

The Electricity Market Operation.

Australia is heavily dependent on coal (about 75%) and increasingly on natural gas (about 15%) for the supply of its electricity, with less than 10% coming from renewable sources, most of which is in fact from the existing Hydro Electricity plants in the Snowy Mountains and Tasmania, brought over on the Basslink cable . As the overall demand is increasing steeply, from both population growth and increased consumption per head, and with global warming challenging the uncontrolled use of coal as the fuel of choice, the industry must look to maximise whatever supply capacity there may be available to it, and uses the "Market" to do so.

Once owned by each States' giant Electricity Authorities, the industry has been now corporatized into three separate layers of companies, Generators, Distributors and Retailers.

The Generators:- There are now some 40 established, ranging from the huge steam plants on the coal fields to smaller community oil fired installations. Some of the better known are, Hazelwood and Loyang in the Victorian Latrobe Valley, Wallerawang and Bayswater on Lake Macquarie using Hunter Valley coal, with Liddell NSW and Cockburn WA using natural gas. To complete the picture there can be added a few bio generators using sugar cane waste or rubbish dump gas and a small but increasing number of wind farms. Domestic roof-top solar PV installations, though trendy and with Government subsidiaries in several forms, still provide a rather insignificant amount of power. Of particular concern; many of the large coal plants have reached the end of their design lives and are overdue for replacement. But with what? Public opinion would not countenance new fossil fuel burning plants puffing away for the next 50 years.

The Distributors:- Some 15 power distribution companies have been formed, with the mandate to own, operate, maintain and expand the vast mesh of transmission lines and switch yards, known as the grid, which carries the power from the Generators to right through to householders' and industries' door. These Distributors, though largely unknown to the general public, are a vital link in the operation and delivery of electricity.

The Retailers:- An ever increasing number of companies now operate, about some 40 odd in number to-date. These are licensed to provide geographically overlapping commercial competition and thus the lowest prices to the end users, the householders and industries, by competing on price and services offered. They are well known companies by now, Origin Energy, AGL, TRUenergy, while many others operate with more regional focus; these are the public face of the industry. Retailers do not own or maintain any power lines.

Company ownership and control of these entities at all three levels presents a strange mixture. Policies, arising from the social philosophy of each State Government over the years have given rise to both jealously owned State entities and privatised ownerships with foreign and Australian investment, and Stock Exchange listings.

But it all seems to work, despite the complication.

Mandatory Renewable Energy Targets.

To begin the process of enforcing green house gas reductions in anticipation of an Emission Trading Scheme, the Commonwealth Government has set Mandatory Renewable Energy Targets, as an obligation on Australia's electricity Retailers. This obligation requires them to increase their renewable sources of the electricity supplied by the year 2020, to 20% or face penalties, to be imposed at the rate of \$40 per MWh of shortfall. Retailers are thus compelled to compete with each other-

- 1)- in buying the limited available renewably generated electricity from the few renewable generators via the wholesale market.
- 2)- in buying and cancelling Renewable Energy Certificates, RECs, from those installing new renewable generating plants,--usually only the wind farms to date.
- 3)-and in purchasing Credits on the Emission Trading Market which may to open in 2010.

The mutual competition for these limited Credits is designed to send the market price for renewable energy up to whatever is necessary for those obligations to be discharged. In so doing, the supply of renewable generation capacity is expected to increase, as renewable Generators should receive a return, per MWh, well in excess of the price that the coal Generators receive, thereby justifying the new plant investment---and so meeting the very valid intention of the scheme in the first place.

It is the value of these purchases that Retailers, too often erroneously market to us as their "Green Electricity", though there is not much "Green" to it.

Emission Trading Scheme, ETS

Assuming the UN will agree to a Carbon Emission Reduction Scheme, and Australia establishes an ETS, the Generators will be issued with Credits, permits to emit a specified amount of greenhouse gas, and initiating a tax if permits are exceeded. These Credits will be tradeable on the ETS Market. The intension is to increase the wholesale price of electricity from fossil fuel Generators in order to give commercial advantage to the more efficient plants and especially to non carbon, renewable Generators, thus stimulating new renewable installations. Funds raised from this extra tax should then be use to compensate those individuals and industries disadvantaged by the higher electricity cost, and controversially, to compensate the investors in existing Generators for loss of income. There are some who believe an ETS is far too complicated, and that a direct carbon tax would be more effective, while others of course, object to a new tax in any form. All this is highly political at this date, and it may take the 2011 Federal Election to give a definition of how Australia will treat the industry on this crucial issue.

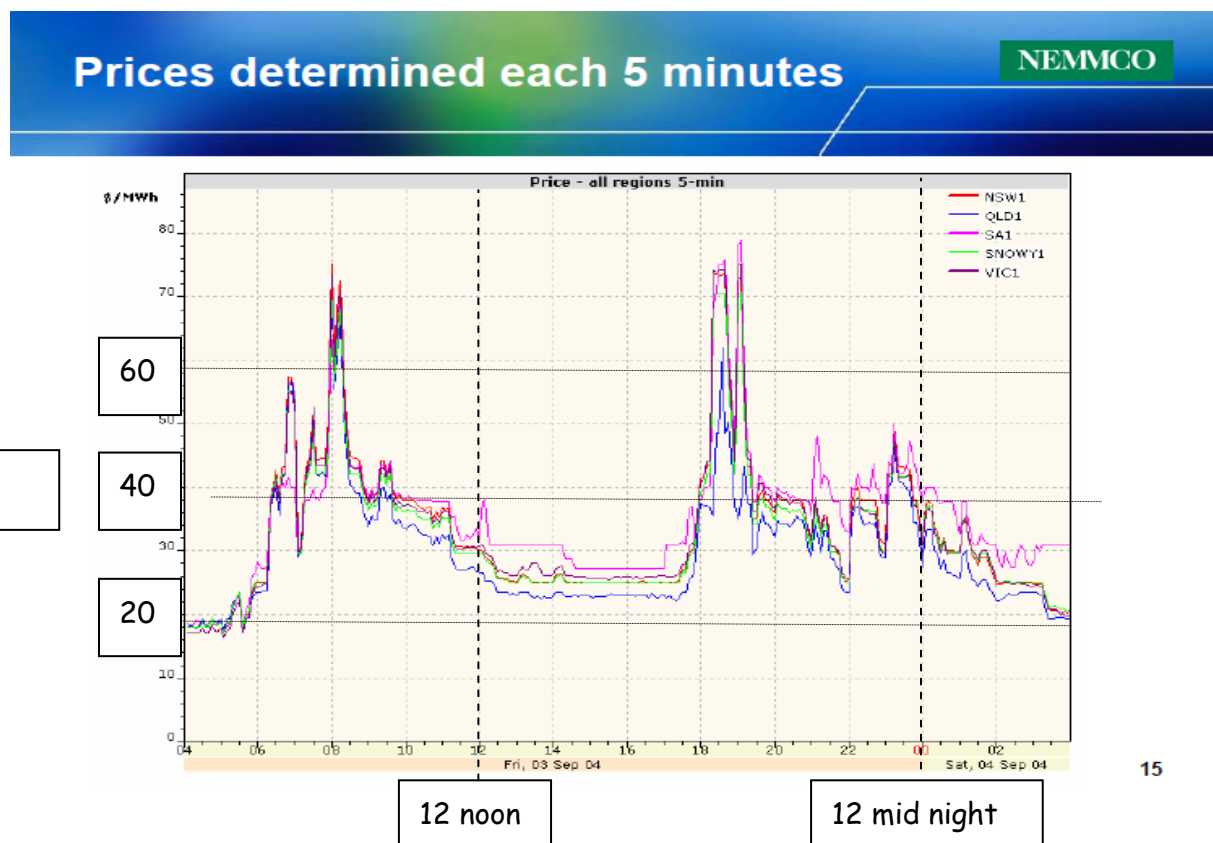
One loop hole that worries carbon reduction advocates is this third alternative, for it opens possibilities for Retailers to buy what are often called "Green Credits "or "Farm Credits" from quite doubtful schemes. Schemes such as tree planting in un-supervisable foreign jungles, or stopping land clearing, clearing that may well have been stopped by the drought, are commonly criticised. By obtaining credits in this way they side step the obligation to foster the construction of genuine low carbon dioxide emission plants.

The National Electricity Market.

The market operates thanks to the 4,000km East Coast grid and a smaller, similar one in the West, whereby the *Generators* offer their deliverable capacity to the grid, and all the *Retailers* purchase their requirements from the grid, with all the market sophistications of long and short-term contracts, spot and futures trading; creating an enormous turnover of \$12billion in 2007 for example. The National Electricity Market's day manager estimates the amount of electricity that will be needed in each 5 minute interval of the day, and calls for bids. The *Generators* offer the amount they plan to generate and their asking price for each interval, and are selected on the basis of the lowest price first, until the demand is met. It's all that dynamic!

One feature of the market, seen by some as a disadvantage, is that the more flexible a *Generator* is, the more it can withhold supply and only offer for times yielding premium prices. At the other extreme, the least flexible, the steam plants must wastefully "blow steam" if out bid and faced with an unforeseen drop in demand.

Here is an example of the price variation for a typical day from the market operator.



Recoverable Energy Certificates. --RECs

To further encourage investment, the Government issues Renewable Energy Certificates, RECs, to those who install any equipment for generating renewable electricity, calculated at one REC for every MWh of electricity it is estimated to produce during its life time. RECs are tradable on the market, \$ 50 per REC at August 2008, but the value is market dependent and varies greatly. RECs are returned by the Retailer to the Government and the MWh value cancelled as discharge of the equivalent amount of obligation. They can also be on-sold as Credits to anyone with an outstanding obligation, or even to speculators. RECs are only issued to the existing Generators for the capacity that they add after the scheme came into force, not for any of their pre-existing capacity. To-date, some 2.5 million RECs have been issued.

Renewable Generators and the Network Control System.

Of course wind and solar generated electricity is available only when the wind blows or the sun shines, a factor that significantly moderates the income these Generators can obtain , as premium prices will only be paid at demand peak, not at any time of the day, nor just when the weather permits. Sophisticated Network Control Centres with highly skilled operation staff manage such fluctuations, and manage to match instantaneous demand to the supply available, 24 hours a day and to the second. It should be remembered that electricity itself is a movement, not a thing that might be put in a can and stored, to used later-it cannot be stored!

It is the ability of the electricity grid to take as much as possible of the renewable energy, whenever it may be available, that creates the possibility for the Network Controllers to schedule lower coal demand that gives wind and solar technologies their usefulness as low CO₂ producers of electricity. There are limits of course, as coal plant output cannot be readily cranked up or down, but fortunately natural gas plants are more flexible, and are invaluable for load balancing, with finally hydro as the last tool before load shedding, the nice word for blackouts, which must ultimately be resorted to should supply be insufficient. The unpredictability of wind and solar renders them ever harder to integrate, especially as a network begins relying on larger proportions of these sources.

The Grid Loss.

There is an inherent disadvantage of the grids, the power lost. Principally as a result of simple heating per kilometre along transmission lines, the power loss is much larger than generally realised. Typically some 10% of the power leaving the generators is lost on the line, an almost unavoidable loss, as coal plants by necessity are placed near to the coal fields, hydro plants in the mountains, with the consumers largely in the cities. Natural gas plants have one advantage in that they can be placed near cities, to reduce this loss.

The Network in Action.

This diagram shows the Victoria's electricity load for the first two weeks of February 2009, and dramatically shows the effect of the daily maximum temperature on the load in the first of those weeks, when Melbourne had three days at 43 Deg C, that were then followed by Black Saturday at 46.4 Deg C.

The now universal usage of domestic air-conditioning is taken as contributing significantly to the size of the sharp peaks on those days.

Each colour represents a specific generating plant as it come on and off line in the period. The coal plants are shown as being more consistently on line in the lower part of the diagram, with gas, hydro, and then wind supplying intermittently in response to the demand. It's a credit to the network that it was able to maintain supply with only limited rolling load shedding occurring for a few hours, though it is believed that much cooperation was obtained from heavy industrial users, like metal smelters, concrete plants, who temporarily lowered their usage to help bridge the crisis.

