



# EnergyWatch

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## Peak Oil: government action please

We know that world oil production will peak 'soon,' and then begin an irreversible, geologically controlled decline. Suppose the Peak Oil brigade (page 18) are right: 'soon' is before 2020, and there will still be no suitable alternatives at anywhere near petroleum production costs. Certainly there are none available now. Coal is Kyoto-busting; even the best deposits of shale oil consume far too much process energy (and in the US it is the same story for bio-ethanol: see page 25); and so on.

In the US, the Bush administration seems to have addressed the peak oil problem and chosen overwhelming military might to secure the lion's share of remaining resources. We discuss possible responses on page 19.

In NZ the 'business as usual' response will be to further subsidise oil and gas exploration; build a coal-to-oil plant; perhaps make energy savings; and of course rejoin ANZUS. This is the broad route the Ministry of Commerce is on. Projections on its website show wind meeting around 8% of new demand as late as 2016–20, with coal meeting more than half. This approach is likely to be disastrous in the medium to long term, with the climate turning nasty and the economy going cold turkey as the US runs out of spare oil for its allies.

Surely the 'Saudi Arabia of wind' (*Harnessing the wind*, page 25) can do better than this. Our ultimate wind resource is an order of magnitude greater than presently needed for electricity sustainability. Wind and hydro are a very good fit: conserve water when the wind blows, for use when the wind doesn't blow. Enough wind turbines can even accommodate a dry year, simply by conserving more water, although there are probably better ways of doing it. And wind is "increasingly economic:" see page 5. Add other sustainable energy sources such as solar, and we

should be well placed for our future electricity.

The table on page 22 shows that our national energy efficiency is very poor. We have little heavy industry (apart from the tailings from Think Big), a very efficient agricultural sector and a benign climate, and yet per-capita energy use is higher than in most European countries. Most consumers could profitably save 20–30% of their energy use on current prices, and probably more at post-Maui, carbon tax-inclusive prices. A local example (page 23) gives 18% savings available at a simple pay-back period of less than two years, on a new plant which should already have good efficiency.

More than half our energy use is for transport, mostly road transport. Too much of it is wasteful, unnecessary or both, and virtually all of it uses oil. Transport is the sector where oil substitution is most difficult. Worse, we have just seen a 10% increase in transport fuel use in two years (page 23). We need to look very seriously at biofuels; energy-efficient vehicles and fleet replacement; as well as demand management, broadly defined to include urban planning and public transport.

Now that we have a government that is only mildly allergic to planning, it is time to look seriously at peak oil. A recent speech by Minister of Energy Pete Hodgson (page 5) is encouraging, but not yet enough.

### EnergyWatch

This edition was intended for publication in June but slipped because of pressure of other work. Our apologies.

The remaining editions in 2003 are scheduled for September and December, as usual.

## More on Maui

John Blakeley, Steve Goldthorpe and Kerry Wood  
Sustainable Energy Forum

In our previous article (EW 28, March 2003) we pointed out that a conservatively estimated billion dollars worth of gas has somehow been 'lost.' We suggested that the reason might be producing gas at too high a rate, although we also said that the gas might have been "never producible economically, or was never there in the first place."

On 28 March the *NZ Herald* published an article by Dr Lloyd Taylor, chairman of Shell NZ (the operating partner and largest shareholder in Maui Development Ltd). This was partially coincidence: Dr Taylor was responding to an earlier *NZ Herald* article by co-author John Blakeley, based on an early draft of the *EnergyWatch* article. The article is worth giving in full:

### ***There's no gas missing from the Maui field***

*Contrary to what John Blakeley wrote, there is no missing, or indeed lost, Maui gas. He did hit the nail on the head when he conceded that perhaps it was never there in the first place. The initial reserves estimate underpinning the Maui gas contract was made 30 years ago when the field was discovered. This estimate, and all those subsequent, including that recently of the independent expert, were, and are, all valid at the time they were made. The point is that they are estimates which lie within a possible range of outcomes. The only thing that has changed through time is that the uncertainty attached to each estimate has reduced with time as the field is produced and greater confidence in the ultimate recovery is gained.*

*Reserves estimation is as much an art as a science. It does not produce a single figure but a reserves range. The latest redetermination exercise carried out by an independent expert has simply estimated the reserves to be at the lower end of the reserves range originally estimated for the field.*

*There is no missing gas; what is missing is a comprehensive understanding of the uncertainty that attaches to any estimate of gas reserves. Such uncertainty is why a probability is attached to the realisation of a reserve estimate — a point that has been completely overlooked by Mr Blakeley, who assumes that a single estimate of reserves has absolute confidence and thus zero uncertainty attached to it. The fact is that there is only absolute certainty of reserves at the point of complete depletion and closure of a field — by which stage we can say with absolute confidence what the reserves were.*

*Addressing Mr Blakeley's three theories as to where the gas might be:*

***Theory one:*** *That estimates in official publications made annually from the mid-1990s of total recoverable reserves were all erroneous.*

*The estimates are not erroneous. They were essentially the mid-point of a reserves range. The reality might now be the lower end of the reserves range, but this could change as further production history and field insight develops.*

***Theory two:*** *That there is something peculiar about the structure of the Maui field and this prevented reliable estimates.*

*There is nothing geologically peculiar about Maui. All that has happened is that estimates of reserves have fluctuated within the uncertainty attached to the estimate of the ultimate gas recovery from the field.*

***Theory three:*** *That excessive gas off-take rates over the past two to three years dramatically changed the total economically recoverable reserves.*

*The rate of off-take has nothing to do with the reduced reserves estimates. The quantum of economically recoverable gas is not determined by off-take, and throughout its life Maui has always been capable of producing quantities considerably in excess of the average daily gas take. In fact, this capacity has underpinned the electricity generating industry through many contingencies, including recent dry years.*

*Looking forward to the coming winter, despite the speculation there is no doubt about the ability of Maui to deliver the gas required to thermal electricity generators, even under the worst-case dry-year scenario.*

Dr Taylor claims that Blakeley does not understand the uncertainty of gas estimates but he fails to make a case. The Maui contract provides for redetermination at intervals of as little as two years — as pointed out in our March article — but why redetermine if there is zero uncertainty? Most of our very limited data comes from the Government's Energy Data File (EDF), whose glossary says:

*Oil and gas reserves are expected reserves, estimated as 'proven and probable' or P<sub>50</sub> (ie with a greater than 50% probability of being technically and economically producible) reserves by the operators.*

As Dr Taylor must know, the uncertainty data needed for a comprehensive understanding is denied to us. We would not be surprised if it is also denied to Government. Notice that when he says (the) independent expert has simply estimated the reserves to be at the lower end of the reserves range originally estimated for the field, he is not telling us whether the Independent Expert's range is entirely

within the original range, or partially outside it.

We are the first to admit that we do not understand all the complexities, but we agree that the initial estimate of the Maui gas quantity will have been fairly rough — not least because of the technology then available. Dr Taylor describes the recent redetermination (88% of the contract quantity) as being at the lower end of the original reserves range, but notice that ‘lower end’ means little when the probability is unstated: the same statement has very different meanings if the probability is 80% rather than 40%.

When a new field goes into production, specialists record carefully how wellhead pressure varies with flow rate; how the ratio of the produced gas and condensate varies; and especially, how these figures vary over time. Using this and other data the uncertainties can be initially narrowed quickly, then slowly improved through the life of the field. The process is complex, but is in principle a series of deductions such as, ‘if extracting volume x reduces pressure by y, then the reserves volume supplying volume x must be z.’

Bearing in mind that Maui is not a ‘tight’ gasfield and is capable of high production rates, our understanding is that estimates of remaining reserves in a well-managed field should be no worse than  $\pm 20\%$  at this stage, and perhaps as good as  $\pm 10\%$ . We are not in the least surprised by Dr Taylor’s claim that:

*...uncertainty attached to each estimate has reduced with time as the field is produced and greater confidence in the ultimate recovery is gained.*

But if this is the explanation for the redetermined reserves, why have the recent revisions of the original reserves been so consistently downwards? If uncertainty is the problem we would expect to see rises and falls, typical of a random process. Given access to the uncertainty data we would expect to see each new estimate falling within previous estimated ranges.

What we actually see is that the changes are all one way and fairly evenly spaced, strongly suggesting a real trend.

In three years the estimates of economically recoverable reserves have gone from 4.4% above the contract quantity to 12.3% below, as shown in Table 1. Comparing the Independent Expert’s redetermination of 1 January 2003 with the three most recent earlier estimates gives the changes shown in Table 2. Each cubic metre of gas extracted is apparently depleting the reserves by nearly 2 m<sup>3</sup>. The amount of gas unaccounted for has been growing alarmingly.

What we actually see is that the changes are all one way and fairly evenly spaced, strongly suggesting a real trend.

**If the recent changes are within the expected range of uncertainty, then the Independent Expert’s redetermination must have been a sham**

**Table 1: Estimates of economically recoverable gas reserves — PJ**

	Original	Remaining
Contract, 1973	4060	—
EDF 1/1/2000	4238	(1627)
EDF 1/1/2001	4130	1324
AEE 1/1/2002	—	>1000
IE 1/1/2003	3562	370

AEE = Assessment of environmental effects, Pohokura gasfield, 22/3/02;  
 EDF = Energy Data File;  
 MoE = Minister of Energy (press release 7/2/2003);  
 IE = Independent Expert.  
 (1627) The bracketed figure is our own estimate, using depletion data from EDF

**Table 2: Comparison of 2000–2002 estimates with the Independent Expert’s redetermination for 1/1/2003**

	EDF	EDF	AEE
Extraction period (yr)	3	2	1
Initial remaining reserves (PJ)	1627	1324	>1000
Extracted gas (PJ)	550	370	180
Remaining gas (PJ)	370	370	370
Unaccounted for gas (PJ)	700	580	>450
Unaccounted for gas (%)	43	44	>43

Dr Taylor’s caution about uncertainty clearly applies here, but apparent changes on this scale seem likely to be something more. Only 15 months ago, Shell were sufficiently confident of Maui reserves to tell the Environment Court that Maui would be the dominant supplier until Pohokura was well established (AEE data). But now we have a 40% plus discrepancy between two estimates of remaining reserves, with three quarters of the gas extracted and (presumably) no new data except another year’s production.

Something odd is going on. If the recent changes are within the expected range of

uncertainty, then the Independent Expert’s redetermination must have been a sham. Unless there is something nasty in the unpublished 2002 data, which has forced a drastic re-think.

If, as Dr Taylor assures us, there is nothing unusual about the geology of Maui, we cannot avoid the conclusion that economically producible gas, included in earlier estimates, is now uneconomic to produce. This might have been a book-keeping exercise, or might have been mismanagement of production rates. In either case we would like to know more.

Dr Taylor seems to tiptoe around that point about production. If the *quantum of economically recoverable gas is not determined by off-take*, why does the contract provide for the production rate to be progressively reduced over the last ten years? If it is practicable to draw gas at high rates right up to closing day, surely that would allow lower costs, by reducing the duration of the very high daily operating costs? As well as allowing Methanex to stay in production. Dr Taylor gives us a clear statement on Maui geology, but will he be so forthcoming about operating practices?

We are left with a strong feeling of being kept in the dark, patronised, and railroaded. All of which leaves us in a position endemic to the Maui contracts, with more questions than answers:

**We are left with a strong feeling of being kept in the dark, patronised, and railroaded**

- Why is Dr Taylor so sure that Maui can *deliver the gas required to thermal electricity generators, even under the worst-case dry-year scenario*? This assurance was made only 3 months ago — does it still apply? Clearly it does **not** apply to the 2004 and later winters.
- Why did Maui go so long with no published redeterminations?
- If there has been only one recent redetermination, what is the basis for changing the EDF figures for total reserves?
- If the uncertainties are so large, what is the value of the recent redetermination?
- What other gas is there in or around the Maui mining licence area? The Ministry of Economic Development's report of September last year refers to undeveloped Maui reserves in the C and D sands: what is the status of that development?
- Why do Methanex think there is another 200 PJ of gas in Maui, beyond the redetermined 370 PJ?
- Who has determined which reserves are and are not part of the Maui contract? Does the Government agree?
- What is the significance of Dr Taylor's claim that reserves *could change as further production history and field insight develops*?

Two more points may help to explain some of this:

- One of us recalls a study made 20 years ago estimating that the Maui A platform would have to close in about 2007, because of the risk of fatigue cracking of the Maui A tower. The exact date will have been refined since.
- We understand that the Maui partners are entitled to close the field when their operating

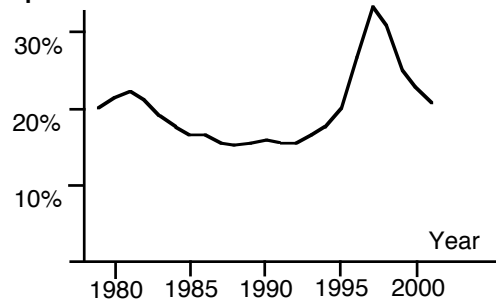
costs exceed their income.

Here, perhaps, lies the significance of the condensate production curve included in our March article, which rose to such a sharp peak in 1998–99. We reproduce it again below. Condensate represented roughly half of the Maui partner's income in 1998, more like a third last year.

It is almost as if someone has reversed the ultimate reserves determination process described by Dr Taylor; starting with a closing date and working backwards. Such a decision could have been taken before the steep rise in condensate production, and the closing date chosen might have been around 2006. Perhaps development of Pohokura was planned so that it would be safely in production by then, to keep the customers happy. But if this was the plan, something got in the way, possibly something in the 2002 production data.

We can only hope that the Ministry of Economic Development (who perform the residual functions of the old Ministry of Energy, including the EDF) have a good team of lawyers, who are looking carefully at both existing and future contracts for petroleum development.

**Figure 1: Proportion of Maui energy produced as condensate**



(After this article was written, the Dominion Post gave further information from Dr Taylor (27 June):

- Maui delivered all the gas generators asked for this year.
- Maui has capacity to deliver twice as much as required in a normal year this year and next year.
- Maui will not start to fall off rapidly until 2006.
- Generators [read Contact] were asking for less gas from Maui because they wanted to stretch out their entitlement, not because it was not available.

See also Methanex on page 23

— EW)

# Electricity growth and sustainability

Pete Hodgson, Minister of Energy

*(An edited version of an address to the Electricity Engineers' Association of NZ Conference, 20/6/2003 — EW)*

You've chosen as your conference theme the idea of 'the growth dilemma.' Calling it a dilemma implies a fundamental conflict between growth and sustainability. I shall argue that we can cope with growing demand for electricity while progressing towards a more sustainable industry. We can achieve this by advancing on three fronts:

- Increasing investment in renewable sources of energy for electricity generation;
- Increasing the opportunities for demand side participation in the electricity market; and
- Increasing energy efficiency and conservation.

## Renewables

I recently announced new measures to improve long-term supply security. This will involve the new Electricity Commission contracting for reserve generation to run in very dry years. That plant will be thermal — a fact that has led some to conclude that the government is set on entrenching reliance on fossil fuels. In fact reserve generation will be thermal for good reasons, and will not detract from progress towards a sustainable system.

Reserve generation will not use renewable energy sources because it must be available to run, hard, when needed. It must run whether or not rain is falling, wind blowing or the sun shining. Reserve generation should not run on renewables because, ordinarily, it will not run at all. It simply makes neither economic nor environmental sense to have renewables standing idle. The fuel is free and clean, and should be used as much as possible to meet daily demand.

The distinction between new generation needed to meet normal demand growth and reserve generation needed for dry years is an important one. At current growth rates, New Zealand needs to build new generating capacity at around 150 MW/yr to meet demand and maintain an adequate reserve. Between 1996 and 1999 more than 1250 MW of new capacity came on-stream, an average of around 300 MW/yr. In early May I released information on industry plans for new

generation totalling more than 900 MW by winter 2006. The bulk of new investment in ordinary generation over the next 20 years is expected to go into renewables, simply because they are increasingly economic. There will be significant new wind, geothermal and hydro generation. Some combined cycle gas plant and co-generation will be in the mix, but the dominance of renewable energy will ensure continued progress, overall, towards environmental sustainability.

The Government is encouraging that shift in a number of ways. In September 2001, I released New Zealand's first National Energy Efficiency and Conservation Strategy (NEECS). Among other things, this includes a national target of an additional 30 PJ of consumer energy from renewable sources by 2012. NEECS commits the Government to a wide range of measures. The electricity policy changes I announced last month included two important measures that will foster growth in renewables:

- Firstly, the opportunities for lines companies to invest in both ordinary and reserve generation will be increased. In 2001 we amended the Electricity Act to allow lines companies to invest in new renewable generation without limit. That law will be further amended so they can own reserve generation without limit and ordinary generation of up to 25 MW, or 10% of their load.
- Secondly, to encourage the development of distributed generation projects — that is, those connected to local lines rather than the national grid — lines charges will be regulated to ensure such generators pay no more than is reasonable for the additional costs that lines companies incur. Distributed generation often consists of renewable energy projects and can include some quite large ones, like both of this country's existing wind farms.

We are also encouraging renewable energy through the RMA and climate change policy. A Resource Management Amendment Act will come into force on 1 August. It is designed to improve the implementation of the RMA, partly through streamlining the resource consent process. These changes will benefit existing and potential generators. Further amendments are planned, including one to allow councils to give greater weight to the value of renewable energy. The law will give explicit direction on the national importance of renewable energy, with improving energy efficiency a key national objective.

Developing more renewable generation will help us meet our Kyoto target, to the extent that renewables displace thermal generation in the normal running order. We have already begun

taking advantage of the opportunities the protocol offers for encouraging new renewables. In the last couple of months we have allocated carbon credits to two wind farm projects, TrustPower's 36 MW extension of the Tararua wind farm and a new wind farm of 40–80 MW proposed by Meridian. Together these will triple or quadruple New Zealand's current wind generation capacity. They prefigure the climate change projects mechanism, which will provide emission unit incentives to other projects that reduce greenhouse gas emissions. I expect at least some of these will involve more renewable energy.

A call for proposals in an exploratory tender round for projects will go out soon. Our intention is that projects rounds will be held at least annually after that. We have decided, for this coming round, that projects that would improve NZ's electricity supply security will be given priority.

### **The demand side**

The second front I said we must advance on, towards a sustainable electricity system, is demand side participation in the electricity market. Of course the supply side is important, but historically it has absorbed the attention of policy makers in this country to the exclusion of the demand side, and that has been our loss. Improving the opportunities and incentives for electricity consumers to manage their demand actively is an essential part of breaking the link between economic growth and growth in energy consumption.

Most large, energy-intensive businesses with some exposure to the spot market are already active managers of their demand, but many medium-sized users — those consuming around 5–10 GWh/yr — do not have such opportunities and incentives. These are sites such as hospitals, factories, airports, ports, large commercial buildings and universities. A report from EECA late last year identified 400 MW of demand reductions that could be available from about 500 medium-sized sites if their ability to manage load was improved.

Regional demand exchanges can help these users save energy and money by providing clear and timely price information, allowing them to reduce or shift load, or switch to embedded generation, when it makes sense to do so. One such exchange is now serving some South Island users, while a second one in Auckland is in the early stages of development. The new Electricity Commission will be responsible for ensuring that regional demand exchanges are available nationwide.

The Government will contribute just over \$M 1.0 over the next two years, through EECA, towards the establishment of these exchanges. The use of demand exchanges will be a significant advance on current energy management practices, so there are some knowledge barriers to overcome. The expected electricity savings from demand exchanges are expected to be up to 100 GWh/yr by 2005–06, a useful result from what is currently one of the less responsive consumer sectors.

### **Energy conservation**

Again, the driver of Government action is NEECS, which sets the target of a 20% improvement in national energy efficiency by 2012. I will mention a few recent developments from the wide range of actions in the Strategy.

EECA's energy audit programme, which identifies opportunities for businesses to use energy more efficiently, is being expanded and will offer more heavily subsidised audits to large electricity consumers using more than 10 GWh/yr. The users will contribute around 20% of the costs and will be committed to acting on the results.

With extra funding of about \$M 1.5 over the next two years, this programme aims to audit a total consumption of 10 000 GWh — about a quarter of NZ's electricity use. The expected savings reach 250 GWh/yr in 2005–06.

Other energy efficiency programmes to be expanded are the EnergyWise Home Grants scheme, which supports projects that insulate the homes of low-income families, and the Crown Energy Efficiency Loan scheme, which funds energy efficiency improvements in the public sector. Both were increased in this year's Budget, by about \$M 1.0 each. As a result the home grants scheme will allocate around \$M 3 to residential retrofits in the coming year, improving the energy efficiency of more than 4000 homes. The Crown Loan scheme doubles in size and will help us towards the NEECS target of a 15% improvement in energy efficiency in the public sector by 2006.

These are all small steps. I have not told you today about anything that will produce a great leap forward for renewables or energy efficiency. But I am saying there is a good story to tell about real, incremental steps towards a more sustainable electricity system. We will reach for that by making steady, practical improvements across the economy and society.

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## CAE supports distributed generation

A major new study has found that distributed generation has the potential to provide up to 40% of future demand growth in New Zealand. Releasing the report, Centre for Advanced Engineering executive director Dr George Hooper says, "Distributed generation has a real role to play in securing New Zealand's long term energy future."

Consumption is growing at about 2% / yr, and distributed generation can supply some of that growth without investment in large new plant. It can also help reduce transmission constraints. Hooper says, "Localised generation provides an alternative to expanding the capacity of transmission and distribution networks." It also means that stand-by generation and fuel switching become economic options for customers exposed to the spot market.

Other benefits include smaller, more fuel-efficient and lower cost generation plant; and plants to use waste fuels such as forest residues and landfill gas. Hooper says distributed generation is not just about energy generation from renewable sources. "It is about providing a diverse energy base for generation and, indirectly, better management of the existing electricity asset base. For some time yet NZ will continue to be reliant on fossil fuels to meet peak demand. Renewable energy types of distributed generation will need government support and will remain a small contributor."

But he says distributed generation will not realise its potential if left to chance. "We must have a regulatory regime where distributed generation and demand-side management opportunities such as energy efficiency compete on a level playing field with large-scale generators supplying the central grid. The full potential of distributed generation will only be realised with the establishment of an 'engineered' secondary energy trading market which is complementary to the existing wholesale market, but with different cost structures and benefits. The market is already emerging as distributed generation is installed around New Zealand. As it develops further it could involve on-selling or buy-back of surplus electricity capacity and it will be characterised by very localised arrangements, open access, and risk sharing between suppliers and consumers which encourages improved environmental and energy outcomes."

Centre for Advanced Engineering, 25/6/2003

## Controlling transport CO<sub>2</sub>

Climate Change Info, 23/4/2003

The Energy research Centre of the Netherlands (ECN) has published a report, *International CO<sub>2</sub> policy benchmark for the road transport sector: Results of a pilot study*. Increasing CO<sub>2</sub> emissions for road transport stress the importance of a more mature climate policy for this sector. This idea has been picked up by 11 European countries (Belgium, Czech Republic, Denmark, Finland, France, Germany, Italy, The Netherlands, Spain, Sweden and the UK) that participated in the project.

The primary objective was to benchmark transport policy instruments reducing CO<sub>2</sub> emissions. Benchmark criteria included CO<sub>2</sub> reduction effect; CO<sub>2</sub> cost-effectiveness; and public acceptance. Of the policy instruments considered, CO<sub>2</sub> emission standards, eco-driving and highway speed limits are regarded as promising. The ACEA covenant on CO<sub>2</sub> emission for new cars is seen as an important EU-wide Kyoto measure, but rebound effects (greater use as distance-related costs fall) and a shift to diesel are points for attention.

Eco-driving is a strikingly positive measure when extensively guided and supported by economic incentives. Lower highway speed limits with increased enforcement reduce CO<sub>2</sub> emissions and have a positive effect on safety and noise. Taxation instruments could be promising when they are designed to support emission reduction (such as CO<sub>2</sub> differentiation of road and sales tax).

Stimulation of bio-fuels and modal shift measures are seen as less promising. Bio-fuels are expensive and raise questions about more efficient use of biomass. Modal split options (both for public and freight transport) need substantial investments but reduce congestion and have positive social aspects. The CO<sub>2</sub> effect however is often small.

Tradable emission permits are not considered effective for the transport sector, because other sectors of the economy are often cheaper.

This pilot study clearly demonstrates that involvement of co-operating and supporting countries is a pre-condition for a successful benchmarking exercise. Benchmarking as an instrument itself can only be successful if instruments can be compared on an equal base with respect to availability and quality of the data, methods that are used and assumptions that are made to produce the data.

The full report is on the ECN website (pdf file):

<http://www.ecn.nl/library/reports/2003e/c03001.html>

# Sustainable energy development for NZ

## Converting a power crisis into a sustainable energy development opportunity

*(An edited version of a discussion paper on the electricity crisis, prepared by SEF and released in mid-May — EW)*

### Part 1 Background

Historically, New Zealand has been fortunate in having plentiful resources of primary energy, used to deliver cheap electricity to industry and homes. This led to an expectation of cheap, unlimited electric power. For some industries, notably aluminium, this expectation was a primary reason for the location in NZ. Now it is becoming clear that the high level of demand, engendered by plentiful supplies, cannot be sustained. The challenge is to realign supply and demand, and progressively phase out wasteful use, to meet NZ's needs for the long-term.

The power crisis presents two distinct problems: the instantaneous supply of megawatts (MW); and the longer-term supply of gigawatt hours (GWh). Addressing one problem will not necessarily benefit the other, and may even aggravate it.

#### Megawatt supply

Unlike other forms of energy, electricity supply is vulnerable to complete collapse if supply cannot meet demand, even momentarily. The supply of MW requires sufficient active and reserve generation capacity to be always available. NZ is much better placed to solve this problem than many countries because of the high level of hydroelectric capacity, which has some flexibility to be called on as required.

In addition NZ has (or had) an infrastructure which permits non-critical applications (such as domestic water heating) to be switched off to avoid short demand peaks exceeding capacity.

Where problems remain with the supply of MW, the solution lies in technical innovation and organisation of both the supply and demand sides, to meet all the technical and safety requirements for a reliable, continuous system.

#### Gigawatt-hours supply

In contrast, supplying GWh is a resource allocation matter. It requires sufficient fuel resources and

generation capacity in place to convert primary energy resources into electricity as needed. The solution to the GWh problem lies in defining a long-term vision for sustainable energy supply for NZ, and then working back from that ideal to identify where there is a need for temporary expedients to assist with balancing supply and demand in the long and short term. Solutions to the annual GWh problem free up short term hydroelectric capacity to be used to address the MW supply problem.

### Completely renewable electricity supply for New Zealand by 2020 — can we get there?

The Sustainable Energy Forum suggests that complete elimination of fossil fuel electricity generation in New Zealand by 2020 is a valid and affordable target:

- Renewable resources are abundant and diverse, in comparison to those available in many other countries.
- Fossil fuels are a finite capital asset, which on a national and global basis are being quickly depleted. Long-term reliance on fossil fuels is inherently unsustainable.
- Fossil fuels are storable and transportable, and can therefore be used to provide direct energy at the point of use. This is generally more efficient than conversion (with large losses) to electricity.

Because of existing hydroelectric infrastructure, we are already well over half way towards the sustainability target. Maintenance and improvement of that resource, plus development of other renewable energy resources can provide electricity indefinitely. Combined with demand reduction, a balance can be achieved.

Renewable energy resources are often unsuitable for direct supply. Conversion into electricity is often the most appropriate means of capturing that primary energy for delivery to the end user.

Recognition of the size of NZ's available resource will provide a basis for allocation, replacing the expectation of unlimited supply (with consequent profligate use). Adoption of a new paradigm of efficient use of a valued resource — to replace the 'cheap and plentiful' paradigm of the last century — will require recognition of the inherent strengths and weaknesses of each of part of the electricity demand / supply balance.

#### Contributors to achieving electricity demand/supply balance

Conservation: Avoiding electricity wastage provides a win-win outcome for both the consumer and the supply system. We replace the



washer on a dripping hot tap because it is easy to see the waste. Seeing electricity losses needs more astute observation. Conservation includes switching off unused lights and standby appliances, but without depriving users of needed electricity.

**Efficiency upgrades:** Adding insulation to ceilings and floors cuts energy bills and makes houses more comfortable and healthy. Changing to more efficient appliances, such as heat pumps and energy-efficient light bulbs, typically pays back in two to five years. But the value to the national energy system is even greater, because these upgrades reduce MW demand in critical winter peaks, as well as saving GWh.

**Energy supply substitution:** Substituting other sources of energy, such as solar water heating, firewood or pelletised wood, has the potential for major electricity savings. Another form of substitution is free-standing LPG heaters, which utilise currently plentiful by-products of oil and gas production, but this is a temporary expedient not a long-term solution.

**'Smart' houses (and businesses):** It is now possible for consumers to monitor and control electricity use. Demand management can make a major contribution to the MW supply problem by smoothing out demand profiles.

**Distributed generation using renewables:** Local capture of renewable energy resources can contribute to GWh. Most renewable resources are intermittent but they usually peak at differing times, creating diversity that helps to solve the MW problem by smoothing bulk demand.

**Distributed generation using fossil fuels:** The use of small fossil fuel generators, to provide local security of supply and to overcome transmission constraints, is a temporary solution of the MW problem. However, the lower thermal efficiency of stand-by generators aggravates the GWh supply problem by consuming fuel inefficiently.

**Hydroelectric generation:** Hydro stations supply GWh renewably. They also address the MW problem, because most hydro generators can respond to hourly demand fluctuations.

**Wind generation:** Wind turbines supply renewable GWh but have no storage capacity. Although they generate only intermittently, their supply is rarely wasted because there is a synergy with hydroelectricity. Solutions of the annual GWh problem have the effect of freeing-up short term hydroelectric capacity to address the diurnal MW supply problem. Wind turbines can be deployed very rapidly, and even moved if necessary to

overcome transmission constraints.

**Geothermal generation:** Geothermal schemes are steady state base load suppliers of GWh. Geothermal resources differ from fossil fuel resources in that they cannot readily be used in more productive applications.

**Co-generation:** The integrated supply of industrial energy services and electricity is an efficient use of fuel resources. Co-generation contributes to the supply of GWh, but, since the timing is driven by on-site demand, co-generation provides no assistance with the national MW problem. Biomass co-generation schemes have the added benefit of long-term sustainability.

**Gas fired generation:** At present gas fired generation is used as a main supplier of peak MW and supplementary GWh. However, the high efficiency combined cycle (CCGT) plants are not well suited to hourly load following. During the Maui era, plentiful supplies of natural gas were available as a by-product of oil and condensate production from the Maui field. With Maui closing soon, the rationale for converting the remaining high value natural gas resource into low value bulk electricity has gone. Similarly the possible future importing of Liquefied Natural Gas (LNG), if the gas market cannot be met from indigenous resources, does not logically have a contribution to make to bulk electricity generation.

Several of NZ's other gas supplies, notably Kapuni, have a high content of CO<sub>2</sub>, which makes them unsuitable for reticulation without expensive, non Kyoto-compliant CO<sub>2</sub> stripping. Natural gas with a high CO<sub>2</sub> content can be used untreated in a CCGT to generate electricity, however, such use would compromise New Zealand's Kyoto obligations and should therefore only be considered a temporary expedient.

**Oil-fired generation:** Heavy fuel oil is a by-product of transport fuels refining from crude oil. Unlike gas, it has no premium market, and environmental issues limit its application and flexibility. Oil fired generation is a short term expedient to address the GWh problem, but the cost of addressing its environmental consequences now limits its applicability.

**Coal fired generation:** Coal is a plentiful, indigenous primary energy resource. NZ has one large coal-fired power station at Huntly, currently a principal supplier of GWh in dry years. The capacity of Huntly power station is greater than the range of annual hydro variability over the last decade. However, routine use of coal is inconsistent with NZ's Kyoto Protocol obligations.

Carbon dioxide capture and sequestration from

coal fired power stations has been extensively studied, but expectations of a technological breakthrough to a mainstream technology — largely emanating from the USA — stray into the realms of science fiction.

### **Balancing the contributions**

Consideration of quantified assessments of these contributors to the electricity demand/supply balance will lead to a road map for developing electricity and other non-transport energy services in NZ. Only when that road map is defined and agreed can we progress along the road to a sustainable energy future.

The purpose of the electricity market mechanism is to provide NZ with a means of navigating along that road by:

- Providing valid signals to encourage appropriate investment in infrastructure and demand management;
- Providing incentives for actions that simultaneously solve the MW and the GWh problems;
- Avoiding the entrenchment of options that are better seen as temporary expedients; and
- Providing barriers to activities that impede progress on our journey towards a sustainable energy future.

In this context the mechanisms of the electricity market are further discussed.

## **Part 2: NZ's electricity market and the power crisis**

The 2003 winter power crisis follows hard on the heels of the winter 2001 shortage. Neither was an electricity crisis as generally portrayed. They were caused by a serious shortage of primary energy — the GWh problem. 'Fixing' the electricity market, or building new power stations, will not fix the underlying cause. The fact is that NZ no longer has large reserves of rapidly deliverable fuel from the Maui field. Coal and imported oil are the only conventional fuels now able to make up for hydro shortages in dry years. New gas resources will be more costly and may be less able to increase their output in dry years.

New primary energy sources will be priced much higher than Maui — which has been squandered because its low price led to petrochemical projects to use the surplus gas. Thus the call by the Major Electricity Users Group for, "sustainable low electricity prices" reflects a dated 'think big' mentality: it cannot be met without subsidy.

New large-scale power stations, as called for increasingly stridently, could only overcome the present electricity shortages after 'encouraging' (subsidising) further gas exploration, fast-tracking hydro schemes through resource management procedures, and ignoring our Kyoto obligations. Project Aqua has already been declared a 'network' project, giving it preferential treatment. Thus this new 'think big' lobby would have NZ panic and solve the problem in a costly way which is also at the cost of the environment.

### **Traditional power planning**

A return to traditional power planning would bring an increased requirement for transmission and distribution investment. Nominally, planning could incorporate demand-side options such as energy efficiency investments, but NZ has little experience of these, and no 'culture' at the political level. To political and industry decision-makers, improving reliability means investing more in generation capacity (up to 40% surplus in normal years during the 1970s and 1980s), and also network and power quality equipment. Power prices would rise sharply to cover these new investment costs along the whole power supply chain. Meanwhile the demand side — back up generators, smaller renewables, co-generation and distributed options — would still be ignored.

Electricity markets were introduced in several countries during the 1990s, in an attempt to force power prices down by creating competition between generators. A competitive market was supposed to create opportunities for small-scale generation and energy efficiency projects. Instead, network companies have suppressed small-scale generation in many countries, by low wholesale prices in the electricity markets, and hostile interconnection rules. Profit-seeking generators whose revenues depended on sales of GWh have abandoned energy efficiency projects.

Theoretical work that underlay creation of electricity spot markets emphasised the need for forward markets to give longer-term price signals.<sup>1</sup> It said independent regulation and public consultation were needed to ensure public purposes would be met. These include controlling the market power of large supply companies and very large consumers, and ensuring that environmental impacts were accounted for. It also advised a transition path that would cause as little disruption as possible to existing power systems.

In contrast, NZ's original electricity market was a

<sup>1</sup> Outhred, H.R., and Kaye, R.J., "Incorporating Network Effects in a Competitive Electricity Industry:- An Australian Perspective", in M. Einhorn and R. Siddiqui (eds), *Electricity Transmission Pricing and Technology* (Kluwer Press Academic Publishers, Boston, Dordrecht and London, 1996), pp. 207-228.

big-bang approach, and included neither regulatory protection nor any transition path. Energy efficiency programmes suffered probably more severely than in most other countries. Spot prices here are much more volatile. Uniquely, market power is unregulated here — NZ still has no market surveillance independent of market participants, who have designed the market in their own interests. As a result, NZ has suffered all the pain of comprehensive electricity restructuring and market formation without capturing its benefits.

### **Two views of NZ's electricity problems**

Extensive discussion within the Sustainable Energy Forum (SEF) has identified several problems with current management arrangements, which have combined to heavily inhibit small-scale energy supply and demand-side management. This is despite NZ's uniquely favourable physical resources of renewable energy, and grossly inefficient energy use — in houses, commercial premises and industry alike. The problems are:

- No incentive to build or maintain reserves of capacity or fuel, or reduce demand.
- A near-complete block-out of small participants, on both the supply and demand sides.
- No convincing future planning, or reliable information on which either planning or efficient markets can be based.
- Generators, retailers and local lines companies suppress energy efficiency because they lose profits when people use less electricity
- No mechanism to require public purposes (reliable supply, reducing environmental and social impacts) to be achieved.

The people now involved in electricity (and gas) reforms are steeped in the culture of 'liberalisation,' and immersed in technical detail. Sustainable energy options, both rational and desirable, are sidelined in the policy-making process. The main objective of the measures proposed by these people is to keep wholesale power prices low.

The SEF characterisation of the problems differs strongly from that now swamping the media debate, which is usually characterised as:

- Spot prices are far too high, making energy-intensive industry uncompetitive.
- NZ needs more power stations. (Forgetting that the Whirinaki and first Stratford gas turbines were shipped overseas; Meremere, Marsden A and most of Otahuhu A were dismantled; and Marsden B was never used)

- NZ needs new gas resources, and exploration should be further subsidised because international companies prefer other locations for their exploration.
- The Resource Management Act is inhibiting new power station investment, and the Kyoto agreement will inhibit coal-fired generation.

Solving all these problems is unlikely, and in any case would not ensure sustainable energy services to all consumers, either short term or long term.

### **A basis for choice — diversity is security**

New Zealand needs to choose which problems it wants to solve:

- Encouraging cost-effective small-scale energy supply and service options.
- Expanding the traditional investments in large-scale power supply.

Neither choice will take NZ back to the luxury of cheap and abundant power. The choice must not be made without open and informed public debate; drawing on extensive international experience of both planned and market systems.

Overseas experience in the wake of the California power crises in 2000 and 2001 has confirmed that 'diversity is security.' Expanding investment in conventional power systems is no longer the most reliable or cost-effective approach. More effective today are small-scale investments in energy efficiency; demand-response to peak loads; and small-scale supply of energy services. This is true even when demand is growing rapidly, as in California, New York and other highly developed regions. However, because several NZ power stations were closed, we will probably need some new generation capacity.

What is true in the US applies even more strongly in NZ, where energy use is particularly inefficient, and the benefits of diversifying supply through investments in energy management and small-scale renewable energy, are particularly high. Yet NZ suppliers of sustainable energy are finding it progressively more difficult to achieve commercial success, or even space in the media. There are strong and increasing barriers to achieving environmental, economic and social rationality. Changes are needed both to the market design and the regulatory environment.

### **Opening the market to sustainable options**

Fortunately the required changes do not require another overturning of the present system. They can be incremental and progressive. The only disruptive change needed is to fully separate retailing from generating businesses, and this is

likely to be required by Government in any case; allowing them to combine was probably the most misguided of all the recent reforms.

Above all we need to facilitate investment in a wide range of small-scale sustainable energy options, on both the supply side and the demand side. These investments appear uneconomic today because incumbent energy suppliers are able to set pricing and terms which are hostile to their small-scale competitors. Small-scale options are risky because any commercial advantage gained when spot prices are high will be reversed if future surplus generation drives spot prices back down.

Those who have been deeply involved in NZ's electricity market design need to recognise how far the present market departs from the original principles of competitive electricity markets. The originators of the idea never expected that large players would be unregulated — or allowed to design their own regulatory regime, as happened here. Ironically, despite that freedom of action, the market players are unable to agree.

In keeping with the 'liberalisation' theory, NZ's electricity market was privately owned, with market design funded by participants. The well-funded generators, and Transpower, dominated the process. The industry's Market Surveillance Committee was unable to prove what to everyone else was self-evident — gross exercise of market power by generators.

Transpower's overseas advisor, Professor Bill Hogan, considers that NZ's market design lacks only provision for financial transmission rights. He believes that the market will then provide for long-term decisions on resource adequacy and sustainability, as well as fair pricing. He also considers that power retailers will be effective advocates for their consumers — not noticing that NZ's retailers buy and sell consumer blocks like cattle. Our 'consumer choice' is a bad joke.

Good market design needs a counterbalance to such advice. Representatives of small-scale sustainable energy options need public funding so they can participate on an equal footing. This must include generous access to expert advice of quality appropriate to challenge the experts now advising the major electricity suppliers and consumers.

An early requirement would be to educate both present market players and representatives of the now-excluded small-scale energy supply and service providers, to create a common understanding of the potential role of small-scale and sustainable options. A single 2- or 3-day seminar would be appropriate, followed by working sessions in which common ground could be negotiated.

## Careful re-regulation of the electricity sector

As well as electricity market design, a careful overhaul of the regulatory system is needed, to reduce the perverse incentives that are suppressing sustainable energy options. Generating companies should not be integrated with retailing, because this insulates them from the very pricing signals they impose on others. They should be required to contract out their generation.

Regulation should be focussed on core public purposes:

- Fair pricing (a concept which can be defined in economic terms);
- Markets open equally to small and large market players;
- Access to electricity or equivalent energy service by low-income people; and
- Environmental protection.

High spot prices should not be capped, except possibly at levels much higher than this year's. The spot price creates the revenues needed to pay consumers to reduce their demand. In fact, sky-high spot prices create 'excess profits' in every sense of the word, so the operating surpluses from these could be regarded as public property (Refer Outhred and Kaye, 1996) and re-directed to overcome the scarcity that caused them. Both competitive bidding and public consultation have a role in such an exercise.

Local distribution network profits should not be based on the throughput of GWh, because network costs depend only a little on throughput. An opportunity was lost when retailers demanded that the network companies reduce the retailers' risks by charging them by GWh, not MW.

Performance-based regulation, developed in the US, recommends that all network companies be subject to revenue caps, instead of price caps which give them incentives to sell more.<sup>2</sup> (Refer to Regulatory Assistance Project) It is unfortunate that SEF's submissions to that effect were ignored by the Commerce Commission in their decision on lines company regulation.

Lines companies are at the heart of reliability management — most lost Gigawatt-hours come from network failures (this year in NZ would be an exception). They also account for roughly a third of overall cost of supply on average — but 90% or

<sup>2</sup> A source of regulatory advice which would be worth tapping into is the Regulatory Assistance Project ([www.raonline.org](http://www.raonline.org)). These people work with electricity systems of all kinds in the US — from pure traditional planning systems through to fully competitive markets. RAP's network includes the big "Energy Laboratories" (Berkeley, Oak Ridge, and several others), with technical and legal expertise as well as regulatory expertise.

more in some locations. As monopolies, lines companies' investment plans are of public interest. Integrated resource planning should be required: comparing supply-side investment with demand-side investment, and choosing whichever is the less costly. NZ has already taken a good first step, in requiring lines companies to disclose their investment plans, with options and costs.

Incentives for energy efficiency are the most troublesome of regulatory issues. A myriad of market barriers — sometimes but not always deliberate — ensures that energy efficiency investment is lower than is economically efficient. Almost all countries run some energy efficiency programmes; many US states apply a levy of 2–3% on electricity sales to fund them. To get maximum benefit in saving both MW and GWh, energy efficiency programmes can be targeted to locations and times where peak loads are costly. Reasonable mandatory standards for appliances and building envelopes are also important.

To encourage small-scale renewable energy projects, mandatory targets appear to be the best regulatory measure — Australia's target of 2% of new generation has been very effective.

As is the case in electricity market design, the regulatory devil is in the details. This means that effective consultation is needed with all affected parties — most particularly small consumers and small suppliers of energy services.

### **Moving forward**

The imminent failure of industry self-regulation opens the way for constructive change to make NZ's primary energy supply, and its delivery as electricity, more robust and sustainable. A return to traditional large-scale power planning would be excessively costly to the NZ economy and the environment.

However central government must take full responsibility for long-term 'resource adequacy,' as markets do not effectively deal with long term issues. This begins with properly verified information on quantities and costs of primary energy resources and energy savings potential. We must never again be caught unexpectedly with the demise of our largest single primary energy source, Maui! The crude analytical model Government now uses in *Energy Outlook* needs to be replaced by modelling commensurate with the importance of this task.

The present power crisis opens the way for immediate investments in those measures that would give the quickest return — probably focussed on the largest electricity users in each category: domestic, commercial and industrial. An

important first step would be free energy audits, followed by appropriate incentives to install electricity saving equipment. Health and safety issues are paramount — wood fires are wonderful for dry years, but chimneys must be clean. Solar water heaters can supply large amounts of primary energy, quickly. Energy audits, especially of households, need to be 'client-centred' in full recognition that peoples' private homes are their castles. Technical efficiency is only part of the input to personal decision-making.

A new Crown Electricity Governance Board is expected to plan the next steps. Market rules will need to be changed by working parties in which small consumers and small suppliers of energy services have representation equal to that of large market participants. An essential first step would be to formalise the membership of sustainable energy advocates on all governance and regulatory committees.

The gas sector is even more subject to market power than electricity, and similar market and regulatory principles are needed.

New legislation is certain to follow this winter's power crisis. The challenge is to abandon the politics of blame, and create a governance and regulatory system designed on a coherent basis, with a workable transition to a more sustainable and fairer energy sector.

This Government can now convert a crisis into an opportunity by adopting sustainable energy policies, which can positively contribute to improving the NZ economy and the environment.

### **Maui pipeline access soon**

Minister of Energy Pete Hodgson announced that negotiations to secure open access to the Maui pipelines should be completed by the end of June.  
Dominion Post, 12/6/2003

### **Quote**

*"It is time we stopped destroying natural rivers just to heat our towel rails."*

Green Co-leader Jeanette Fitzsimons  
on Meridian's Project Aqua

# The Electricity Commission and reserve generation

NZ Government, 20/5/2003

The Government is to set up a new Electricity Commission, which will implement measures designed to deliver long-term electricity supply security. Minister of Finance Dr Michael Cullen said, "Electricity supply security has become a serious concern to the Government, business and the wider community. For sustainable economic growth New Zealand needs a more reliable and fairly priced supply of electricity than the current electricity market arrangements have delivered.

"Our hydro dominated electricity system delivers cheap electricity but is vulnerable to very dry years. To improve supply security we will need more reserve generation to run in very dry years, but it has become clear that the current electricity market does not encourage generators to hold such reserve plant."

The Government's solution begins with the establishment of a seven-member Electricity Commission to govern the electricity industry. Commissioners are due to be appointed within three months. The Commission will be responsible for managing the electricity sector so that electricity demand can be met in a 1-in-60 dry year without the need for national power conservation campaigns.

It will do this by contracting with generators for the provision of dry year reserve generation capacity and fuel. These reserves will be withheld from the market until dry years, when they will be released into the market at a high price. Energy Minister Pete Hodgson said, "This solution has been carefully designed to ensure that the wholesale electricity market will continue to deliver the price signals and opportunities it is designed to deliver.

"Withholding reserve generation from the market in normal years will allow the market to operate as usual. A high price on reserve generation in dry years will ensure that investment in other new generation to meet normal growth in electricity demand is not deterred. It will also significantly reduce spot market volatility in dry years, because prices above that of the reserve generation will be relatively rare."

The cost to electricity consumers of securing adequate reserve generation is estimated at well under half a cent per unit of electricity. The cost is low because reserve generation is expected to

comprise new plant with relatively low capital costs, plus heavily depreciated old plant. The fuel, though costly, will be rarely used.

The Commission will have the power to recover the cost of reserve generation in the manner it judges to be most efficient, for example through a levy. The necessary portfolio of reserve generation is expected to be built up within about three years.

"This is the Government's preferred policy for electricity supply security and it will be open for comment for six weeks," Hodgson said. "We expect to introduce legislation to implement these changes in August or September."

Other important changes included in the package are:

- 1 The law will be amended to allow lines companies to own reserve generation without limit and ordinary generation up to 25 MW, or 10% of their load. Lines companies can already invest in new renewable generation without limit.
- 2 To encourage the development of small generation projects connected to local lines, rather than the national grid, lines charges will be regulated to ensure such generators pay no more than is reasonable for connection.
- 3 The Commission will be empowered to require generators to offer long-term electricity hedge contracts into the market, for a nominated proportion of their reliable capacity, if it decides this is necessary to safeguard against under-investment in ordinary generation. Related powers to require electricity retailers and major electricity users to hedge a set proportion of their consumption will also be provided for.
- 4 The Commission will be responsible for improved modelling and forecasting of future electricity supply and demand. It will also have new powers to require disclosure of information from the industry that will improve the function of the wholesale market, including information on fossil fuel supplies and hedge contracts.
- 5 The Commission will be responsible for establishing, as a high priority, a decision-making process and transmission pricing methodology that will enable necessary investment in the national grid to proceed.
- 6 The Commission will be responsible for making demand-side energy exchanges, which enable consumers to on-sell electricity they have contracted for but do not need, available nationwide. It will also be charged with improving the industry's ability to manage ripple control for water heating.

“It is important to note that the decisions announced today address specifically the provision of reserve generation for very dry years,” Hodgson said. “A lot of investment in new generation to meet normal growth in demand for electricity is being made now and is planned for the near future. Most of that generation will be based on renewable resources. The provision of reserve generation will not change that and New Zealand’s electricity system will continue to make progress towards environmental sustainability.”

### EnergyWatch comments

(With a lot of help from the SEF discussion group)

Let’s start with the good news:

- Reserve generation plant is to be designated, with reserve fuel supplies.
- Regulation of lines charges should lower (but not eliminate) the barriers to small renewable energy sources, such as the new Windflow turbine in Gebbies Pass (point 2 at left. Further support for small-scale renewables may be available under point 6).
- If the Government decides to regulate hedge contracts this should help to open up the market and control spot prices (point 3).
- The Commission will have the powers to take a broad and long term view of the investment needs of the transmission system (point 5). This might be very good news if the Electricity Commission is given the power to take a truly holistic approach, or might be bad news if a purely supply-side ‘turbines-and-wires’ approach is taken. However, it means very little either way until the Commission’s power to raise funding is clarified.
- The Commission will have powers to model the system and develop forecasts (point 4).

That leaves the problem of when to run the reserve generation capacity. Before looking at that problem it will help to clear up some misconceptions:

- Having reserve generation for a one in 60 dry year does **not** mean that it will only run once in 60 years. The capacity will be nominally just adequate for the worst year in a 60 year period.
- Until now the only real obligation on generators to plan for a dry year has been their need to retain capacity to meet their direct obligations to customers. The only real obligation to supply the spot market has been the risk that gross supply failures would provoke the government into

regulating. Now the government has said it will regulate, but the effects are still unknown.

The fundamental problem for the Electricity Commission is going to be deciding when to call up reserve generation. The 2001 event could have been avoided if Huntly and New Plymouth had been run earlier and harder; the 2003 event could perhaps have been avoided without calling for energy savings — we don’t know yet. However, we understand that the autumn inflows were at about the 1:20 year level.

Reserve generation is expensive to run, so it should clearly be run as little as possible. The ideal would be if the rains came a day or two before the hydro stations reached their lowest technically or environmentally possible water levels. However, trying to achieve this would bring a very large risk of running out, with costs far higher than the cost of reserve generation. How much the reserve generation plant is run will depend ultimately on when the Electricity Commissioners lose their nerve, and ECNZ experience suggests that that will be ‘early.’

So what advice is SEF able to offer the Electricity Commissioners? Several interesting points, which unfortunately contribute very little to practical solutions:

- The Commissioners could use lake levels (expressed as GWh) as a trigger for bringing in reserve generation, but what levels? The figure would change with the season, but what about el Niño; transmission constraints; and reserve generator fuel stocks? What about press scare stories or election years?
- The Commissioners could use the spot market price as a trigger for bringing in reserve generation but again, what price? They would face the same political pressures, plus the notorious blindness of markets to future scarcity, especially at levels as low as one in 60 years.
- The Commissioners could use a one-in-something low inflow event (it would have to be less than 60 years), plus modelling plus a minimum hydro reserve at the end of the event. This is getting more objective, but still begs a lot of questions, both political and around what-levels-when.
- Businesses like to transfer risk to others, and the Electricity Commissioners will be fair game. The decision-making process used will inevitably be known to the generators, who will game in that knowledge. How much risk will be transferred? How often will the Commissioners be left holding the baby anyway, regardless of whether or not they have accepted the risk?

Will the Commissioners' powers to require hedge contracts really be enough to keep all this under control? Hydro generation will be more profitable if lake levels are kept low, so to minimise the risk of losing gigawatt-hours through spilling water from full lakes. Thermal generation will be more profitable if the Commissioners hold the fuel stocks. Factors like this will increase the risk of having to run the reserve capacity, and whenever it is run, a profitable price floor will be set in the spot market. The Minister was wise to avoid saying how much use the reserve capacity will see, or what are the implications for our Kyoto commitments.

## The market must be the servant of the electricity industry, not its master

Steve Goldthorpe, Energy Analyst

*(The text of a submission to the Energy Markets Policy Group — EW)*

The Electricity Industry in New Zealand is as a ship heading into uncharted waters, being steered by a crew who are busy playing a game of poker. The Government's announcement on 20 May of the formation of an Electricity Commission (EC) is like putting a new skipper in charge of the ship. It is the declared intent of the Government that the EC should steer the industry out of the rough waters of cyclic fuel shortages, volatile spot prices and save-it campaigns into calmer waters where the needs of the country are met in a fair, reliable, efficient and sustainable manner. For the new skipper to achieve that new course it will be necessary to remove the game playing of the crew from the wheelhouse and put it back in the engine room where it belongs.

For any enterprise that is under new management, it is critical that the first actions by the new regime should be decisive, to set the tone of the new management style and to send a clear message how things will be run. To that end, the arrangements for the ring-fenced Reserve Generation scheme that is proposed to address hydrofarming should be very clearly divorced from the competitive electricity market game.

Unfortunately the Government's proposal and the questions are couched in the language of the game and are sending the signal that the game will continue in the wheelhouse, with an extra player. That is highly regrettable.

This submission addresses the specific questions raised in the context of the need to demonstrate a distinctly different approach to management of the electricity industry and against the following background:

- The Government has recognised that the present electricity market arrangements fail to make satisfactory provision for the natural variability in the hydro resource when combined with other events, such as the recent realisation that natural gas supplies are less plentiful than was previously thought. To address this shortcoming, the Government propose to instruct the Electricity Commission to ring-fence some generation capacity and fuel supplies as Reserve Generation, to be used only when similar unforeseen circumstances arise in the future.
- In our isolated position in New Zealand some stand-by emergency provision is prudent in order to avoid the loss of essential services. This is similar to the self-sufficient person living in a remote location who normally supplies all his own power from a combination of micro-hydro, wind turbine and PV panels, but prudently keeps a petrol generator in the shed for emergency supply to essential services should all else fail.
- The luxury of low cost gas from the Maui field that New Zealand has enjoyed for the last 30 years will not be available into the future. Therefore some short-term contingency will be required whilst the electricity industry develops additional renewable resources to adapt to the post-Maui paradigm.

In that context, I make the following comments on the matters raised by MED.

### **1 What is the most appropriate length of the contracts and how often should the commission let tenders?**

This question should be looked at in the same way as buying an insurance policy. The contracts should be annual, but should normally be renewed, subject to satisfactory performance. The risk should be spread between service providers (ie holders of fuel and plant in readiness). However, over time, as the short term contingency needs diminish and diversity of renewable supply and demand side management enhances the natural resilience of the system, the need for Reserve



Generation should decline and therefore some contracts would be allowed to expire.

## **2 What quantity of ring-fenced capacity would be best and what is the best balance between new and existing generation in that portfolio?**

No new generation is necessary. The relegation of the older fossil fuel stations to Reserve Generation only should meet the need for Reserve Generation.

When it costs in the region of \$ 1000/kW for new generation capacity and very much less than that for measures to reduce electricity demand in industrial and domestic situations, there is ample economic incentive for demand management and energy efficiency to rectify the supply/demand balance without the need for additional power stations.

## **3 What are the optimal price(s) and conditions under which Reserve Generation should be offered into the market for dispatch by the system operator?**

This question typifies the flawed approach to restructuring governance of the EI that is promulgated in the Government's announcement. This is the key question that signals to the crew that the new captain intends to join the poker game.

The competitive electricity market mechanism is the wrong mechanism for the introduction of Reserve Generation. The use of Reserve Generation should be controlled by non-financial rules such as:

- Unexpectedly low hydro lake levels
- Unexpected shortages of primary energy for other generators
- Breakdown of major components of the transmission system (eg Cook Strait cables)

Reserve generation should be normally be dispatched (NB not offered for dispatch) when the projected supply/demand balance shows that insufficient supply is likely to be available to meet demand in the near future (eg turning coal or oil into water to top up the hydro batteries before the winter.) Note that the decision to dispatch Reserve Generation should be based on technical assessment by the Electricity Commission of non-financial factors.

The direct instruction by the EC for the dispatch of some Reserve Generation would have the same effect on the rest of the electricity supply market as the sudden reduction in a major load (such as might be caused by a major manufacturing plant shutdown). The wholesale electricity market price

would reflect this effect, but should not be subjected to major fluctuations.

## **4 Is a levy on wholesale electricity prices to recover the Commission's costs for Reserve Generation fair and efficient?**

A levy on the wholesale electricity price to cover the standing costs of the standby generation and fuel stores is fair and reasonable. However, when the Reserve Generation is actually used then only the marginal cost of operating (principally fuel cost) should be charged to the wholesale electricity market.

This means that the contract for Reserve Generation would be on the basis of \$ x /MW day of Reserve Generation made available plus \$ y /MWh of actual electricity delivered into the grid as demanded.

The payment for electricity delivered from Reserve Generation to the wholesale pool may well be at a different price from the prevailing pool price at the time. This would be an aspect of ring-fencing the Reserve Generation from the market.

This arrangement would eliminate financial risk to the Electricity Commission and would minimise distortion of the competitive electricity market by the dispatch of Reserve Generation.

### **Neil Cherry**

Dr Neil Cherry died on 25 May, after a battle with motor neurone disease. He was 56. Neil was an Associate Professor of Environmental Health at Lincoln University. He specialised in weather and climate, which led him to become an expert on wind resource assessment — and Chairman of Windflow Technology. He had been involved in the Windflow project for a decade, and only a week before his death he was on site in the Gebbies Pass for hoisting the wind turbine blades. Neil was also active in local body politics and the peace movement. And as if that wasn't enough, he helped organise the Christchurch SEF conference.

# Peak Oil

Kerry Wood

*(Peak Oil is another of the subjects raised in SEF News [SEFnews@yahoo.com] Much of the information here is from articles by Michael Ruppert [see [www.fromthewilderness.com](http://www.fromthewilderness.com)] and Richard Heinberg [see <http://globalpublicmedia.com/ARTICLES/richardheinberg.museletter.petroleumplateau.2003-05.php>])*  
— EW

The concept of Peak Oil is that world-wide oil production will peak very soon and then decline. (See *EnergyWatch*, March 2002 for an article on oil depletion). From the moment when decline begins, additional supply will only be possible using other energy sources, or improving energy efficiency faster than the rate of fall of oil extraction. There are no resources close to being as cheap and convenient as oil.

An active group in this area is The Association for the Study of Peak Oil & Gas (ASPO — see <http://www.peakoil.net/ASPO.html>), and a recent ASPO conference in Paris was covered by Michael Ruppert. ASPO's current base estimate is that oil extraction will peak in 2010, with a most probable range of about 2005 – 2015. Within about five years after the peak production year, annual production will be declining at about 2.0–2.5% a year. However, local shortages can be expected before the peak date, and there is some evidence that this phase is already upon us.

Richard Heinberg's view is that oil production has been more-or-less plateaued since 1974, and the first major geologically-controlled decline will be in North American gas production, starting next year. Yet another view is that Peak Oil arrived in 2000. This is the view of Professor Kenneth Deffeyes, author of the book, *Hubbert's Peak: The Impending World Oil Shortage*. Perhaps the most plausible peak year estimate comes from SEF member Steve Goldthorpe: "Probably within my lifetime."

Obviously, there will not be a single fateful day when the world changes forever. Real life is messier than that. Even the year will probably be discernible only in hindsight, and 'plateau' is probably a better term for those living through it (although 'peak' will be how our grandchildren see it). Even when shortages begin to bite, it may be a while before oil executives and politicians admit that the problem is geological. Taking that view, we are either on the plateau or very nearly on it. Or just possibly beginning to move off it.

The success rate in discovering new oil and gas is declining rapidly. US gas production grew quickly

in 1990, but by 2001 there was no increase in supply, despite record exploration activity, and by 2003 production was in serious decline. North American gas prices have quadrupled in eighteen months, and new gas wells in Texas have seen their extraction capacity fall by 83% in their first year. Dry holes (wells that find no exploitable oil or gas) are becoming common even in the Middle East, and the expected oil bonanzas in the Caspian Sea and Kazakhstan now look more like damp squibs. Analyses were presented at the ASPO conference that even Saudi Arabia's famed reserves of 260 billion barrels (41 km<sup>3</sup>) may in fact be far lower. With 100 billion barrels (16 km<sup>3</sup>) already produced, the mid-point of production may already have been passed, which would mean that declining production is imminent.

Ruppert reports that three 'camps' quickly emerged at the ASPO conference:

- Peak Oil. There is a real problem which is becoming the paramount energy issue.
- Alternative Energy. There is a real problem but it can be overcome using alternative energy sources.
- Flat Earth. There is no problem.

The ASPO material runs contrary to predictions by the US Geological Service (USGS) and International Energy Agency (IEA). However, Ruppert reports that the view expressed at ASPO — with no contrary view even from the flat earthers — was that these organisations have been politically 'captured' and their "books on oil reserves are as cooked as the books of Enron." This is consistent with the article on page 26 (*Growth in wind power*), and the USGS weasel-words quoted in *EnergyWatch* (June 2001):

*These adjustments to the USGS and MMS estimates are based on non-technical considerations that support domestic supply growth to the levels necessary to meet projected demand levels.*

Even if the USGS projections are correct, all they do is buy a little more time.

It was generally accepted at the ASPO conference that hydrogen and ethanol are not real options<sup>3</sup> although one speaker conceded that 'green' hydrogen (non-petroleum origin) might become viable in several decades, but only if the primary energy source was nuclear.

Other alternatives are no better. The Canadian tar sands projects are mired in pollution and scarcity

<sup>3</sup> See the Rocky Mountains Institute website <[www.rmi.org](http://www.rmi.org)> for another view on hydrogen. *EnergyWatch's* guess is that the ASPO view is correct if the objective is to run existing-technology vehicles on centrally-produced hydrogen, but the RMI view remains credible as a package.

of the vast quantities of gas needed to heat wash water (3 litres of water heated to steam, for each litre of oil extracted, or upwards of 20% of the energy in the oil for washing alone). Huge costs for deep water offshore oil mean that only exceptionally high production rates will be even remotely economic.

Heinberg identifies three response options, and the SEF discussion group has pointed out a fourth (in italics):

- War. The US is already on this path.
- Powerdown. The Europeans are on this path, however tentatively, and so are we. Heinberg recognises that getting everybody onto it, and keeping them there, will be a huge political challenge.
- Sleepwalk. At present all nations are on this path to a some extent, and keeping away from it for decades will be a difficult task.
- *Panic. Build coal-to-oil plants and nuclear or coal-fired power stations, focussing only on the supply side and ignoring Kyoto commitments.*

This last point is a toxic combination of three attitudes: simple denial; TINA (There Is No Alternative); and the Ossian heresy (there is One Simple Solution).

So what are the policy options for New Zealand? We could take the war route, scurrying back into ANZUS, hosting nuclear ship visits and so on. If we took this path we would know that the danger was not if we were dumped, but when. Or we could sleepwalk until too late, or panic: we have seen examples of both in the recent power crisis.

Or we could powerdown. Join with other nations to develop co-operative policies and pressure the US to do the same. (As a first step how about paying for our oil in Euros?) If we take this route we have major advantages over most other countries: excellent renewable resources and a small population. A third 'advantage' is massive scope for improving efficiency, as shown by an international comparison of energy use (see page 22 — EW).

But will we prefer to sleepwalk? If we took this course we could join the flat earth camp on Peak Oil; ignore our Kyoto commitments and develop our coal reserves; and do nothing to 'hurt the economy' (disturb the 'business as usual' camp). We could continue this process right up to the point where our oil bill was so high that we could no longer afford to get our produce to market. The really scary thing about sleepwalking is that it is the default option.

## More on London's congestion charging

Kerry Wood

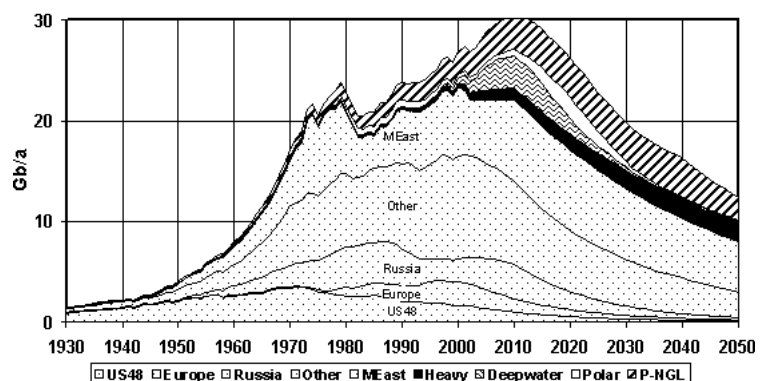
After four months, the Transport for London congestion charging project is struggling with the problems of success. It has cut traffic so successfully that it faces a cash crisis, with the estimated net income halved.

Sally Hamwee, Chair of the London assembly, said she was concerned that the mayor seemed to have no rescue plan. "The things that get cut in these situations are things that are less high profile, like road safety provision for pedestrians and cyclists." Another problem is that new users of public transport are tending to favour the overloaded tube system, instead using the extra buses put on for them.

There were early complaints from the Chamber of Commerce that shoppers were avoiding the city centre, but there has been nothing on this subject on *The Guardian's* website since 20 February, three days after the scheme was introduced. This is a typical reaction to new traffic restrictions in Europe, suggesting that any commercial problems have been more than offset by gains elsewhere.

The scheme's success is prompting the government to take a serious interest in national road tolling, although they have ruled out any widespread scheme before 2010. Electronically gathered tolls of £ 0.03 – 1.30 / mile (NZ\$ 0.06 – 2.40 / km) are being considered, with the low rate applying on quiet rural roads and the high rate in the centre of congested cities. A further trial is scheduled in Leeds this year, with roadside detectors triggering on-vehicle transponders. The London scheme uses video technology to read number plates.

Oil & Natural Gas Liquids  
2003 Base Case Scenario



# Funding infrastructure

Dr Michael Cullen, Minister of Finance

(Abstracts from an address on 3 July — EW)

We face a ballooning infrastructure spend in New Zealand. The big problem is the sheer range of items that need attention, to catch up on the 1990s decade of infrastructure neglect. Putting a price tag on this is a bit like costing Concorde in the 1960s — think of a number and keep doubling it.

Then I open the budget and the spending doesn't look at all unmanageable. Ignoring things like student loans and the NZ Superannuation Fund, gross sovereign issued debt is forecast to rise only modestly — well below the rate of inflation. This is a rapidly falling debt burden. Gross debt is a bit over 27% of GDP now and is forecast to fall to 23% by 2007. That raw figure has to be qualified:

- Our demographic structure is fiscally benign. There are relatively few younger and older people: the two cohorts that cost governments money. This means we have a structural surplus that is partly driven by demographic rather than tax or spending alignments.
- It is also possible — but much less certain — that the tax and spend configurations are producing a structural budget surplus.
- We have had a reasonably long and strong economic expansion so there is a cyclical element in the numbers.

These three factors allow a significant contribution to infrastructure spending to be financed out of current operating surpluses.

A second reason why this is manageable is that a lot of the infrastructure upgrade is financed within the balance sheets of state owned enterprises. They borrow, the core Crown does not. Even there, the numbers over the next four years are not frightening:

- \$bn 3 to be spent by government departments, with defence equipment, corrections facilities and school building and maintenance taking the lion's share.
- \$bn 6 to be spent through Crown entities like hospitals, Housing NZ and Transit NZ.
- \$bn 4 to be spent within the SOEs, a large portion of it in the electricity sector.

Part of the infrastructure is owned by regional and local government, and by private enterprise. That is a double edged sword: central government is

relieved of the need to invest, but loses the ability to ensure adequate maintenance and anticipate new demands on infrastructural capacity. This highly fractured ownership avoids the perils of excessively centralised control but has its own problems: operators pursue their own interests, which may or may not coincide with the national interest.

As an example, with electricity generation, narrow interests suggest that it is best to match generating capacity with a retail customer base, and to avoid locking too much capital up in reserve generating capacity which may not generate an ohm in anger<sup>4</sup> for many years. From a national interest point of view, limited reserve capacity exposes users to high prices. The government's recent announcements address this while leaving baseload capacity management decentralised.

As with many areas of policy, the second half of the last century saw us go from one extreme to the other, and we are now trying to pull back to a sensible middle ground. We are not searching for either heavy handed central management or regulation of infrastructure providers. There is a mix of interventions needed: a bit of co-ordination, some new approaches on financing, rebalancing the legal and regulatory framework and a clarification of when and how the government intervenes directly to safeguard the national interest.

Capital budgeting, in my experience, is a process of constantly pushing the timing of anticipated spending into later budget cycles. I see three delay factors inherent in almost every capital project that the government has entertained:

- Technical, or engineering delay. Do not underestimate this. If, for example, we were to give the go-ahead to a major upgrade of the electricity transmission grid, getting the design right would take months if not years.
- Resource consent delay. We must have an efficient RMA process, but we must equally avoid populist demands to downgrade or bypass proper resource management controls. I find that demands for fast-tracking projects evaporate when the project impacts on the back yard.
- Construction delays.

This leads on to the issue of whether or not we should be exploring private sector building, leasing, owning, operating or tolling parts of the infrastructure. As a general rule the answer is no. There is no rocket science in deciding what level of debt is prudent. With that qualification, the

<sup>4</sup> Ohmigawd. Dr Cullen should be aware that an Ohm is a unit of resistance, so generating Ohms is a political rather than a technical activity — EW.

government has set itself a long-term goal of managing sovereign issued debt at below 30% of GDP over the economic cycle. In particular cases, though, it may be sensible to look at other methods of financing infrastructure. The BOOT regime has a lot of backers, for understandable reasons. As a prominent former politician who shall remain nameless once said to me, a very dangerous place to be is anywhere between construction companies and their bankers, and a large bag of money.

Infrastructure can only be financed in one of three ways:

- out of general taxation (which includes rates in a local body context);
- by charges on users; or
- by a mix of the two.

If a private operator charges a toll, that does not create new money: the government itself could have decided to apply a toll.

What private-public partnerships do is get a better mix of risk distribution in the design, construction and operation phases. Non-traditional financing arrangements seek a better allocation of costs. For example, a reserve generation capacity levy on electricity users shifts the cost of covering dry year risk away from generators, but does not shift it back to the government. An Auckland-specific charge — such as congestion charging — shifts part of the cost of congestion relief onto road users. It doesn't take all the cost off central government but it rebalances it, and can expand the range of options.

It is easy to neglect the infrastructure because the problems are not immediately apparent: we tolerate a slight extension in the time it takes to get to work, reallocate prison musters, ride out the occasional electricity price spike, keep on using the rail carriages even though replacements would be nicer, and so on. People adapt. Then, as demand growth outstrips the capacity to adapt, action gets more and more urgent. Unfortunately, with infrastructure, quick fixes are seldom on offer.

### **Carbon charge levels**

European analysts suggest that the most likely carbon price on the European exchange will be about € 10/t (CO<sub>2</sub> basis) when the exchange opens in 2005, with an upper limit of € 20/t. That is about \$NZ 20/t, with an upper limit of \$ 40/t.

Planet Ark, 26/5/2003

## **Electricity demand programmes to improve security**

The Government is giving a post-Budget boost of \$M 2.9 to the Energy Efficiency and Conservation Authority (EECA) for programmes that will save businesses money and help improve electricity supply security.

"These programmes focus on savings we can make on the demand side of the electricity market," says Minister of Energy Pete Hodgson. "They offer a real opportunity for medium and large electricity consumers to cut costs, contribute to system security and help keep prices as low as possible." The programmes are expected to bring electricity savings totalling 350 GWh a year by 2005/06.

### **Demand Exchanges**

Last week Hodgson announced the Electricity Commission's responsibility for making demand exchanges available nationwide. These exchanges enable medium power users to trade power they have contracted to buy. This makes load shifting, demand reduction or the use of stand-by generation more profitable.

"Cabinet agreed yesterday to fund EECA to work with the electricity industry to get more demand exchanges up and running," Hodgson said. This is expected to produce electricity savings of up to 100 GWh/yr by 2005/06. Government will contribute \$ 700 000 in 2003/04 and \$ 450 000 in 2004/05.

### **Energy Audits**

EECA's energy audit programme will be expanded by \$M 1.1 in 2003/04 and \$M 0.54 in 2004/05. The expanded programme will offer subsidised audits to large electricity users — those consuming more than 10 GWh/yr.

This programme aims to audit a total consumption of 10 000 GWh, approximately one quarter of New Zealand's electricity use. The expected energy savings reach 250 GWh a year in 2005/06.

### **Incentives**

A feasibility study costing \$ 68 000 will look into the case for a financial incentive scheme for investments in energy efficiency by electricity users.

NZ Government, 27/5/2003

## Agricultural greenhouse gas research

On 23 May the Government released an independent report on the research that will be needed over the next decade into reducing greenhouse gas emissions from agriculture. This was followed on 18 June by a call for comment.

The agriculture sector emits methane and nitrous oxide gases and is responsible for over half of New Zealand's total greenhouse gas emissions. Government climate change policy exempts agriculture from emissions charges on these greenhouse gases, but requires adequate research, funded predominantly by the sector, to develop practices and technologies to reduce these emissions.

The report finds that about \$M 8.4 / yr is likely to be needed — less than half the original estimate. The Government sought voluntary funding from the industry but reserved the option of a levy. Industry leaders, including Federated Farmers and representatives of the dairy, meat, wool and deer sectors, have indicated that they would prefer a Government-imposed levy, rather than using funds collected under the Commodities Levies Act to fund the research.

The June discussion document seeks comment on the levy mechanism and on the administration, function, structure and governance of an Agricultural Emissions Research body to manage levy expenditure. Agricultural sector organisations will be invited to form a technical working group to consider implementation issues. Responses to the discussion document are sought by 31 July 2003.

The report is available at:  
[www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/climate/abatement-of-agricultural-greenhouse-gas-emissions/greenhouse-gas-emissions.pdf](http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/climate/abatement-of-agricultural-greenhouse-gas-emissions/greenhouse-gas-emissions.pdf)

The consultation document is available at:

<http://www.maf.govt.nz/mafnet/rural-nz/sustainable-resource-use/climate/agricultural-emissions-research-funding/>

Hard copies are available from Sustainable Resource Use Policy, Ministry of Agriculture and Forestry, PO Box 2526, Wellington. E-mail: [Helen.Avery@maf.govt.nz](mailto:Helen.Avery@maf.govt.nz)

*(There were two press releases, covering the report and the consultation exercise. Neither got around to explaining the exact source of the emissions — EW)*

## New Zealand's scope for energy efficiency

The table below shows international comparisons of energy efficiency, expressed as Gigajoules of energy use per head of population per year. Figures are for 2001 (from US Energy Information Administration data, originally expressed as million btu):

Country	Annual energy use (GJ/capita)
Kuwait	495
Canada	425
USA	361
Australia	269
Sweden	265
<b>New Zealand</b>	<b>231</b>
Russian Federation	206
France	188
Germany	184
Japan	182
S Korea	180
UK	174
Ireland	167
Italy	148
China	33
Nepal	3

Our energy use is almost as high as Sweden or Australia, and worse than Japan and most west European industrial countries, when:

- We have very little heavy industry. The energy used to make our cars is largely Japanese.
- Our pastoral sector is an exceptionally large part of the economy, with exceptionally low energy use (see *EnergyWatch*, March and May 2002).
- Our climate is temperate, with little need for heating or air conditioning.
- We don't have Australia's major minerals extraction and processing sector.

The Ministry of Commerce have very little free and up-to-date data, but what they have gives about half the energy use in the US data: about 540 PJ/yr compared with (231x10<sup>9</sup> X 4x10<sup>6</sup> population) = 924 PJ/yr — more research needed!

Taking MoC data projected from 1998, and correcting for an assumed 100 PJ/yr fall in commercial energy use now that Maui has gone lame, gives rounded figures of:

Transport	240 PJ/yr	50%
Industry & commerce	190 PJ/yr	40%
Domestic	40 PJ/yr	10%

# MiniWhats

## More greenhouse emissions

New Zealand's energy sector emissions continue to grow. Gross CO<sub>2</sub> emissions grew by 2.7% from 2001 to 2002. Average annual growth since 1990 was 2.4%.

Of the energy sector's CO<sub>2</sub> emissions, 45% came from domestic transport, 21% from industry and 18% from thermal electricity generation. Carbon dioxide emissions from domestic transport grew by 10% 2001-2002, reflecting higher petrol and diesel consumption. The average annual increase since 1990 was 3.9%.

"These figures emphasise the challenge we face in halting growth in emissions and securing a reduction in the long term," said the Convenor of the Ministerial Group on Climate Change, Pete Hodgson.

International comparisons show that amongst 23 OECD countries New Zealand's per capita emissions were relatively low, but it had the second highest percentage increase in CO<sub>2</sub> emissions from 1990-2000. "New Zealand needs to break the link between economic growth and escalating fossil fuel use," Hodgson said.

A report is available at [http://www.med.govt.nz/ers/en\\_stats/green2002/](http://www.med.govt.nz/ers/en_stats/green2002/)

NZ Government, 3/7/2003

*(We question that bit about 'relatively low' per-capita emissions: see the article at left —EW)*

## These comedians are doing better than we are

Nine out of ten UK firms claim to have energy efficiency policies in place, but only 6% of these actually monitor their energy consumption at all, according to a new report by a UK energy consultancy.

"It is difficult to implement an effective energy policy without knowing how much energy you use and where your energy is going," said Julian Miller, director of Sussex-based consultancy AEC, which carried out the survey. AEC interviewed facilities managers from 50 of the UK's largest 1000 firms. Just 44% of those who claimed to have energy efficiency policies actually knew how much energy their firms consumed, the consultancy said. Four times as many firms sought to reduce their energy bills by negotiating with their supplier than by adjusting their heating and boiler systems, AEC claimed.

Edie Weekly, 23/5/2003

## Industry really can save energy

Last year, SEF member Rob Bishop identified the following energy savings available on a large NZ sawmill:

	Energy saving (%)	Simple payback (yr)
Fix compressed air leaks	1.0	–
Balance phase voltage	0.3	–
Optimise boiler tune-ups	1.4	0.4
Insulate outside vessels & piping	1.7	0.7
Insulate indoor vessels	0.6	0.9
Recommission power factor correction	2.8	1.5
Replace v-belts with cogged	0.4	1.2
Install boiler flue heat recovery	1.8	2.4
Reinsulate kilns	1.7	2.1
Improve electric motor controls	2.7	2.3
Install kiln exhaust heat recovery	3.9	2.9
Total	18.3%	

That's a saving of \$ 330 000 /yr, for 11.4 GWh/yr of gas and electricity, at an overall simple payback period of 21 months. All this is obtainable on a large, almost-new plant — just the sort of consumer that you might expect to be already well optimised. So how big are the economic savings available on older and smaller plants?

## Methanex

Methanex has closed its Waitara Valley plant in Taranaki, and one train (half) of its Motonui plant. Expected production in NZ this year is only about 800 000 t of methanol — about 40% of capacity.

Methanex delayed the redetermination by the Independent Expert (and we understand that they have now jammed further legal spanners in the works). As a result the old allocations are still in effect, allowing Methanex to stay in production for longer. If this is correct, the fact that they are not in full production suggests that Maui is no longer able to deliver the flows of 2002 and earlier.

Methanex provides useful 'base load' for Maui and any offshore replacement. The idea is that without Methanex the New Zealand gas market is so small that it would be difficult to justify the expense of developing a new offshore field.

ERN (Australia), 25/3/2003

## Pohokura go-ahead

The Environment Court has dismissed appeals over the development of the Pohokura gas field in Taranaki, giving the \$M 900 project the green light. Rata Pue, from Te Ohu O Pohokura had appealed against resource consents granted to Shell Todd Oil

Services for the development of the major new gas field under the Resource Management Act.

Phil Moore, Shell Todd Oil Services project delivery manager, says the decision means they should be free to get on with Pohokura's development, once the 20 day appeal period is up.

Shell expect to begin gas extraction in time for the 2006 winter.  
NewsRoom, 20/6/2003

### **NZ's first negotiated greenhouse agreement**

The \$180 million Marsden Point upgrade announced by the NZ Refining Company (NZRC) is supported by the first Negotiated Greenhouse Agreement (NGA) to be put in place, Pete Hodgson, the Convenor of the Ministerial Group on Climate Change, said. NGAs provide an exemption to the proposed greenhouse gas emissions charge to be put in place from 2007. In exchange, firms commit to moving towards world best practice in emissions management.

NGAs are limited to firms or industries whose competitiveness is at risk from producers subject to less stringent climate change policies. "Securing an NGA was critical to NZRC's decision to continue investing in New Zealand," Hodgson said. "This significant investment is required by the refinery to achieve the lower petrol benzene and diesel sulphur levels that are required as a result of the new Petroleum Products Specifications Regulations." "This investment will help our environment in two ways. In moving towards world best practice emissions management the refinery will reduce greenhouse gas emissions from the refining process. By producing higher quality petrol and diesel it will enable New Zealanders to use vehicles with more advanced, cleaner engine technologies," Hodgson said.

New Zealand Government, 24/4/2003

### **More interest in cycling and walking**

Transfund New Zealand has announced funding for twenty-four projects to support cycling and walking, with a total cost of nearly \$M 1.0. Chairman David Stubbs said the Transfund Board was pleased to enable these projects to go ahead. "Cycling and walking obviously have numerous benefits, ranging from helping to reduce congestion on roads and improving fitness levels, to supporting efforts to reduce greenhouse gas emissions."

This is not in itself earth-shattering. Much more important is that funding has been set aside; funding mechanisms and technical standards are being developed; roading authorities are being encouraged to develop strategies; and a course is

being developed to train traffic engineers in design for cycles.

Unsurprisingly, it isn't working yet. In 8 years (1989/90 to 1997/98) cycle use in NZ has fallen by 19%. The biggest drop in on-road cycling has been amongst school-age children and teenagers. This is thought to be partially because wearing a helmet (or riding a bike for that matter) is 'uncool' in a culture of cheap motoring; the school run; 'stranger danger;' and unsafe cycling due to poor driver behaviour and roading design.

However, the benefits of cycling are becoming more widely recognised, not least in government and official thinking: cheap, near-silent transport; good exercise; efficient use of road space and no emissions. And cycling is very safe if it is well handled: cyclist's risk in the Netherlands is an order of magnitude lower than in NZ (and no, they don't use helmets). Watch this space.

e-CAN, EW, 2003

### **New gas turbine for Huntly power station**

Genesis Power is to apply for resource consent for a new 40 MW open cycle gas turbine plant at the Huntly Power Station, prior to winter 2004. The new turbine will provide additional security of supply ahead of commissioning the 365 MW combined cycle gas turbine in December 2005.

The plant will be located on the existing Huntly site and will run on natural gas from existing Huntly contracts. It will operate at 41% efficiency, compared to Huntly's 36%.

Genesis Power, 10/6/2003

### **Energy Management Myths**

#### **Fluorescent lights**

*You'll use less electricity and fluorescent tubes will last longer if you "turn lights off if you expect to be away for more than a few minutes."*

The turn-on for fluorescent lights energy equates to about one seconds running.

Frequent switching of fluorescent tubes does reduce their life — but they generally last longer because the off time exceeds the reduction in lamp life, if they are off for a few minutes or more.

#### **Computers**

Start-up energy is completely negligible. No doubt there is a tiny amount to spin the hard drive up but you wouldn't even be able to measure it and there is no case for leaving the machine on even for a couple of minutes to save that.

There has been an issue with reliability. Hard drives in particular are expected to fail as a result



of either ongoing wear (related to hours of use) or wear caused by head to disk contact which happens each time it starts and stops. EECA commissioned a study on that about three years ago and the suggestion was that the 'average' life is around 500 000 hours (57 years) or 500 000 starts, whichever comes first. This indicates that the optimum would be to turn it off if you are not using it for an hour. However they are both such large numbers that the average disc drive is obviously junked long before it fails.

A study done by Canterbury University in June 2001 on a wide range of Pentium PCs found the power use for a PC is 30–60 W, plus 60–75 W for the monitor, so it is certainly worth turning the monitor off.

Director, Information Technology, Massey University, 27/5/2003

### **Bio-ethanol a waste of energy?**

First year students at the University of California, Berkeley have concluded that producing ethanol in the US is a waste of energy. The ethanol industry were not happy, but Professor Ted Patzek stood by the student's conclusion. In a statement one of Patzek's students, Jason Lee, said that ethanol, which is distilled from field corn, appears to be environmentally friendly. "But if you dig underneath, you find that it's really misleading," Lee said. "The amount of fuel and oil needed to use ethanol is greater than the value of energy ethanol provides. It's ridiculous to think it would decrease our dependence on oil." The students found a net energy loss, including use of pesticides and petroleum-based fertilisers on the corn, and all the petroleum energy used to harvest the corn, deliver it to market and then make ethanol, was 65%.

SEF News, contributed by Jonathan Leaver

### **Whisper Tech wins contract with UK's largest electricity supplier**

In a world first for residential distributed generation, Christchurch-based Whisper Tech Ltd has won an order to supply 400 of its innovative in-home combined heat and power systems to Powergen; one of the largest electricity and gas suppliers in the UK.

The unit is called WhisperGen. It can replace the traditional (UK) domestic boiler and produce all the hot water needed in the home for normal domestic and heating purposes. When it produces hot water it also generates electricity which can either be used in the home or fed back to the electricity grid.

The WhisperGen runs on either gas or heating oil and is highly fuel efficient. It will reduce the typical UK home's annual energy costs by up to 40%. Generating electricity inside the home means greater than 90% of the fuel energy can be used compared with less than 40% for a conventional power station and electricity network. This leads to better use of non-renewable resources and lower CO<sub>2</sub> greenhouse gas emissions.

Whisper Tech's managing director David Moriarty says the technology is ground breaking. The WhisperGen will be the first commercially available in-home generator in the European market, where six million domestic boilers are sold each year. The WhisperGen is sized as a suitable alternative for the bulk of this market. "While we knew the technology had huge potential as a more efficient way of providing heat and electricity in European homes, this order is a major breakthrough for us because it confirms that other people believe it has potential too."

Whisper Tech employs 68 staff in Christchurch but now plans to increase its staff numbers and production capacity to meet the order. It is targeting export sales of \$12 million over the next 12 months.

Newsroom, 12/6/03

### **Harnessing the wind**

Greenpeace has published a report on wind power in New Zealand: *Winds of Change*, exploring our "phenomenal" wind resource. The report points out that installed wind turbine capacity worldwide is growing at 30%/yr, but New Zealand, the 'Saudi Arabia of wind' has only 0.25% of this.

The report cites a 2001 government study, saying that wind in New Zealand could produce 100 000 GWh/y — three times our total present-day supply from all sources. There have been industry claims that this figure is overstated, but it is at least as likely to be understated.

Identified barriers to harnessing the wind resource include:

- Artificially low hydro power costs because generators are insulated from the true capital costs of their plant.
- Artificially low thermal power costs, due to exceptionally low fuel costs. (This barrier will tend to disappear as gas prices rise with the early closure of Maui, and the introduction of a carbon tax in 2007)
- Commercial nervousness over new technology. Ironically, part of the trouble here is uncertainty about how turbine designs will stand up to such strong winds.

- Artificially high financing costs because of untried technology.
- Lack of research on suitable sites.
- Artificially high grid connection costs.
- Community NIMBYness about noise and visual effects.

The report recommends greater Government support, citing successful development in Denmark, Germany and Spain. All these countries have substantially more wind turbine capacity than New Zealand, despite a substantially less attractive resource.

The report is available at [www.greenpeace.org.nz](http://www.greenpeace.org.nz)

### **Growth in wind power**

A report by Greenpeace and the European Wind Energy Association estimates that wind power could provide 12% of world electricity demand by 2020, if policies are put in place which recognise its benefits to the environment. The current figure is 0.4% (implying an expected growth rate of 20%/yr). In contrast, the International Energy Agency (IEA), reported last year that (all) renewables would account for only 3% of demand in 2020.

Planet Ark, 29/5/2003

### **Business travel plans in Christchurch**

Three Christchurch organisations have helped reduce traffic congestion and staff parking hassles through business travel planning. Three pilot schemes have been co-ordinated by Environment Canterbury at Christchurch Polytechnic Institute of Technology (CPIT), consultancy firm MWH New Zealand Ltd and Environment Canterbury (EC) over 12 months. A travel plan aims to promote more efficient and sustainable transport options for staff travelling to work and for other business trips. Results were:

CPIT 11% reduction in car use.

EC Only marginal change but from a high base: almost 30% of staff now cycle to work

MWH 19% of staff cycle to work — up from 15%.

Organisations wanting to source information on the benefits of alternative transport can visit [www.gosmarter.org.nz](http://www.gosmarter.org.nz)

### **A business plan for Auckland rail**

The Auckland Regional Council, Infrastructure Auckland and ARTNL have released a business plan for the Auckland rail network. The plan sets a vision for 2021 and defines the preferred network configuration, sets out an upgrade pathway and

outlines funding and delivery structure arrangements.

Patronage targets have been set at 25 M passengers by 2015 and 30 M by 2021. The business plan concludes that electric heavy rail will be the best infrastructure to meet the long-term vision. The plan estimates the cost to 2018 to be approximately \$M 775 for the core network upgrade and \$M 695 for ongoing expansion.

The first (core) stagewill be carried out in 2004–09. It will include electrifying of the western, main truck and isthmus lines, double-tracking on the western line, construction of a Manukau link and upgrades of signalling on all lines. Stations will also be upgraded and new rolling stock purchased. The second stage, from 2009–2023 would involve implementing traffic demand measures, selected capacity expansion, and upgrade of stations and rolling stock to meet demand.

For more information see the draft business plan at:

<http://www.artnl.co.nz/downloads/DRAFTRAI.PDF>

### **Greens call for stop to fossil freeloading**

Coal advocates should get their heads out of the ground and stop taking a free ride on the environment and public health, Green Party Co-Leader Jeanette Fitzsimons said. She was refuting claims by Solid Energy chief executive Don Elder that a carbon tax will distort the energy market. “Don Elder is leading with his chin in claiming that a carbon tax would be ‘distortionary’ in the energy market,” said Fitzsimons.

“What has distorted the energy market for many decades is the subsidies to coal at the expense of the environment and people’s health. An efficient, competitive economy can only function properly if enterprises have to pay for all the costs they cause.

“A carbon tax is a small step towards making coal pay for its contribution to climate change, air pollution, black lung disease, surface water pollution and landscape scarring from mining.

“Only when these costs are fully accounted for in the price of coal can there be a level playing field where it can compete fairly with wind, solar and hydro electricity.”

Fitzsimons said the energy industry must search for sustainable solutions to the impending energy crisis, not digging up fossils from the past.

Green Party, 27/3/2003

### **First Windflow 500 turbine in service**

Windflow Technology's first wind turbine was erected at the Gebbies Pass (Banks Peninsular) site in mid-May and is now generating power. It was officially opened by Minister of Energy Pete Hodgson on 9 July.

"The project has successfully completed its commissioning period and the machine is performing as expected," said Geoff Henderson, CEO of Windflow Technology, "This is a significant milestone for Windflow Technology, placing us firmly on the map as a serious contender in the field of sustainable energy." The opening marks the end of commissioning tests on the pre-production machine, that will culminate in the windmill being brought to its full output capacity of 500 kW. On average it will produce about 200 kW.

"The high performance of the Windflow 500 design is due to the torque-limiting gearbox and the rotor teetering mechanism, that allow more energy to be produced from a lighter machine compared with conventional structures. It leads the way globally on energy generation efficiency and structural excellence."

Support for Windflow Technology's work has been widespread across government departments, investors, environmental groups and the general public. "In particular we must acknowledge the strong support of the Christchurch City Council, Orion and our many shareholders whose faith is being vindicated by the performance of our first windmill," said Henderson

The Christchurch City Council signed a contract with Windflow Technology in 2001, to purchase power from the Windflow 500 over a period of 10 years. This is consistent with the Council's policy regarding sustainable energy supply for the city. Similarly, Orion signed a 10 year agreement to provide connection to the national grid.

"Wind powered generation provides a sustainable and economic energy source, that is so easily accessible to New Zealanders" Henderson said, "We can now start on the next stage of the development of Windflow Technology and wind powered generation. And to this end we will be announcing a Rights Issue soon."

Windflow Technology, 3/7/2003

### **Biodiesel option investigated**

Animal tallow — a by-product of New Zealand's meat processing industry — may power earthmoving machinery used in the construction of Meridian Energy's massive Project Aqua on the lower Waitaki River.

Meridian is working with a Massey University team led by Masters student Andy Smith to develop an environmentally friendly fuel to power the bulldozers, scrapers and diggers used in the construction of the hydro project. Smith is aiming to build on the experience gained when he manufactured biodiesel from canola oil to power a VW Golf in the 2002 EnergyWise Rally of New Zealand. Based in Meridian's Christchurch office on an Enterprise Scholarship, he is scoping the development of a refinery that would convert animal tallow into biodiesel. He believes this would be the country's first biodiesel plant and the first in the world to use animal tallow as the base product. "We know how to make biodiesel. Animal tallow is a readily available waste product in New Zealand and there are many meat processing plants in the South Island," said Smith. He estimates that 55 million litres (ML) of fuel will be needed to power the machinery that will build the scheme. He is working on identifying sources of tallow for the biodiesel, its cost, and developing plans to build a refinery that will be able to be used to produce biodiesel for other purposes once the construction of Project Aqua has been completed. The biodiesel will be greenhouse gas-free and could be blended with ordinary diesel in any proportion or used on its own.

Massey University, 19/6/2003

### **Behaviour change can reduce congestion**

A study by Transport 2000 for the UK Department for the Environment says that a consistent set of policies aimed at changing people's transport behaviour, rather than trying to improve technology, would give the greatest reduction in CO<sub>2</sub> emissions from the transport sector.

The study highlights the potential for 'soft' transport initiatives (those that don't require heavy capital investment) to reduce car traffic and therefore congestion. Two scenarios considered are:

- 'Enlightened business as usual,' which assumes most local authorities achieve current best practice.
- 'Ambitious change,' which assumes national and local governments "pull out all the stops to achieve maximum behaviour change."

Under the enlightened scenario, car travel demand could be reduced by 12–15% in urban peak conditions. Under the ambitious change scenario, demand could be reduced by 26–33%.

The report analyses the potential reduction in vehicle traffic from bus improvements; local rail and tram schemes; workplace travel plans;

teleworking; school travel plans; individualised marketing; car clubs; better cycling facilities; and incentives to walk more. Potential synergistic effects (when several measures are applied in the same place at the same time) have not been included in the estimates. The report acknowledges that measures would need to be coupled with traffic restraint to prevent their benefits being eroded by induced traffic.

Philip Watson: philip.watson@eeca.govt.nz

**Power crisis over**

After three weeks of heavy rain, the power crisis seemed to be over in mid-June. However, Minister of Energy Pete Hodgson supported the caution of power crisis boss Dr Patrick Strange in not calling off the savings campaign. At that stage the hydro lakes contained 2500 GWh of stored energy, about 600 GWh more than when the campaign began in late April.

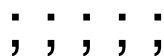
Earlier, National Party Energy spokesman Gerry Brownlee had claimed that Vector's customer contract did not allow for Aucklanders' hot water to be turned off as a conservation measure, unless Transpower declared a grid emergency, and that would allow Vector to flick the switch.

**Warning: SEF Discussion Group**

There have been problems on the SEF discussion site with a new virus, the C-Nile Virus, which seems to defeat all virus checkers. Symptoms of C-Nile Virus are:

- You send the same e-mail twice.
- You send a blank e-mail.
- You send e-mail to the wrong person.
- You send back the message to the person who sent it to you.
- You forget to attach the attachment.
- You hit SEND before you have finished the

We can only recommend that group members take great care.



## Sustainable Energy Forum Conference

The next SEF Conference will be held on Saturday and Sunday 27–28 September 2003 (note the revised dates), at the UNITEC Institute of Technology, Carrington Road, Mt Albert, Auckland. The theme will be:

*Achieving Targets for Sustainable Energy in New Zealand*

The objective is to review the National Renewable Energy Strategy and the National Energy Efficiency and Conservation Strategy; progress in their implementation; and to compare this with what might be realistically possible over the next decade.

See the SEF website: [www.sef.org.nz](http://www.sef.org.nz)

### Forum Membership



Memberships are for twelve months and include at least four copies of EnergyWatch. Membership rates, including GST, are:

Unwaged/student	\$ 22.50
Individual or library	\$ 45.00
Corporate	\$ 250.00
Overseas	\$ 55.00

Mail the form below, with your payment or order, to The Sustainable Energy Forum Inc, P O Box 11 152, Wellington, NZ. A GST receipt or invoice will be sent on demand.

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