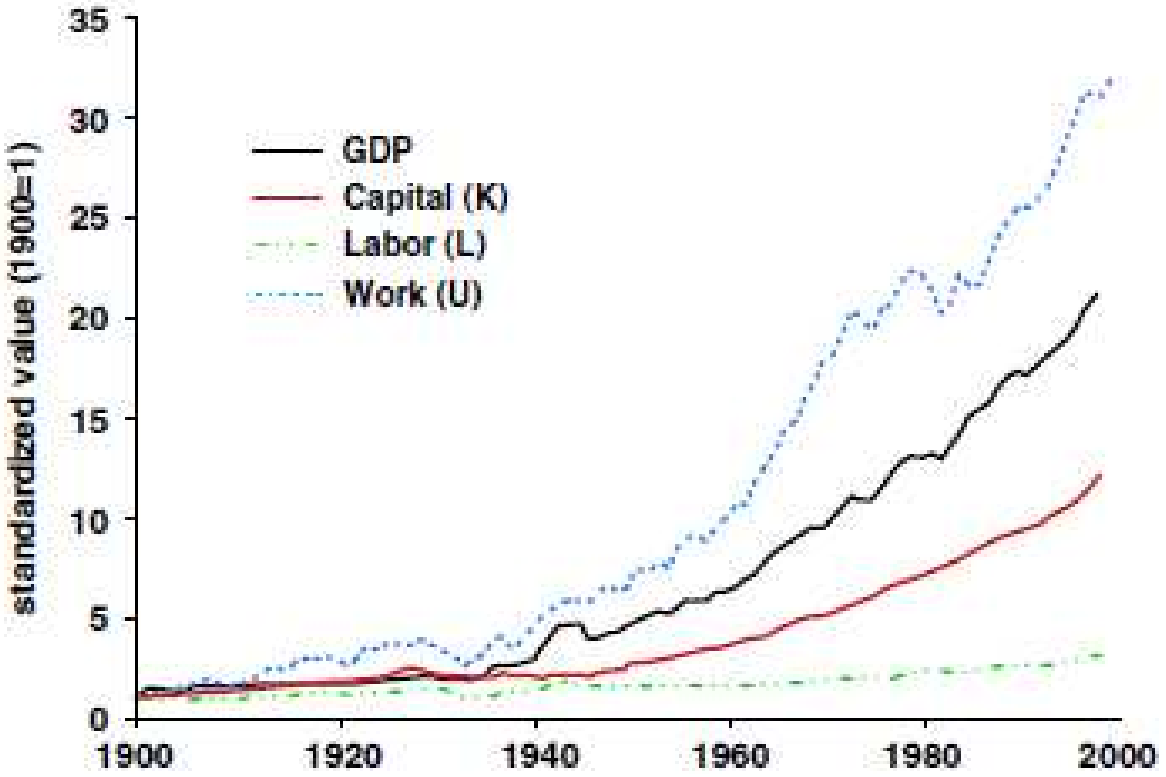


Fig. 3. GDP and factors of production of US, 1900–2000.

Source: Ayres & Warr (2007)

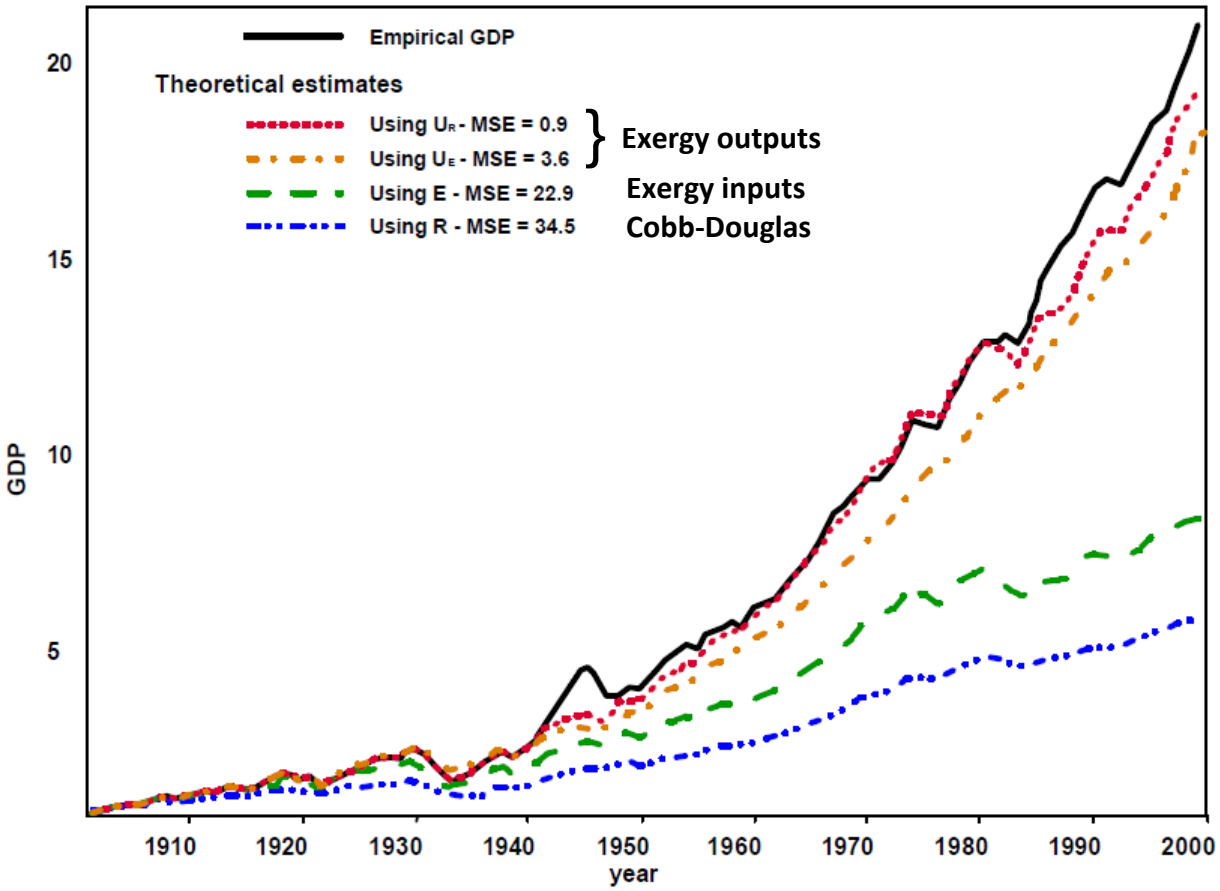
Energy and GDP growth

GDP not explained by Cobb-Douglas - 'Solow residual'

Adding **exergy** (energy + materials) as a third input with capital and labour improves matters

Only when efficiency is added to model useful work obtained from exergy inputs, does a correlation appear

LINEX production function fits with different "energy" factor inputs
USA 1900-1998



Source: Ayres & Warr, "Accounting for Growth: the role of physical work". INSEAD

Section 2

The end of civoilisation?

‘Economic peak oil’

- Reconciling the geological and economic perspectives
  - Geological perspective – finite nature of reserves, demand outstrips supply
  - Economic perspective – higher prices send a signal to the market

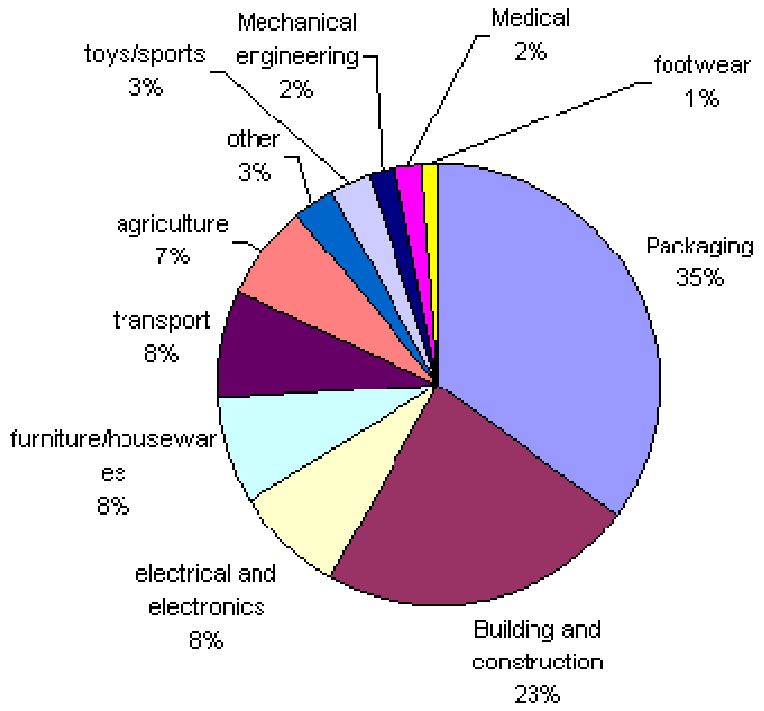
- Economic peak oil: *The point at which the cost of incremental supply exceeds the price economies can pay without significantly disrupting economic activity at a given point in time.*

- While hard to pinpoint, there is an oil price, beyond which economies begin to experience severe negative impacts, depressing economic activity and causing extreme social hardship.
  - Developed economies - $90 per barrel
  - Industrialising economies – $100-110 per barrel

A crisis of transport fuels

- Oil is exceptionally useful
  - Energy dense: 1 litre = 146 human hours
  - Easy to transport
  - Multiple products
- Key to advanced industrial economy
- 80-85 % of oil use related to transport
- Transport demand growing fast in industrialising economies

Uses of plastic in the UK



Source: WasteWatch, 'waste online' (Feb 06)

Substitutes for oil

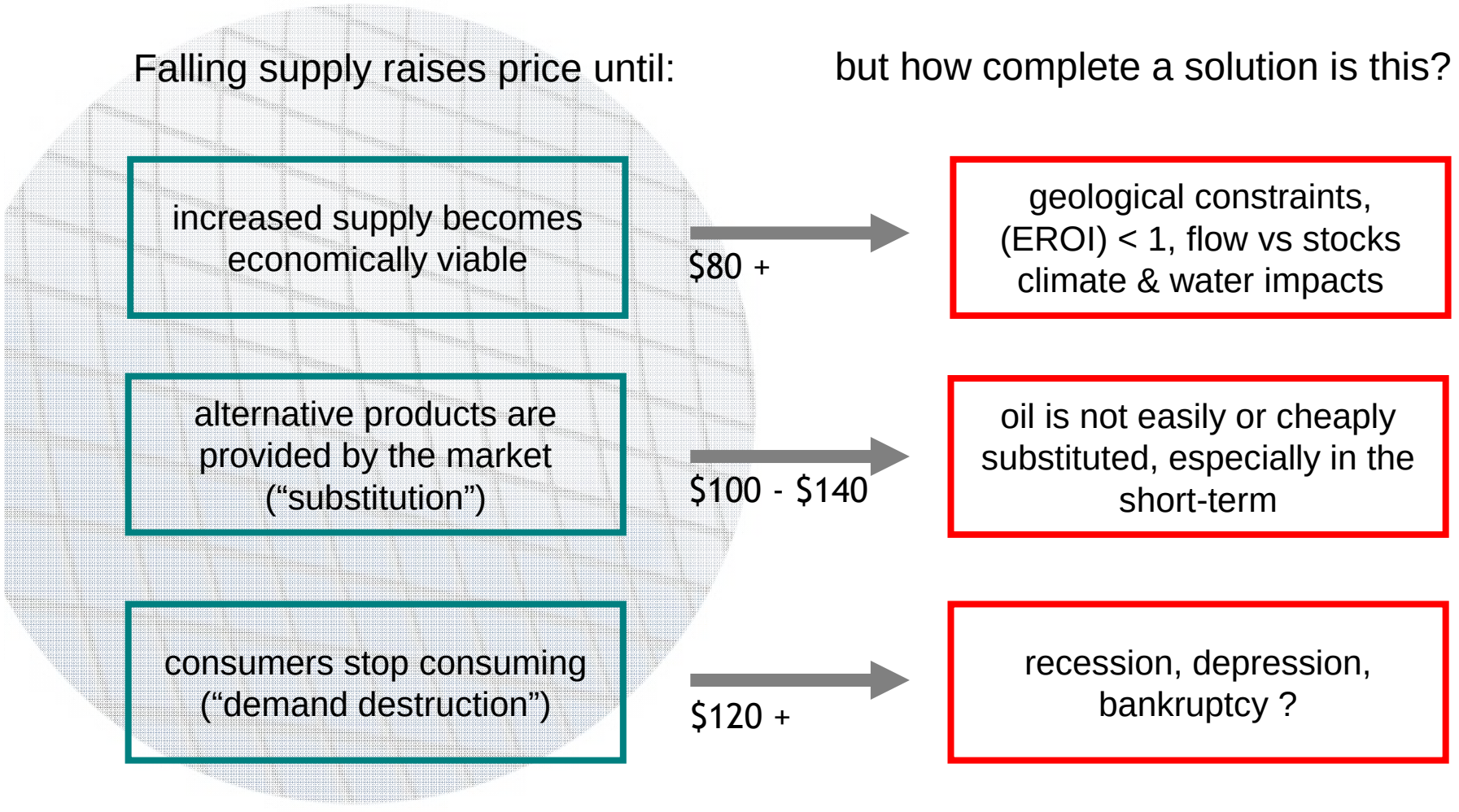
- Electricity
  - Renewables: Different infrastructure: huge investment
  - Nuclear?
- Biofuels
  - Fuel extenders
  - Food v.s. fuel conflict
  - 2nd and 3rd generation, not yet economic
- Natural gas
- Hydrogen Economy / Fuel Cell
- Non-conventional hydrocarbons
  - Tar sands, oil shale, polar oil & other
  - Shale gas
- Improved reserve recovery

Materials use in energy sources

Source: Materials Innovation Institute, Nov 2009

	Raw materials (application)
Fuel cells	Platinum
	Palladium
	Rare earth metals
	Cobalt
Hybrid cars	Samarium (permanent magnets)
	Neodymium (high performance magnets)
	Silver (advanced electromotor generator)
	Platinum group metals (catalysts)
Alternative energies	Silicon (solar cells)
	Gallium (solar cells)
	Silver (solar cells, energy collection / transmission, high performance mirrors)
	Gold (high performance mirrors)
Energy storage	Lithium (rechargeable batteries)
	Zinc (rechargeable batteries)
	Tantalum (rechargeable batteries)
	Cobalt (rechargeable batteries)

Leave it to the market?



Softening the blow

- New sources of low-cost oil?
- Improved efficiency in oil use?
- Transition to a low carbon economy?

Further information

Economics of oil dependence: A glass ceiling to recovery, downloadable from **nef** website www.neweconomics.org

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