



Worth Noting

Volume III, Issue XX, 17th September 2003

Worth Noting is the fortnightly management journal of research and conferences company L21. It is focused on management strategy issues of relevance to senior executives.

'Energy' is the largest industry in the world. It is probably the most talked about and controversial industry at the moment. Events of recent time have occurred to bring back a concerned interest in the industry: the collapse of huge corporations like Enron; blackouts in California and Victoria; the seduction of post-Saddam Iraqi oil and resulting chaos for OPEC ... the term 'energy crisis' has been branded about frequently.

In this edition of Worth Noting, we look at the 'energy industry' and extract a few facts and calculations that give perspective to some of the energy challenges we face. To simply say that we face an 'energy crisis' tells us very little indeed.

World Energy Demand

It is crucial to understand the mix of projected energy demand before we go any further. Energy can be classified into three types:

Renewable fuels	Non-renewable fuels	Renewable natural forces
Bio-fuels (e.g. wood, fuel crops for ethanol/methanol production)	Fossil fuels (e.g. coal, gas, oil) Uranium and thorium (fission) Deuterium-tritium (fusion)	Solar heat and light Wind Waves Tides Rivers (hydro) Geothermal heating Ocean thermal gradients

Source: Uranium Information Centre; L21 Research

Bear in mind that when most of us think of energy, we often think about secondary products derived from the three basic classifications above. The main secondary product is **electricity** which can be produced a number of ways:

1. From fossil fuels.
2. From natural forces such as wind and water.

The next secondary fuel product that many assume will become significant is **hydrogen**, mainly derived from the electrolysis of water. But currently, it is immaterial for us.

Is There A Crisis?

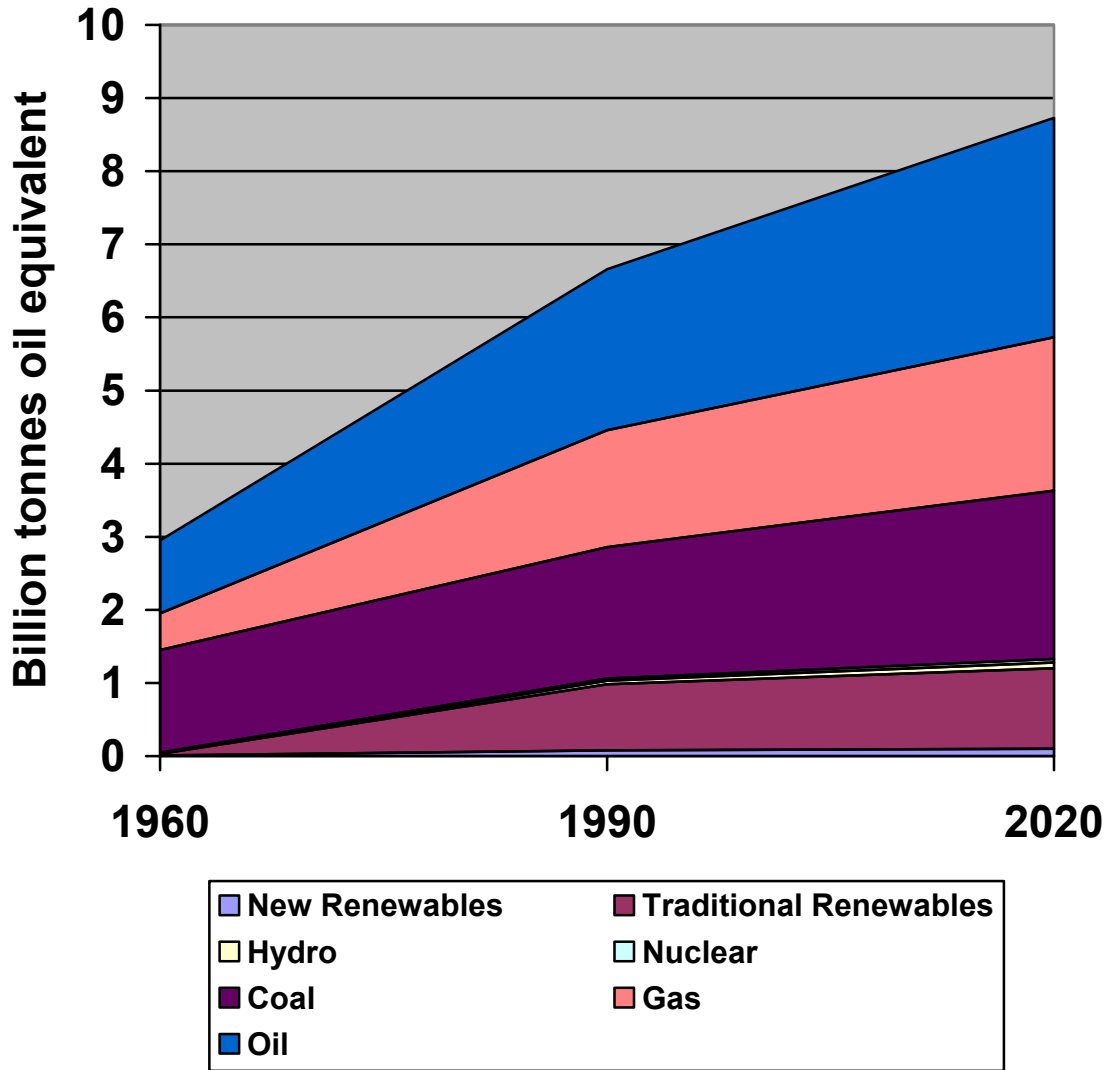
When we speak about an 'energy crisis', we can mean many things: environmental concerns, regulatory inadequacies, corporate collapses of energy companies, technical inadequacies and distribution problems, and so on.

In this context here, an 'energy crisis' will refer to a situation either where supply does not meet demand, such that forms of energy is simply not available or where supply is so scarce that meeting our energy needs becomes dangerously expensive.

Whilst blackouts due to inefficient electricity grids and huge corporate collapses do cause some pain to those affected, they do not constitute a general 'crisis' *per se*. But they might lead to localised crises as a result of poor supply.

The figure below looks at projections of world energy demand and the energy-mix type.

World Energy Demand & Mix



Source: World Energy Council

This chart is important. Much of the talk has been about fossil fuels, especially oil, and it is easy to see why. From the chart, we can see that oil began to replace coal as the main energy source in the 1970-80s while the relative importance of newer technology fuels is miniscule and will remain miniscule (on current projections).

There are also a few crucial points worth noting regarding energy dependence mix:

- Production costs for oil have remained largely unchanged since 1973 while politics determines oil prices more so than economics through OPEC agreements (which regulates about 75% of the world's oil in use).
- Natural gas production, although increasing rapidly now, is likely to reach its peak in many countries over the next couple of decades.
- Nuclear energy is the most uncertain source given the volatile and unpredictable political reactions to this source of power.
- There is limited experience in the utilisation of renewable energy sources and significant reliance on such energy sources is limited without large changes in lifestyle in developed countries.

The upshot: fossil fuels will remain the primary energy source over the next few decades. This is the case both in terms of direct fossil fuel consumption and use of fuel to produce other forms of power (i.e., electricity which constitutes a little less than 50% of the world's total primary energy supply).

The key then is fossil fuels – if there is an ‘energy crisis’ approaching, the problem and solution over the next few decades at least lies in the fossil fuel industry.

The nature of industry and machinery which relies heavily on fossil fuels, the structure and health of the world economy which assumes a constant, cheap supply of fossil fuels, and our lifestyle means simply that reliance on non-fossil fuel energy over the next two decades will remain minimal.

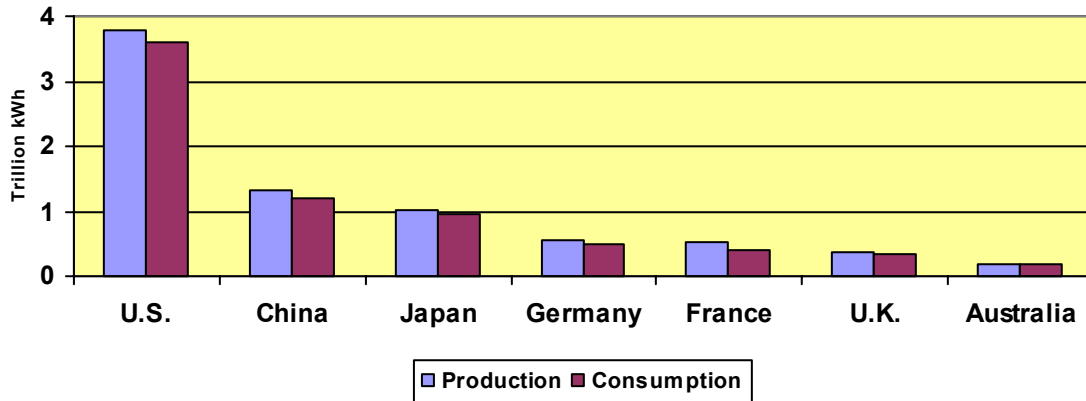
This is the case for a number of reasons and we list them briefly below:

(a) Electricity Production

Electricity is the by far the most common form of household energy consumption.

If we pause for a moment and look at electricity production and consumption, most states only produce a little more than they consume – makes sense as far as relatively rational production levels are concerned – supply levels are close to demand levels.

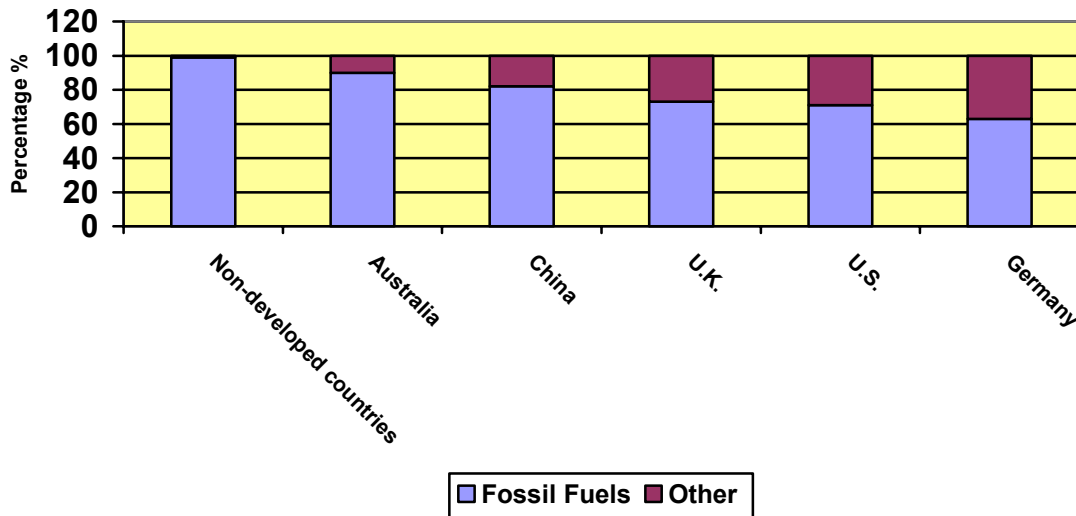
Electricity Production & Consumption 2002



Source: CIA World Fact Book 2002

What is important for us to know however is the source of electricity production. As the chart below shows, most countries, except for a handful of developed countries, rely almost exclusively on fossil fuels for electricity production. Even in developed countries, the reliance on fossil fuels is highly significant.

Electricity Production by Energy Source



Source: CIA World Factbook 2002

The point: As demand for electricity increases, demand for fossil fuels will increase proportionately. As shown above, it is not likely that alternative forms of electricity production will be significant in 2020.

(b) Demand for electricity from poorly developed countries and regions to increase dramatically.

The growth in demand for electricity from poorer countries and regions will far outpace that of developed countries. This is not surprising. As these poorer countries develop, the demand for better lifestyles will increase rapidly, underpinning a huge spike in energy needs. Energy needs will come from three main sectors:

- Domestic Use
- Industry and Agricultural Needs
- Transport

Electricity will be the main source of energy, and as shown above, fossil fuels will be almost the sole source of electricity production in these regions. Non-fossil fuel sources of electricity (i.e, hydro) are simply too expensive and the technology too undeveloped to meet the needs of developing countries. Moreover, genuinely quantum leaps in non-fossil fuel technology that will equal or exceed the lifestyle and productive advantages fossil fuels currently offer are not likely and therefore not presupposed.

Electricity Consumption (billion kWh)

	1990	2002	Increase (%)
OECD	7603	9900	30
Non-OECD	4270	6300	47.5
World	11873	16200	36

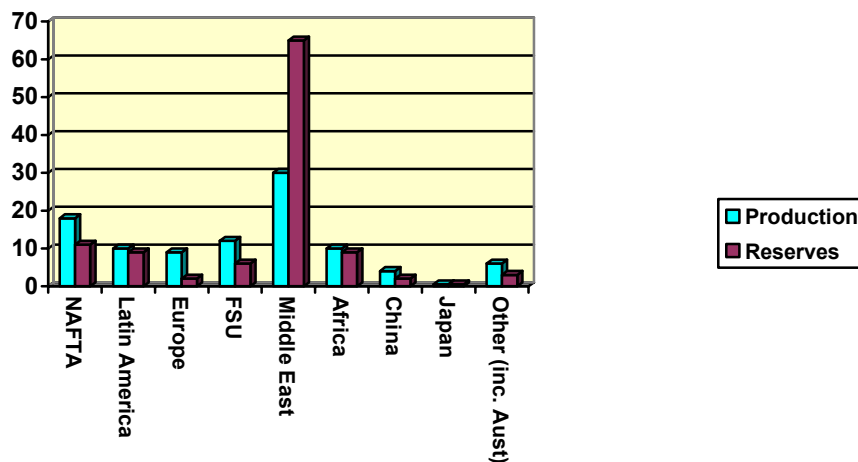
Source: OECD/IEA 2002; L21 Analysis

(c) Constant increases in demand for oil

We saw the chart earlier pointing to an increased reliance on oil in the energy mix. In other estimates, the U.S. Energy Information Administration (EIA) estimates that world demand for oil will rise by between 37% and 90% by 2020. Significantly, the EIA also forecasts that the Middle East will provide between 50%-67% of the world's oil by 2020.

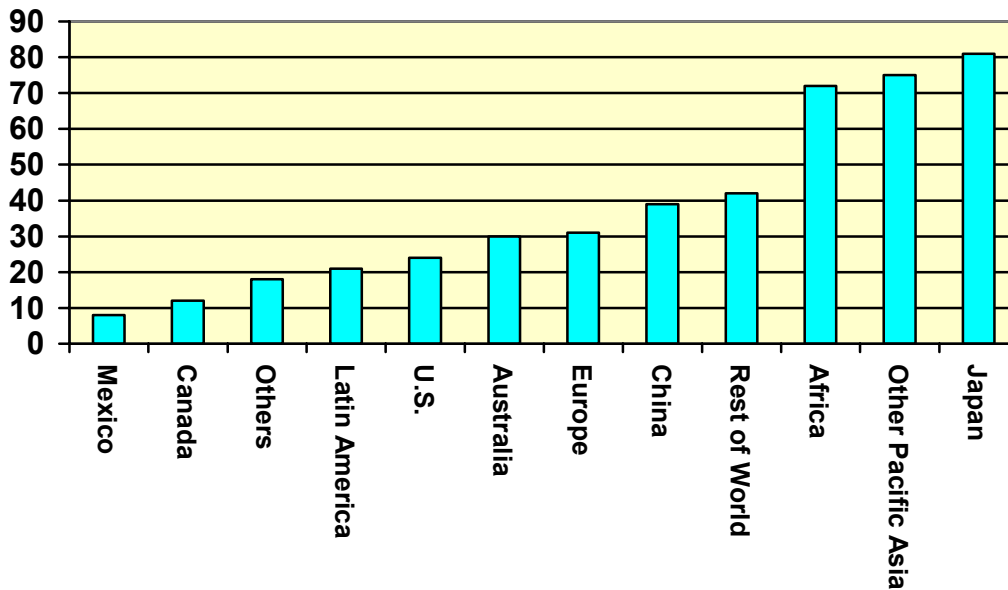
As far as oil is concerned, the Middle East is the key variable which is precisely why Middle Eastern countries with high levels of oil production and reserves punch way beyond their weight in global affairs. The two charts below bear this point out.

2002 Share of world crude oil reserves & production by region (%)



Source: BP, ETLA

2002 Dependency on Middle East crude oil (% total oil imports from Middle East)



Source: BP, ETLA

Crisis? What Crisis?

There's good news and bad news.

The good news is: at the very basic level there is no 'energy crisis' in the sense that there are adequate reserves of fossil fuels for our needs. We did believe 20 years ago that we were going to run out of crude oil by about 2040 but that doesn't seem to be the case anymore after discoveries of more reserves.

But having said that, this is where further challenges and bad news comes in. There are a couple of sub-crises going on in many areas that might lead to a full-blown energy crisis. They are listed below.

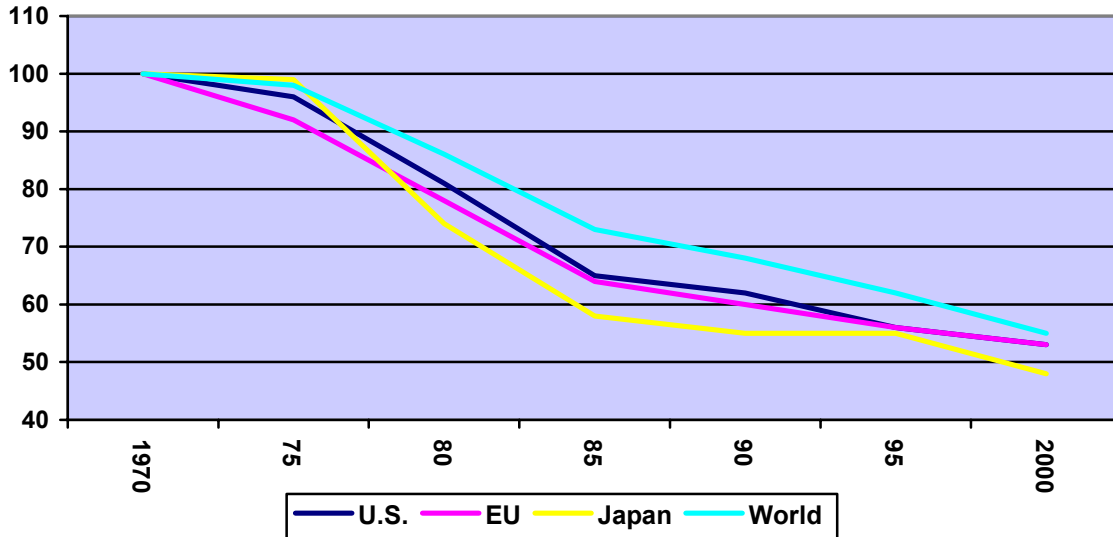
(a) The Politics of Oil

This is a global problem and involves high stakes, the Middle East and developed countries led by the U.S. – a volatile combination.

Even though the value of oil consumption as a proportion of GDP has halved since 1970 due to increased efficiency, other energy sources as a response to

the 1973 oil crisis (see below), oil consumption has still increased by 66% over the same period.

World Oil consumption/real GDP (1970 = 100)



Source: IMF, BP

The '2002 Dependency on Middle East Oil' chart above shows how important Middle East oil is to the major economies. The major economies are the main consumers of oil but do not produce enough for their own needs. They are hence net importers of oil, mainly from the Middle East. Japan heads the list at 80% but the U.S., Australia and Europe still receive between 25-30% of their oil from the region. It is also important to note that even though the U.S., for instance, is a significant producer of oil, reserves (oil still in the ground) are relatively low and the U.S. is a net importer of oil. This means that the U.S. does not produce enough for their own needs, does not have sufficient known reserves to meet future needs and relies heavily on the Middle East for oil imports. It is therefore not surprising that President Bush has been controversially looking to allow oil exploration in Alaska.

For our purposes, it is easy to see why events in the Middle East matter more in oil terms than in any other region.

It is important to understand the structure of the global oil industry. The industry does not operate in a free market environment that depends wholly on pure demand and supply. If it did, experts estimate that oil should remain at about

US\$10 a barrel. Rather, the oil industry is dominated by a cartel of major oil producers – OPEC – which set artificial quotas on production and supply.

Much of the talk is about OPEC. It is important to note that OPEC does not include all the oil producing countries in the world but does include most of them (Algeria, Indonesia, Iran, Iraq, Kuwait, Libya, Nigeria, Qatar, Saudi Arabia, the United Arab Emirates and Venezuela.) In 2002, the combined share of OPEC oil production compared to world production was 41% while known reserves was at 78% of known world reserves. Clearly, OPEC is the most significant body and highly industrialised countries such as the U.S. are in a constant lobbying/give-and-take relationship with OPEC in order to secure higher quotas of production and supply and hence lower prices. OPEC is also a net exporter of oil and has excess production to cover shortfalls in conflict situations. Currently, OPECs stated desirable barrel price is between US\$22-28 a barrel.

Remember that it is in the economic interests of these oil producing countries to provide services as normal in order to compete for market position. This includes both countries within OPEC competing and non OPEC producers competing with OPEC.

What's the big deal? Net oil importers depend on countries like Saudi Arabia (and soon Iraq) for oil. However, the governments in many of these countries are plagued by certain tensions. Were oil prices to fall to its market value of about US\$10 a barrel, the loss of oil related revenue for many Middle Eastern regimes would be disastrous for them – they depend heavily on provision and subsidisation of basic services to maintain power and authority.

However, if oil prices were to rise too high, several things would probably happen. First, relations between the oil producing nation or organisation selling expensive oil and with especially the U.S. would deteriorate. In the case of the Middle East, the U.S. who is currently effectively subsidising several regimes in oil producing countries might consider a change of policy. Moreover, non-OPEC producing nations would increase their market share, decreasing the market share of OPEC. And finally, there would be a forced dependence on other forms of fossil fuels effecting long term damage to the oil industry. Given the relative cheapness of oil, this would most likely raise energy costs above levels we are use to.

The key then is stability in the supply and price of oil. U.S, and first world support for OPEC currently guarantees this. Indeed, OPEC serves several purposes that keep oil supply flowing at the levels and prices we expect:

- The current structure and operation of OPEC effectively entrenches the short and medium term political and economic interests of all parties which in turn creates stability of supply in the oil industry. Both the developed world and OPEC members need OPEC with the result: relatively stable oil

supply and prices. It would not be in the interest of these two groups (for various political and economic reasons) to have a completely deregulated global oil market. For countries like the U.S., OPEC allows a forum to negotiate a guaranteed supply of oil at a set price range; for countries like Saudi Arabia, OPEC creates for them a reliable market in which to sell oil at a price higher than its true market price.

- OPEC creates a forum where differences are settled before such differences affect oil supply. This is critical for the world economy.

What is the problem then? Basically, the problem is uncertainty in the politics of the Middle East. Many regimes in the Middle East are either hanging on by a thread, have populations that are suspicious of the developed world, or both. This forces, for example, the U.S, to prop up regimes like the Saudis they really do not like very much – it is within this rubric and resulting uncertainties that any crisis would lie.

(b) Local supply inefficiencies

This was brought to attention when California declared a State of Emergence on 16th January as hour-long blackouts hit the northern part of the state. Known previously as an innovative and dynamic market, new laws were passed to allow the State to buy electricity on behalf of the two largest retailers, Southern California Edison (SCE) and Pacific Gas & Electric (PG&E). This was needed because both SCE and PG&E had their facility to buy power with credit withdrawn due to defaults on credit payments. This was exacerbated by generators who had been exporting electricity to retailers in other States with a better credit history.

How did this humiliating episode occur? The Californian market was set up with the intention of delivering benefits of competition and lower prices to consumers – a noble goal. However, for various reasons, while the wholesale market was deregulated, the retail market was stuck with a price cap. New entrants to the retail market were also discouraged to sweeten the deal for existing retailers. The supply crisis occurred when a combination of factors began to drive the wholesale price of energy above the retail price cap. In hindsight, market designers got it wrong in believing that the wholesale price of energy would always stay below the retail price cap.

The larger lesson however was about the typical result of irrational market design. A series of events conspired toward the supply crisis which an irrational market design could not handle:

- Excess supply in capacity was eliminated by 2000-01.
- No significant new generation has been installed in the last 5 years in California and very little new generation had been built in the last 15 years

due to stringent environmental requirements and the NIMBY phenomenon (not in my back yard).

- Natural gas prices increased over the same period, which increased costs of generation.
- Weather conditions led to decreases in hydro reserves in other states that would normally be exported to California.
- A retail price cap protected customers from wholesale market prices and provided no signal to consumers as to the true market price of electricity (hence giving them no incentive to conserve electricity.)



DEMAND OUTWEIGHS SUPPLY

In Australia, many problems in the energy sector exist. Government, regulators and other groups tend to take ownership of energy to promote their various interests. As a result of various factors, Victoria and South Australia are dangerously short of generation capacity while NSW and Queensland have overcapacity of about 20%.

In 1993, the Business Council of Australia Energy called for effective competition in energy supply. It wanted electricity to cost as little as possible and prices to be stable. However, there has been little success in creating real competition between generators, the situation made worse by weak links between state electricity grids (thus hampering an efficient market.)

Australia has an electricity pool trading system model, one that was abandoned by Britain and California most recently. This system has proved to be unstable and vulnerable to price manipulation. Under this system, companies can use short-term market power to harm the efficiency of a competitive market. For example, a joint submission by Holden, Visy Paper, Onesteel, WMC and BHP Billiton argued that the present trading system allows “gaming by generators when reserve margins are tight” – in other words, generators can blackmail retailers when reserves are small causing large spikes in electricity prices.

Notwithstanding any reform in the sector, the fact remains that generators in areas where supply is tight hold all the aces since competition in the wholesale market is poor. Hence, following so-called reforms towards the former Californian style ‘trading pool system’, where supply has been high (NSW, QLD), costs have come down, and where supply has been tight (VIC, SA), costs have actually gone up. For instance, in 2001, SA saw a 45% hike in industrial/commercial prices while Victoria will see a 30-35% increase in tariffs in 2003.

Not surprisingly, some large businesses like Amcor and PaperlinX supply a significant amount of their own energy by building their own energy plants!

The situation in Australia has not yet reached a crisis level. However, we are drifting toward such a situation while markets are anti-competitive and operate inefficiently. The system can handle the true market cost of energy since ultimately it has to but it cannot handle volatile prices due to anti-competitive behaviour or unpredictable supply as a result of standoffs between wholesalers and retailers trying to manipulate the market.