

ENERGY RESEARCH CLUSTER

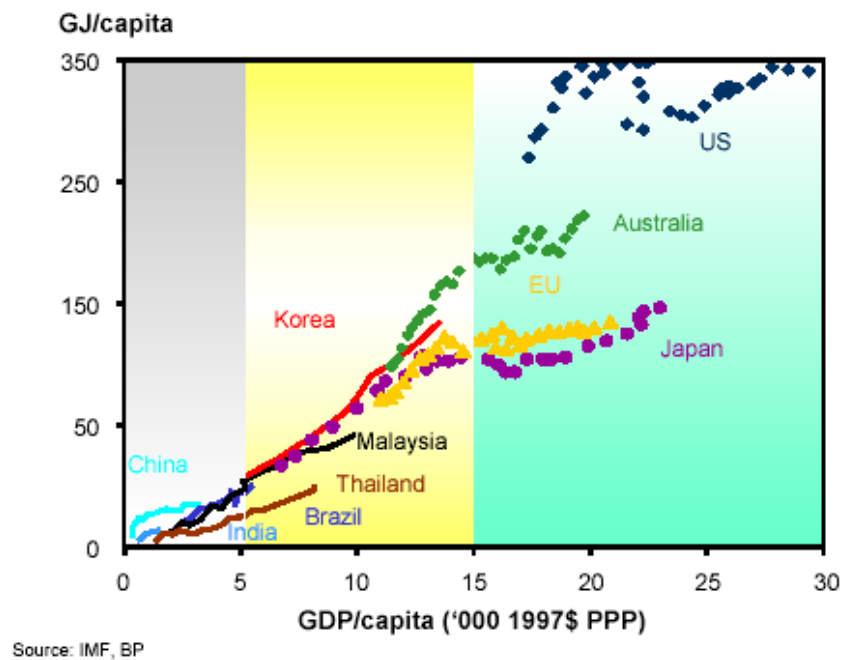
NOTES FROM BREAKFAST MEETING ORGANISED BY THE CENTRE FOR ENERGY AND GREENHOUSE GAS TECHNOLOGIES

SPEAKER: Tim Warren, Chairman of the Shell Companies in Australia
TOPIC: Future Energy Scenarios - 50 years on

Date: Tues 22 November 2005
 Location: Windsor Hotel, Melbourne

Shell is well known for developing comprehensive scenarios concerning the future business environment and analysing the consequences of each scenario.

Warren commenced in a somewhat sombre vein by displaying the graph below, which demonstrates that Australia is one of the most energy-intensive major economies in the world. The graph also shows that as economies develop they become more energy intensive until a stage is reached where economic growth requires little additional energy and energy demand plateaus. An implication is that as major emerging economies develop, world energy consumption will increase strongly.



In 2001 Shell released a paper titled “Evolving Sources of Revolutionary Technology - exploring alternative energy paths to 2050.” The paper presents two scenarios: ‘Dynamics as Usual’ and ‘Spirit of the Coming Age.’ The scenarios are summarised below.

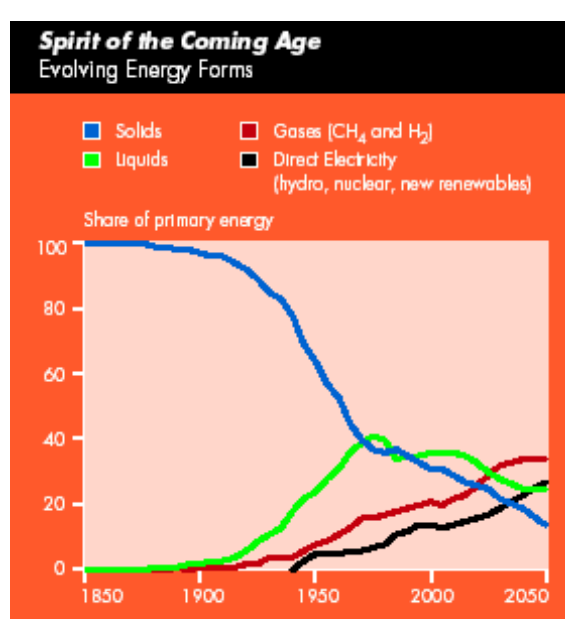
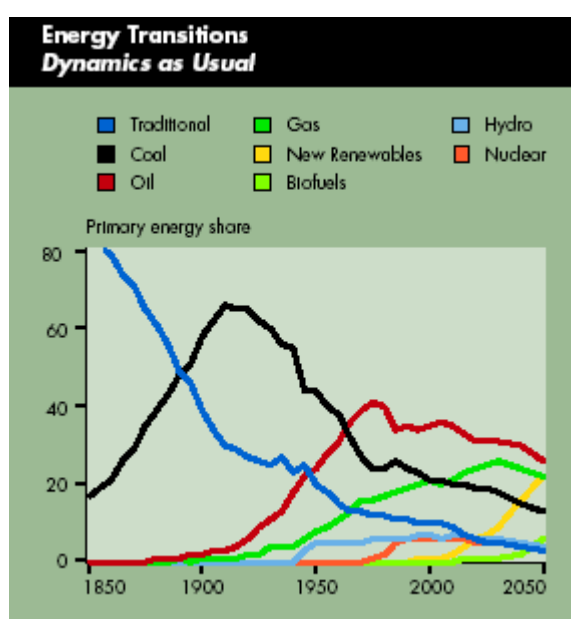
DYNAMICS AS USUAL	SPIRIT OF THE COMING AGE
Evolution by progression (from coal to gas to renewables or possibly nuclear)	Technical revolution
Driven by social concerns	Driven by customer needs
Key Driver: Social and personal performance	Key Driver: Technical change
Diverse energy system	Hydrogen economy (fuel cells, advanced hydrocarbon technologies, carbon dioxide sequestration)

The scenarios suggest that the rise in human-induced carbon dioxide emissions can be halted within the next 50 years, leading to a stabilising of atmospheric carbon dioxide levels without jeopardising economic development. Interestingly, the two scenarios do not forecast substantially differing CO₂ emissions 50 years hence.

Warren spoke to two key papers that are available on the web at www.shell.com. (Enter "alternative energy paths to 2050" into the search box, top right.)

Highlights:

- Direct burning of coal will continue to decline as a proportion of the energy mix due to its environmental impact and increasingly difficult transportation logistics
- Oil will decline as a proportion of the energy mix due to its increasing scarcity
- Much more gas will be produced and consumed
- Major roles are envisaged for nuclear power and hydro-electricity
- Hydrogen looms as a major source of energy in 2050



- Companies who master the CO₂ issue will triumph
- The next dominant fuel will be natural gas - but this will be a bridging fuel
- Wind and Solar PV will grow faster than other renewables to 2010 (Shell owns 740MW of wind generation capacity and is a Top 10 investor. It is a top 5 investor in PV and is backing thin film CIS technology - efficiency of 13.5% achieved.)

Shell is investing heavily in hydrogen fuel cells. The first combined gasoline and hydrogen refuelling station was recently opened in Washington DC as a demonstration project. It is a joint venture with General Motors.

The potential for advanced coal technologies is huge. These include coal gasification, clean burning and CO₂ sequestration. Shell has partnered with Stanwell Corporation (Queensland) to research and develop coal-to-gas and geo-sequestration projects.

Geological sequestration is seen as a bridging technology. It will be used at Gorgon (offshore NW Western Australia) if an investment decision concerning the development of the Gorgon gas field is positive.

Nuclear is also seen as a transitional energy source that cannot be ignored. It has a role to 2050 and could become increasingly important if new-technology fuels cannot break through.

Questions:

Mark Sturgess - Citipower/Powercor

Q: Does Shell collaborate at an industry level?

A: Shell competes. It does very little joint-venturing. This is distinct from areas where it does collaborate such as environment or safety

- The battle over technologies that will dominate future energy supply is intense
- Shell does joint-venture with non-competitors, eg auto manufacturers. (In 2008, the Australian government has mandated the next clean fuel improvement tranche and improved engines will be required.)

Ian Sheppard - CSIRO

Q: The rate of economic growth in the "New Age" scenario is much greater than Business as Usual. Why?

A: 20% of consumers have no energy today. Less regulation is part of the "New Age" scenario, meaning that governments have less say about how the world will solve its problems. This leads to a faster growth curve.

Andrew Nelson - Ceramic Fuel Cells

Q: There's an internal conflict: Surely Shell's shareholders want to maximise profits from Shell's existing portfolio of petroleum and coal interests.

A: Customer expectations are changing. Companies who do not listen to their customers will suffer. Self regulation is customer-driven. However, customers will not yet pay for environmental protection although they will buy green as a first choice if prices are equal.

Not Identified

Q: Who will win the race between hybrids and clean diesel vs hydrogen?

A: It's not wise to pick a winner. Hybrid/clean diesel technologies are winning during the transition race but only a couple of hydrogen breakthroughs are needed for hydrogen to leapfrog.