EnergyWatch

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Life after Aqua

It was good to see, almost immediately after the cancellation of Project Aqua, Minister of Energy Pete Hodgson refusing to be railroaded. His speech (in edited form on page 3) was a good summary of where we are and what we need to do next.

Was it coincidence that Meridian pulled the plug a day or two before a national power conference? One hopes that the Minister had more warning than Joan Public, because the special interests were out in force and a wavering Minister might have made Tina (There Is No Alternative) very busy.

The Resource Management Act (RMA) was clearly to blame, and some of those clamouring for reform would have it replaced by something certain and cheap — for business — but apparently with no other requirements. We review some of this circus on page 15.

We hear that two real problems faced by Meridian were that the earthworks would have cost much more than expected, and that demands for irrigation water were closing a loophole in the RMA: with no competitors and no water management plan the minimum flow could perhaps have been set by Meridian thinking of a number.

Coal is now not only the only solution (Tina please note) but also the cheapest. Ignoring Kyoto, coal-fired thermal electricity at 5 ¢/kWh looks very attractive, but it also looks too good to be true — and is probably just that. Any contract would need to be checked very carefully for wording such as, "regular price review" and "having regard for world market prices." But even if growing exports of high-quality coking coals could subsidise a local price for a much lower quality coal, how long would it take to get a coal-fired station or two through the RMA (if that were still a requirement), and then build them? We understand that ten years is typical in the US and we doubt whether New Zealand could do much better.

If we cannot do better, what is the problem that demands immediate action and that new coal-fired power stations will solve, when they will be commissioned 5–8 years after the start of any gas gap left by Maui; 2 years into the second commitment period of the Kyoto Protocol (yes, we live in hope: see page 21); and with atmospheric CO_2 still rising fast (see page 27)?

Neither is there any alternative to gas (cc Tina). Here we have more sympathy with the Tina approach. Getting onstream with Pohokura, Kupe and whatever else we can find is only good sense, with the gas turbine power stations already built. But it is going to be a close-run thing.

We have much less sympathy for the gas exploration concessions in the budget, especially given our high prospectivity (see page 4), although we can see that a Minister who doesn't Do Something might be in trouble at election time. We can only hope that the concessions made will not blow up in our faces. Reserves can only appreciate in value — very steeply — as peak oil arrives, but when they are discovered, will the windfall go to New Zealand or some overseas oil company?

But if the petroleum exploration concessions in the Budget were politically necessary, surely some greater support should have been given to developing energy efficiency and wind generation? All the signs are that these would be far more effective investments in New Zealand's infrastructure.

Public education would have been another useful area for budget funding (Was it an election promise?). No wonder Kyoto looks dumb to so many parliamentarians, and others, when the antis are having a field day (see our March issue), the media is hiding behind some obscene concept of balance and our public education programme is so far behind most other developed countries.

(continued on page 2)

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Life after Aqua

Continued from page 1

Despite encouraging action on the ground, wind has hardly featured in the post-Aqua debate, apart from a rising level of strident put-downs. And yet wind is the only real alternative that can be developed in time to cover loss of generating capacity in a massive and frighteningly short-term level of uncertainty over gas supplies (Now *we* are playing Tina: sorry).

Wind turbines, we are told, are too unsightly. Would we prefer to freeze in the dark through any gas gap, then accept coal and cooling towers from about 2014, or nuclear another decade or so later? Similarly, wind turbines are too expensive (when Meridian's estimate for Te Apiti is 6.5 ¢/kWh and falling, with no carbon charge?); too unreliable as supply (use hydro backup as 'virtual storage'?); and too disturbing to grid stability (already? and is no correction possible?). But there is still a big 'if' around wind turbines: how can they be fitted into the electricity market, at both grid and distributed levels? See page 24.

Which brings us back to the demand side. EECA is doing good work on building up the infrastructure of trained energy auditors and efficiency equipment installers. But with so much to be done, is annual funding for EECA of 1% of the cost of Project Aqua enough — when the prize is even bigger than Aqua?

And last but only-too-far-from least, peak oil. New information (see pages 6–13) suggests that our views on when peak oil might strike might have been too optimistic: 'Probably within the lifetime of a 60-something' now looks more like, 'probably far too soon.' And if that is even plausible, should we not be taking urgent action to improve the efficiency of our transport fleet?

EnergyWatch

In our March edition we over-did our fondness for the Euro, with stray €s scattered across our pages. At one point we had a reference to 100€000€PJ (intended as 100 000 PJ). We apologise, and sympathise with anyone who was confused.

What happened was that EnergyWatch was sent to the printers as a PDF file instead of the usual paper copy — an electronic box in the wire leading to the editorial laserjet was sulking. The printers produced a proof photocopy which was correct, but then printed on a different machine which confused Euros and non-breaking spaces.

So we are back to photocopying for this edition. A pity — the printing was a nice job.

NZ's electricity future after Aqua

Electricity issues in the wake of Meridian Energy's cancellation of Project Aqua

An edited version of a speech by
Minister of Energy Pete Hodgson to the
National Power Conference, 31 March 2004

At over 500 MW, Meridian's Project Aqua loomed large in this country's energy future. It promised a large amount of competitively priced baseload generation, starting in about five years. Shelving the project will prompt a reassessment of the opportunities for new projects; both the capacity for new megawatts and the price. That price is likely to be a little higher without Aqua. I have been given two estimates of the possible increase, of about 0.5–1.0 c/kWh, cutting in around the end of this decade. Either estimate should bring a reasonably wide range of projects into contention.

The Government's position has always been that if Aqua is to proceed it should proceed on time — and if it is not to proceed the country needs to know sooner rather than later. In the event Meridian has decided in good time for other generation options to be rescheduled and for new proposals to be developed.

New projects

Yesterday I released an updated list of projects that we know are coming on in the next four years. I think it's important to lay this out, because I have wondered whether the study of journalism or engineering might cause an optical disorder that renders anything less than about 400 MW invisible. The list of confirmed new projects includes:

- Trustpower's expansion of its Tararua wind farm by about 40 MW, on target for completion in May;
- The Government's 150 MW oil-fired reserve generation plant at Whirinaki, Hawke's Bay (now commissioned);
- Genesis' open-cycle gas turbine of 40-odd MW at Huntly, due to be commissioned soon;
- Meridian's Te Apiti wind farm, of about 90 MW, due to come onstream progressively over the next year or so;
- A further 40 MW at the Mokai geothermal station, due by Autumn 2005; and
- Genesis' "e3p" combined cycle gas turbine at Huntly, about 400 MW, which the company says it expects to commission in December 2006.

There are a number of smaller generation projects as well, including geothermal, improvements to the efficiency of existing hydro, and co-generation.

Supply growth

The total coming on from this year until 2007 is about 840 MW, so the average over the next four years is over 200 MW/yr — when New Zealand needs to average about 150 MW/yr of new generation to keep up with growth in demand. The average growth rate between 1990 and 2007 will be about 160 MW/yr. And this is working from a conservative assessment of what is coming onstream. Many more proposals are under assessment and some will sneak up on us quickly — announced one year and built the next, like Meridian's Te Apiti windfarm. We will also have to factor in anything the Electricity Commission chooses to build by way of reserve generation, or provide for by way of demand management.

Challenges

I am not setting out this information by way of saying "She'll be right". I am simply trying to intrude some facts into the debate about our future electricity needs. However, there are some real challenges ahead. We are at a turning point in NZ's energy history. Hydro has been our mainstay for decades, providing some of the cheapest electricity in the developed world, but future hydro development is likely to be small to micro in scale. It will continue to be important but its massive dominance of our electricity system will gradually be eroded. The advantage will be a gradually decreasing vulnerability to the risk of shortages in dry years. The disadvantage will be that other new generation sources will not be as cheap.

Wind power is becoming more attractive as capital costs fall and electricity prices rise. It is about to grow rapidly into a significant minority of our generation capacity. It will quadruple over the next year or so, and by international standards our wind resource is very good. Clearly, however, wind cannot be the only answer to our growing electricity needs. It has a relatively low load factor. There are technical limits on how much wind generation can be handled by the national grid. And the best wind sites will become more expensive with time, after the easiest locations have been taken.

Geothermal power is another significant minority player. While it is a generally stable source of power, it too is unlikely to become a major source of energy for our future growth.

So the future of renewables is not continued dominance by hydro, or a shift from hydro to geothermal, or a shift from hydro to wind, but continuing growth in all of these. It remains true that most new generation in the foreseeable future

will be from renewable sources, because they are cheaper.

Gas supplies

Gas has been the main fuel for new thermal generation in the last couple of decades, given the abundant and flexible supply from Maui, and facing the future without Maui is probably the biggest energy challenge ahead of us. Maui is not dead yet. Existing small fields are still producing. Pohokura, Kupe and presumably Karewa are on their way into production. Total known reserves might therefore get us through to about 2015, if consumption averaged about 140 PJ/yr. But there are no known supplies beyond that, and this is a country that has allowed itself to believe that there was always loads of proven, available gas. More exploration is needed.

Exploration has increased significantly with the impending demise of Maui. The number of wells drilled each year has doubled since the early 1990s. Crown Minerals is active in marketing exploration blocks, with a new Northland block offer announced and work under way on at least two more, for Taranaki and the East Coast. The question now before the Government is whether this is enough. The answer appears to be: "Perhaps not". We have an attractive fiscal regime and our international ranking for prospectivity is now high. But no stone can be left unturned here, and we have been investigating whether we can provide an even more positive environment for gas exploration, and expect to make decisions in the next month or two.

The electricity sector is taking its own initiatives in this area, with Contact and Mighty River setting up their joint fund for gas exploration, and Contact joining Genesis in funding a feasibility study into the importation of LNG. These are prudent, useful moves.

There is no doubt that NZ has plenty of gas — we just have to drill enough holes to find it, and attract the capital necessary to develop the fields. Similarly there is no doubt that we have plenty of coal. What is not clear yet is the future balance between these two fuels within our electricity system. To a large extent that will be determined by what gas is found. It will not be determined, contrary to some suggestions I have heard, by whether or not NZ has a carbon tax.

Carbon charge

The carbon charge this Government's climate change policy envisages would add perhaps 1 ¢/kWh to the cost of new gas generation and 1.5 ¢/kWh to the cost of new coal generation. It will not radically alter the price differential between gas and coal. And it is a small variable compared to the level of uncertainty about wholesale gas prices, which are in the process of doubling and could rise still further. Perhaps the industry's current tendency to focus on the prospect of a carbon charge arises from the superficially reasonable premise that — unlike the future price of gas — it is entirely within the Government's power to clarify what the charge will be. We have provided some clarity by specifying that the charge will be no more than $ 25/t of carbon. Industry might want to think very carefully about what calls for more clarity might entail. A minimum charge? A fixed price now?

Those who wish that this would all just go away, or hope that it will if the Kyoto Protocol does not come into force, have missed a fundamental point about global energy politics. Whether by Kyoto or some other mechanism, we are heading into a carbon-constrained world. A price on carbon is being gradually and irreversibly embedded in the global economy. New Zealand cannot shut itself off from this development. Attempting to do so would simply turn us into a museum for outdated energy technologies, just as we once managed to turn our nation into a quaint South Pacific car museum.

A carbon charge is not so much about pricing fossil fuels out of the market as about pricing alternative, low-emission and efficient energy technologies into it. We might well see new coal-fired electricity generation built in New Zealand in the next decade. A carbon charge will not prevent that happening. It will simply ensure that the price we pay for that electricity will be a little more reflective of the environmental cost of choosing that source of energy.

Emissions projects

There is also a real benefit for the energy sector from climate change policy that is too easily overlooked. It is called Projects to Reduce Emissions. Last year's Budget contained, for the first time, two currencies. One was the New Zealand dollar. The other was 4 Mt of carbon credits. *(See p 25 — EW)* These credits were offered by tender to anyone with a project that would reduce greenhouse gas emissions, but which was not quite economic on a business-as-usual analysis. The bulk of the successful bidders are projects that will help make New Zealand's electricity supply more secure in the next few years, as well as reducing emissions. They include wind farms, geothermal and hydroelectricity schemes.

I recently signed the last few contracts to be concluded from the tender round. If all of the contracted projects proceed, the result for the electricity system is equivalent to more than a third of Project Aqua. And if a contract is to proceed it will need to be done by 1 January 2008, or the credits won't be earned. Without the Kyoto Protocol, this wouldn't be happening.

The RMA

Like the protocol, the Resource Management Act won't prevent new thermal generation being built — or new renewables, for that matter. More than 2000 MW of new generation capacity has been built in New Zealand since 1990, most of it, obviously, under the RMA. The RMA did not create the NIMBY syndrome, nor did it inspire a previously unknown human and commercial capacity for mercenary or vexatious objections to new projects.

Of course it can be improved. This Government has already made amendments to streamline consent processes generally, as well as more specific amendments to ensure better consideration of the benefits of energy efficiency and renewables when decisions are made on energy projects. We have also increased the resources of the Environment Court, enabling it to halve its backlog of cases and cut the time taken to hear cases by even more than that. There will inevitably be more change to come, as we keep the whole RMA framework under constant review. But there will always be a need to consult communities about developments affecting them, particularly major infrastructure projects. People have a right to air legitimate concerns about any proposal. In fact we compromise our ability to make wise decisions if we do not allow such scrutiny.

A key factor in the sequencing of new generation over coming decades will be the extent to which we are successful in moderating demand growth by increasing energy efficiency and conservation

Already, inevitably, the critics have picked up Project Aqua as Exhibit A in their case against the RMA. I appreciate Keith Turner's careful, honest insistence that the decision on Aqua was not simply a case of consent fatigue, despite endless invitations to do so. I also appreciate his call for the industry to think strategically and suggest practical improvements to the law, rather than simply complaining to the Government. And I would remind those who take the demise of Aqua as an indictment of the RMA that Meridian also has a remarkable story to tell about a project that shot through the consent process in a flash. It secured consents for its Te Apiti wind farm in a matter of days.

It has been argued ... that demand growth will inevitably march ahead in lockstep with economic growth, forever. That is not the experience of other modern economies, where demand growth is increasingly being decoupled from economic growth.

Energy efficiency and conservation

I have been talking mostly about the supply side because that is where interest has been focussed by the Project Aqua announcement, but my interest in the demand side is just as strong. A key factor in the sequencing of new generation over coming decades will be the extent to which we are successful in moderating demand growth by increasing energy efficiency and conservation. The National Energy Efficiency and Conservation Strategy aims for a 20% improvement in the nation's energy efficiency by 2012, and is currently on track to achieve that. The more we save energy, the more we moderate the need for costly investment in new generation.

It has been argued at this conference that NZ has limited scope for improving energy efficiency without an expensive and unlikely turnover of capital stock — and that demand growth will inevitably march ahead in lockstep with economic growth, forever. That is not the experience of other modern economies, where demand growth is increasingly being decoupled from economic growth.

Yet this kind of supply-side thinking has dominated in this country for decades. It needs to be spiked. Let me do that with a few quick examples:

- Chelsea Sugar replaced a sugar purification process that had run with little change for almost 120 years. Chelsea halved its gas consumption, saved on labour, water, wastewater, heat and air pollution, and expects the $ 7 million it spent on new plant to repay itself in four years.
- Sealord focussed on energy use at its Nelson and Dunedin processing plants and cut it by 6.5% while increasing production by 7.5%.
- DB saved about 10% on its annual electricity bill and 30% of its gas consumption by improving efficiency.
- Norske Skog Tasman replaced fuel oil with wood waste to heat their boilers and saved electricity worth $ 500 000 /yr.

New Zealand's electricity has always been so cheap that it should not surprise us when we find we have not been using it as efficiently as we should. Of course we can do more with less, and the incentives to do so rise with prices. They also rise with our aspirations for a more sustainable energy future — or the realisation that inefficient use of energy is just a bit dumb. The demand side embraces energy efficiency, load shifting, energy conservation, and, by some people's reckoning, fuel switching. If we look at it as a resource, alongside supply resources, its potential for helping meet our energy needs is large indeed. The problem with the demand side resource is that it is very diffuse and difficult to identify, unless you set out determinedly to do so. It is, however, cheap. And if we are interested in achieving the holy grail of a secure electricity supply at an affordable price, the demand side demands more attention.

From all of us.

Oil supply limits

Kerry Wood

Apart from the sections 'reservoir behaviour' and 'conclusions', this article is very largely abstracted or adapted from:
Beautiful and not so beautiful minds: an introductory essay on economic theory and the supply of oil, (2002)
Ferdinand E Banks, Nationalekonomiska Institutionen, Uppsala University, Box 513,SE-751 20, Uppsala (Sweden)
(copy from Peter Read)

No initiative put in place starting today can have a substantial effect on the 'peak' production year. No Caspian Sea exploration, no drilling in the South China Sea, no SUV replacements, no renewable energy projects can be brought on at a sufficient rate to avoid a bidding war for the remaining oil. Kenneth S Deffeyes (2001)

…in order to keep prices up the Arabs would have to curtail their output by ever larger amounts. But even if they cut their output to zero, they could not for long keep the world price of crude at $10.00 per barrel. Well before that point the cartel would collapse… World oil prices are weakening. They will soon tumble.
Milton Friedman (*Newsweek*, 4 March 1974)

We find ourselves having to consider that world oil production might peak in less than five years.
Ferdinand Banks (2002)

The above quotations from Deffeyes and Banks illustrate what seems to be a reasonable view of the current situation, although the quotation from Friedman is a useful commentary on the value of predictions. Banks also quotes a (1970s?) study in which 25 experts predicted a year-2000 oil price in the range US$ 70–110/bbl. They were way out on price, but they might yet be right on price and only a little out on the date.

World oil consumption is "almost certain" to follow present trends for at least the next 5–10 years. Massive sunk investments in oil use — on both supply and demand sides — mean that the response to changing price and supply can only be slow. However, present trends are to impose new demands on supply from the Middle East. China's oil production is declining, and with domestic demand growing at up to 15%/yr, rising oil purchases in the Middle East are one of the reasons for the current price spike. China's economy is growing rapidly and the Chinese are motorising even more rapidly.

But when oil goes into scarcity pricing, something will have to give. New Zealand is badly placed here, with oil use dominated by transport, and transport dominated by a bias towards road transport and old cars. The average life of a NZ car is perhaps 15 years (the average *age* in 1992 was 10.3 years), and this may not always include a previous existence in (usually) Japan.

Production and discovery trends

The world oil market 25 years ago was very different from today. In 1977 the total consumption of crude oil was 50 Mb/d (2.9 km^3/yr)[1], and could easily be raised a few percent by more drilling,. However, with current consumption about 4.6 km^3/yr, and a predicted need to add around 0.1 km^3 of additional oil each year, it is high time to take stock.

The total of conventional oil already produced is some 140 km^3. Banks gives a 2002 consensus figure for proven reserves as 120 km^3, but with Shell's recent reserves downgrading and rising concern about Saudi Arabia that consensus must now be doubtful. The (estimated) amount still to be found is given by Banks as some 50–80 km^3, so on that basis ultimate reserves would be around 320–350 km^3. The International Energy Agency forecasts world crude oil demand at 5.5 km^3/yr (95 Mbbl/d) in 2010, and 6.7 km^3/yr in 2020. Taking ultimate reserves as 320 km^3 (Banks' lower figure) and using Banks' figures for current use and growth, the half way point (160 km^3 produced) will come in 2007. If ultimate reserves of 350 km^3 are still plausible the halfway point will only be delayed until about 2011. It does not make much difference if these forecasts are inaccurate: even large errors make surprisingly little difference to the peak year. Banks considers it advisable:

...to believe that oil is scarce now, given the potential demand for it in the — perhaps — not so distant future. At the present time ... it is hardly rational for political and industrial leaders to think in terms of a future characterized by a surfeit of low-cost oil, even if (ex-post) this turns out to be the case!

It is now almost traditional to believe that Saudi Arabia has a decisive role to play in future oil supply. Around the time of the 1970s oil-price shocks, the Saudi Arabian economy was being programmed to produce 20 Mb/d of oil (1.2 km^3/yr). In the event the proposed plateau rate was scaled down to 16 Mb/d, 12 Mb/d, and eventually to well below 10 Mb/d, close to the current production rate *(See page 10 — EW).*

The world-wide rate of oil consumption first exceeded the discovery rate in 1981, and the trend

[1] In this article cubic kilometres are used as a unit of oil reserves and global production, in an attempt to make the figures more meaningful: very large units tend to be more comprehensible than very large numbers in conventional units. A cubic kilometre (km^3) is 6.29 billion barrels (Gbbl). A 1 km^3 tank would be as tall as Wellington's Majestic Centre, with a diameter of 1.8 km, stretching from the Majestic Centre to the Cake Tin, and from Tinakori Road to Te Papa.

since then has been for increasing production and decreasing discoveries. For the first time, there were *no* large field discoveries in 2003. Discoveries in the last 40 years have been:

Decade	1960s	1970s	1980s	1990s
Discoveries (km^3/yr)	5.8	4.4	2.4	1.2

The option of dramatically increasing the discovery rate now seems to be no more than a fantasy, so we are heading towards some kind of supply crunch. The looming problem is illustrated by discoveries and production in the 1990s:

Year	92	93	94	95	96	97	98	99
Discoveries (km^3/yr)	1.2	0.6	1.1	0.9	0.8	0.9	1.2	2.1
Production (km^3/yr)	3.8	3.7	3.9	3.9	4.0	4.3	4.3	4.3

The approach to Peak Oil

The oil industry is looking harder than ever for oil, and is finding more. But it is also moving farther than ever from finding enough. With a huge number of wells drilled in North America, onshore and offshore, even a much higher success rate will not reverse rising oil imports. It is less expensive than ever to find and produce oil, so the root of the problem is a shortage of reserves. The same applies to the North Sea and China, and could apply to Russia soon.

Despite this, certain oil companies have endorsed the idea of plentiful future oil at relatively low prices, because they understood that merger-related cost reductions had more to contribute to earnings than a frantic search for 'cheap' oil that is no longer available. Promoting the idea of future cheap oil should make shares in the targeted firms less expensive — and sometimes it did.

The Former Soviet Union now produces 0.4 km^3/yr, which puts it third in the world (behind Saudi Arabia and the US), with both output and exports increasing. The FSU probably has an important role to play, but with only 5% of the world's proven oil reserves it is unlikely to become an oil superpower. One problem is that the FSU ratios of estimated undiscovered reserves to identified reserves are suspiciously high: up to 2 for the world as a whole, but 4 for the FSU as a whole and perhaps 10 for the Caspian Basin. Banks says:

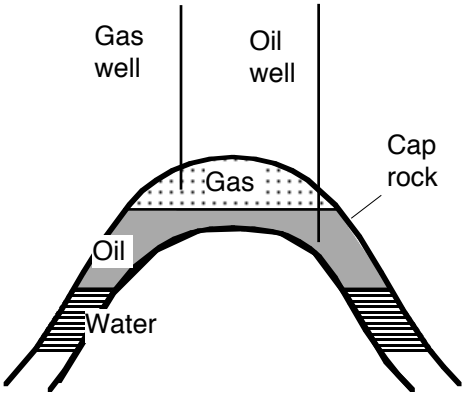
Oil firms in the FSU have been in the habit of maintaining that deposits that might possibly be developed, but haven't yet been discovered, should be treated as bona-fide assets for everything except tax purposes, so it could happen that somebody at the negotiating table might find themselves believing things that they would be better off ignoring, and making deals that they could ultimately come to regret.

Reservoir behaviour

The average recovery factor (the ratio of the expected oil reserves to the total quantity in place) for oil is about 35%. It can be as little as 5% for heavy oil or as much as 80% for light oil. Geological factors are also relevant. There is no reason to believe that recovery factors will improve dramatically, which is what is needed to radically change global reserves. Servicing company Schlumberger claim that they have quadrupled daily production in at least one North Sea well, but this seems unlikely on a large scale and in the long term.

The sketch shows a typical layout, with gas and oil collecting in a permeable rock formation beneath an impermeable 'cap rock' that stops them from seeping to the surface. However, note that the sketch implies an oil reservoir thickness of hundreds of metres when tens or ones is more likely. Also shown are 'gas' and 'oil' wells, but in practice wells are often arranged so that they can produce from any of several levels. Another complication is that reservoir fluids change phase as the pressure drops: the difference between gas and oil is not as clear-cut as it seems to be at atmospheric pressure.

When a production well is turned on, oil or gas will (hopefully) flow up from the reservoir, usually as some mixture of oil, gas and water. The pressure needed for flow comes from the reservoir, which in a new field is, broadly, the pressure at the bottom of a column of water extending from the reservoir up to the surface — usually a very high pressure.



A column of mixed of oil, gas and water, flowing up a well, will be less dense than water, so the reservoir pressure will be more than enough to support it. This means that there is surplus reservoir pressure available to push reservoir fluids into and up the well. A mixture of oil and water will be closer to the density of water and will need more reservoir pressure to support it, leaving less surplus pressure for flow. A column that is mostly water may hardly flow at all, so produced water limits production in two ways, reducing both total flow and the proportion of hydrocarbons in the remaining flow.

Initial production tends to be constant for a period ranging from days to years, then decline as the pressure drops. When an oil well is first turned on, the oil is pushed out by reservoir pressure in one of these ways:

- Water drive: Oil and gas are propelled by water entering the bottom of the field, driven by hydrostatic pressure in other formations surrounding the field. Ideally this will allow the whole field to be emptied with little loss of pressure but practice is rarely that simple.
- Gas drive: Oil and gas are propelled by the gas cap expanding. If the field is 'oil' rather than 'gas' there may be limited gas available and pressure may fall quickly.
- Some combination of water and gas drives.

When these process become inadequate other measures are needed:

- Additional gas compressed and reinjected into the top of the field, using gas separated from produced oil, from an adjacent gasfield, or sometimes using CO_2 if an industrial source is available.
- Additional water injected into the bottom of the field, from produced water, another aquifer or surface supplies.
- Submersible pumps installed down a production well and lifting oil directly from the field (special centrifugal pumps are used, with many small impellers in series, to get an impeller diameter small enough to fit down the well). In this case the objective is to pressurise oil in the well, and not the whole reservoir.

Whatever is done, care is needed to keep the 'layers' of gas, oil and water as distinct as possible. Drawing off oil may lead to water coming up from beneath the oil layer and entering the well, or gas coming down from above, or both. Complicating factors are faults in the porous rock structure; the greater mobility of gas and water compared with oil; and excessive production rates, and once water or gas has begun to enter the well the damage may be done. The results may include high production costs because of the need to reinject excessive quantities of produced gas or water, or pockets of oil that become inaccessible because they are bypassed. The ideal is to 'lift' the bottom surface of the oil towards the well intake (water drive), or 'lower' the top surface (gas drive). If a submersible pump is used there will be no particular way of ensuring even displacement of the oil/water and oil/gas surfaces, which may explain why pumping has a bad reputation. *(See 'Abu Safah' on page 11 — EW).*

The Reserve: Production ratio

A key factor is the Reserves:Production ratio (R:P). When it falls below a critical value, based on field data and typically about 10, the production rate should be limited. If this is not done the field will be 'overworked', reducing the amount of oil that can ultimately be produced. In effect the R:P ratio is a proxy for a great deal of important reservoir information.

As an example, assume that an oil field contains 225 units of accessible oil reserves (= R), and the desired production rate is 15 units/year (=P). The critical R:P ratio is 10.0. In this case the desired production rate can be sustained for 5 years, in which time the R:P ratio falls from 15.0 at the start of year 1, to 10.0 at the end of year 5. At that point cumulative production is 75 units and remaining producible reserves are 150 units, so two thirds of the originally producible oil remains in the ground. However, from this point on, continuing to produce at 15 units/year will violate the critical R:P ratio of 10.0, reducing it to (135/15) = 9.0 at the end of year six, 8.0 at the end of year 7 and so on. To maximise the ultimately recoverable reserves it is necessary to reduce the production rate after the end of year 5, to 13.5 units in year 6, 12.4 units in year 7 and so on.

In the real world a field may produce for many years before the R:P ratio becomes a controlling factor (half a century in the case of some of the super-giant fields in the Middle East), or it may splutter almost immediately (gas from some exploration wells in Taranaki).

The effect of the R:P ratio is extremely important and too often ignored. In this example, production turns down after the fifth year with only a third of the original reserves produced, when the original R:P ratio suggested a 15 year life — a completely false picture. Production may continue on this steadily declining basis for a very long time. 'Stripper' wells ('Nodding donkeys' driving downhole plunger pumps) account for 29% of US domestic oil production, but the output of individual wells averaged only 350 litres/day in 2000.

In the UK sector of the North Sea the R:P ratio is now closer to 5 than 10. What this probably means is that offshore production costs are so high that, unless prices are high, maximising profits might entail consuming (effectively destroying) some of the deposit to speed up recovery of the capital invested. This illustrates that the R:P ratio is important because of economics at least as much as geology. The basic operation is choosing a production profile that maximises the present value of profits from a field. If, for example, prices (and profits) were rising and expected to stay high, then the objective would be to extract the largest total quantity possible. Both economic and geological considerations would then lead to moderating the production rate — using a higher R:P ratio — so as to maximise the asset. Note that this would reduce production rates!

The Hubbert Peak

A mid-point depletion rule is now generally accepted, for oilfields, from work by M King Hubbert. In a given field or region, when approximately half the oil discovered and likely to

be discovered has been produced, production will level off and begin to decline. This pattern comes from activities during three phases:

- Initial phase: As production wells are drilled the flow from new wells exceeds the depletion of those already drilled, giving a rising pattern; or perhaps the rise comes from rising demand, or transport and treatment capacity.
- Intermediate phase: New drilling takes place at a pace designed to keep output more or less constant. Regionally, new production is from smaller fields and gets into diminishing returns.
- Mature phase: Drilling slows because the cost of extra wells is high compared to the value of the additional oil obtained. The downturn accounts for the declining production.

The fundamental law of decline applies everywhere. Additional wells must constantly be drilled, and/or processes introduced for maintaining pressure by water or gas injection. Even then production can decline by up to 6%/yr. The result is that inadequate investment will eventually result in a loss of production capacity.

In 1962 Hubbert issued an updated version of a highly controversial report in which he claimed that oil production in the 'lower 48' of the US (excluding Alaska) would peak between 1966 and 1970, when approximately half of the total amount of US reserves had been produced. The peak came late in l970 and output has been falling ever since.

Expressed another way, the oil reserves needed to defer the production peak to some time in the future depend on large discoveries made in the past. This was the fundamental insight of Hubbert: the production peak will imitate the discovery peak. Discovery in the US peaked in 1930, and 40 years later production peaked. Discovery in the North Sea peaked in l974, and comparatively high rates of production brought a peak in 1999, after just 25 years. World discovery peaked in 1964, and suggests that a global peak is unlikely to be delayed much past 2010 — 46 years. Since oil still provides 40% of traded energy, this means that some traumatic economic and political decisions may be needed soon.

Conclusions

Some very important conclusions can be drawn even from this simple explanation of a very complex subject. However, real-world uncertainties, for example around the actual producible reserves in a field, tend to make everything more complicated than presented here:

- Overproducing a field may cause serious damage by reducing the ultimately recoverable reserves.
- Investment to increase a field's production may not be worthwhile if the field is approaching Hubbert's Peak, because an approaching critical R:P ratio may not allow the increased production for long enough to justify the investment. The problem is even more severe if production is declining.
- Scarcity pricing as peak oil arrives will present almost irresistible temptations to overproduce, or perhaps this is already happening.
- A logical, economic, production response to a sustained oil price rise may be to *reduce* the production rate, so as to maximise the total future production from new investment that is now economically justifiable.
- Having 40 years-worth of producible oil reserves (the estimated current world total at current extraction rates) does *not* mean that production rates can be maintained for 40 years, let alone that business-as-usual consumption growth can be maintained.
- An old field may theoretically remain in production for centuries, but in practice it is likely to be abandoned with producible oil in place, because of problems such as excessive energy costs to reinject water produced with the oil, or unjustifiable capital costs to replace worn or corroded equipment.
- A field with declining production may be deliberately overproduced, to maximise financial return rather than cumulative production. This practice seems to be happening in the North Sea, and perhaps on most offshore fields. It will tend to maximise present-day production, but limit or deny opportunities for future generations to reopen the abandoned field.

These conclusions suggest that reopening an abandoned field might happen several times over the coming centuries. This in turn suggests that good records will be an immensely valuable gift to future generations. Another gift will be good housekeeping before a field is abandoned, such as plugging wells properly. But will these gifts be offered?

More on Kirkuk

In our March edition (EW 32, p 23) we reported that the Iraqis have been reinjecting up to 15 000 m^3/day of *oil* into their giant fields at Kirkuk. The reason given was that they had been taking gas for their own use and reinjecting the produced oil. Now the article above explains why taking too much gas off the top of the field could cause serious damage.

We do not know for sure that the field *has* been damaged, but with no likely source of replacement gas, any loss is a worry. If there was another gas source, why risk the goose that lays the golden eggs?

Rising oil demand challenges tired Saudi fields

An edited version of an article by Jeff Gerth
The New York Times, 24 February 2004

(Last September we quoted Energy Investment Banker Matthew Simmons as saying:

> Over the last year, I have obtained and closely examined more than 100 very technical production reports from Saudi Arabia. What I glean is that Saudi Arabia has very likely gone over its peak. If that is true, then it is a certainty that planet earth has passed its peak of production. *[EW 30, page 6]*

Now this disquieting but inconclusive article give more information on the Saudi fields. See also the next three articles. — EW)

Saudi Arabia's oil fields are in decline, prompting industry and government officials to raise serious questions about whether the kingdom will be able to satisfy the world's thirst for oil in coming years.

Energy forecasts call for Saudi Arabia to almost double its output in the next decade and after. However, oil executives and government officials in the US and Saudi Arabia say capacity will probably stall near current levels, potentially creating a significant gap in global energy supply. Outsiders have not had access to detailed production data from Saudi Aramco, the state-owned oil company, for more than 20 years. But interviews in recent months with experts on Saudi oil fields provided a rare look inside the business and suggest looming problems.

Expected production

According to experts an internal Saudi Aramco plan estimates total production capacity in 2011 at 10.15 Mbbl/d (1.6 million m3/d), about the current capacity. But to meet expected world demand, the US DoE's research arm says Saudi Arabia will need to produce 13.6 Mbbl/d by 2010, and 19.5 Mbbl/d (3.1 million m^3/d) by 2020. "In the past, the world has counted on Saudi Arabia," one senior Saudi oil executive said. "Now I don't see how long it can be maintained."

Saudi Arabia is not running out of oil. Industry officials are finding, however, that it is becoming more difficult or expensive to extract. Today the country produces about 8 Mbbl/d, roughly 10% of world needs. (The official quota from 1 July 2004 is 8.133 Mbbl/day, 1.29 million m^3/day, just under a third of OPEC production).

If Saudi production falls short, industry experts say the consequences could be significant. Other large producers, like Russia and Iraq, do not have Saudi Aramco's huge reserves or excess capacity to export, and promising new fields elsewhere are not expected to make up the difference. Saudi Aramco says its dominance in world oil markets will grow because, "if required" it can expand its capacity to 12 Mbbl/d or more by, "making necessary investments", according to written responses to questions submitted by *The New York Times*. But some experts are sceptical. Edward O Price Jr, a former top Saudi Aramco and Chevron executive and a leading US government adviser, says he believes that Saudi Arabia can pump up to 12 Mbbl/d, "for a few years" but, "the world should not expect more from the Saudis." He expects global oil markets to be in short supply by 2015.

Investment needed — but problematical

Dr Fatih Birol, the chief economist for the International Energy Agency (IEA), said the Saudis would not be able to increase production enough for future needs without large-scale foreign investment. The IEA sees investment in energy exploration and field maintenance as vital, but such proposals face strong opposition inside Saudi Arabia. Tensions with the West, particularly the US, make such investment politically difficult for Saudi society. For example, an effort by Crown Prince Abdullah, the kingdom's de facto ruler, to encourage Western companies to invest US$ 25 billion in his country's natural gas industry essentially collapsed last year. "Access to Persian Gulf oil reserves, especially Saudi Arabia's, is the key question for the whole world," Birol said.

Publicly, Saudi oil executives express optimism about the future of their industry, but privately some are less sanguine. "We don't see us as the ones making sure the oil is there for the rest of the world", one senior executive said in an interview. A Saudi Aramco official cautioned that even the attempt to get up to 12 Mbbl/d would "wreak havoc within a decade", by causing damage to the oil fields.

In an unusual public statement, Dr Sadad al-Husseini, a senior executive in Saudi Aramco and their leading geologist, warned at an oil conference in Jakarta in 2002 that global, "natural declines in existing capacity are real and must be replaced." Dr al-Husseini, one Western oil expert said, has been, "the brains of Saudi Aramco's exploration and production." But he has told associates that he plans to resign soon, and his departure could hinder Saudi efforts to bolster production or entice foreign investment.

The IEA warned in November that huge investments would be needed to offset the decline rates in mature Middle Eastern oil fields — it put the

average at 5%/yr — and the increasing costs of oil and gas production.

Ghawar

Saudi Arabia's reported proven reserves, more than 250 Gbbl (40 km^3), are a quarter of the world's total. The most significant is Ghawar. Discovered in 1948, the 500 kilometre-long sliver near the Persian Gulf is the world's largest oil field and accounts for more than half of the kingdom's production. The company told *The New York Times* that its field production practices, including those at Ghawar, were, "at optimum levels", and the risk of steep declines was negligible. But Price says that North Ghawar, the most valuable section of the field, was pushed too hard in the past. "Instead of spreading the production to other fields or areas", Price said, the Saudis concentrated on North Ghawar. That, "accelerated the depletion rate and the time to uncontrolled decline."

In Saudi Arabia sea water is injected into the giant fields to help move the oil toward the top of the reservoir. But over time, the volume of water produced with the oil increases, and the volume of oil declines. Eventually it becomes uneconomical to extract the oil. There is also a risk that the field can become unstable and collapse. Ghawar is still far too productive to abandon, but because of increasing problems with managing the water, one Saudi oil executive said, "Ghawar is becoming very costly to maintain."

The average decline rate in Saudi Aramco's mature fields — Ghawar and a few others — "is in the range of 8%/yr" without additional remediation, according to the company's statement. But Saudi Aramco is counting on Ghawar. One estimate from 2002 puts Ghawar's production at more than half the total expected capacity, according to US government officials and oil executives. "The big risk in Saudi Arabia is that Ghawar's rate of decline increases to an alarming point," said Ali Morteza Samsam Bakhtiari, a senior official with the National Iranian Oil Company. "That will set bells ringing all over the oil world because Ghawar underpins Saudi output and Saudi undergirds world-wide production."

In his Jakarta speech Dr al-Husseini noted the need for exploration, pointing out that colleagues at Exxon Mobil predict that more than half of oil consumption in 2010 must come from new fields and reservoirs.

Qatif and Abu Safah

To offset its declines, Saudi Aramco is bringing back into production one idle field, Qatif, and is enhancing production at a nearby offshore field, Abu Safah. The company says that with expert management, these fields will produce about 800 000 bbl/d. But current and former Saudi Aramco executives question those expectations, contending that the goal is unrealistic and that development costs are higher than anticipated.

Qatif poses real difficulties. It is near housing for Saudi Arabia's minority Shiite population and contains high concentrations of H_2S, a highly toxic gas. Its development is, "particularly challenging" according to a technical paper by Saudi Aramco engineers presented last year in Bahrain, which said that 45% of potential drilling sites, "were rejected due to safety concerns."

At Abu Safah, Saudi Aramco has experienced increasing water problems as it has turned to submersible pumps to extract oil. Experts say the technique is ill advised. Saudi Aramco, in its written response to questions, defended the use of the pumps at Abu Safah and its ability to manage the water after 37 years of production. However, one US government energy expert noted that, "submersible pumps is what the Soviets went to on an indiscriminate basis in West Siberia and it went south." Samotlor, a huge field in Siberia, once produced more than 3 Mbbl/d, but it declined sharply in the 1980's after the Soviets pushed it too hard. Today it produces only a few hundred thousand barrels a day.

(Saudi Arabia's oil reserves were increased from 170 Gbbl to over 250 Gbbl — an increase of some 14 km^3 — during the 'quota wars' of the late 1980s, with no obvious exploration or research backing. Despite cumulative production of the order of 40 Gbbl since then, Saudi reserves are now stated as nearly 260 Gbbl.

Using the information on page 8 and assuming an R:P ratio of 10.0, reserves of 260 Gbbl imply a Saudi production limit of a huge 26 Gbbl/yr (71 Mbbl/day), but the apparent limit of 10 Mbbl/day in this article implies that Saudi reserves may be less than 40 Gbbl — a broad hint that a very large chunk of world oil reserves may have vanished.

See 'Stop press' on page 13. *— EW)*

Tongariro ruling

In early June the Environment Court ruled that the new water right for diverting water from the Whanganui should be reduced from 35 years to 10. Whanganui Iwi were never consulted about the river diversion, and they and Genesis should now negotiate before the reduced water right expires. Tongariro generates about 1400 GWh/yr, plus another 600 GWh as the water goes down the Waikato.

The Dominion Post (8 June 2004)

Tired oilfields, tired regime

Opinion

Perhaps the biggest problem in Saudi Arabia is not so much tired oilfields as a tired regime; note the bit in the article above, about investment plans collapsing. Another indicator came at the end of May, with the 'escape' of four cornered terrorists after they had killed 22 people in an attack aimed specifically at foreign workers in the Saudi oilfields.

In a piece in the *New Zealand Herald* (1 June 2004, originally from the *Independent*), Bruce Anderson describes Saudi Arabia as being, "in a classic pre-revolutionary situation. The House of Saud is trapped between the pincers of rising expectations and crumbling support." An opinion piece in the *Guardian Weekly* (originally from *Le Figaro*, 31 May) said much the same thing:

There are two reasons for Osama bin Laden's aggression against Saudi Arabia: the country is a strategic target, and its soft belly is exposed. A revolution in Riyadh would give the head of al-Qaida enormous geopolitical assets in the struggle against the American devils. By seizing control of the holy cities of Islam he would win religious legitimacy for his cause. By seizing control of the world's primary oil fields, he would be assured inexhaustible revenue to finance all-out jihad. [The Saudi monarchy] *is undermined by contradictory pressures: from the US, which calls for reform, and from traditionalists who denounce all changes as a violation of the Koran...*

Between an old, ill king, his princes and his brothers (who are just as old, and are waiting for him to die so that they can bicker over the crown) Saudi Arabia is threatened with paralysis... So it is logical that Bin Laden steps up his attacks.

Focussing those attacks on the expatriate workforce needed to run the oilfields is a smart move: the Saudi regime can hardly guard them or do without them. As early as 11 June it was reported that 'hundreds' of New Zealanders had already left, and the advice to those staying was not encouraging.

Anderson again:

A windfall economy on the Saudi scale does not encourage the work ethic. Instead, it gives everyone the impression that there is an infinite amount of fruit on the tree, to be harvested with minimum effort...

Much of the education system is controlled by fundamentalists, which is why many children leave school knowing the Koran and little else. That makes them almost unemployable.

Making Peak Oil visible

Based on an interview with
Matthew Simmons by Julian Darley, 15 April 2004
See: www.globalpublicmedia.com/RAM/2004/04

The oil reserve write-downs announced by Shell at the beginning of this year are just a start, according to Energy Investment Banker Matthew Simmons. He says that Shell has been one of the better companies. Future write-downs are likely to include most companies and most producing areas. Simmons claims that world-wide oil (and gas) reserve data is looking very suspect:

- There are no real standards for what is meant by terms such as '90% probability' or 'highly certain' reserves.
- Dramatic falls in the cost of developing reserves over the last twenty years or so are largely because far fewer appraisal wells are drilled and there is much less flow-testing. This makes the reserves less certain, despite new technology.
- There is no independent checking.
- Most large fields are developed by more than one company, who book their share of the field as part of their own pool of reserves: a barrier to independent checking.

As an example of the last problem Simmons quotes Ormen Lange, a new, giant, deep-water North Sea gasfield in the Norwegian sector, where the reserves booked by each of the five partners were:

BP	83.7%
Norsk Hydro	79.6%
Shell	64.3%
ExxonMobil	32.9%
Statoil (Norway)	25.0%
Total	285.5%

Not all partners have the same share in the field, so culpability is not necessarily proportional to booked share. Shell's share is now stated as 22.6%.

Simmons' solution is much more published information in company reports, so that analysts can see what is going on. The information he calls for is already available for all reserves worthy of the name. All that is needed is publication in a standard, *certified* form. The suggested information is:

- The field name and the company's share in it.
- Actual production from the field in each of the last five years.
- The average number of producing wells in each of the last five years.
- The cumulative total of hydrocarbons produced.

- The estimate of hydrocarbons originally in place.
- The estimate of ultimately producible hydrocarbons.

Simmons on Saudi Arabia

Simmons was asked if the Saudi reserves might not be quite what is claimed. He replied, "They're not even vaguely what they say they are."

Simmons on LNG

Simmons points out that liquefying and re-evaporating natural gas uses up about a third of the energy originally in the gas.

Stop Press

Peak oil in 2008–10?
See www.peakoil.net

Deal extends life of Maui gas field

Shell NZ announced in early June a deal which it says will help to ensure maximum recovery of gas from the Maui gas field. The Maui contract has been renegotiated to provide further incentives to develop remaining gas reserves in the Maui gas field. In return for guaranteeing 367 PJ of gas at the existing Maui gas contract price, the Maui Joint Venture will be able to sell any additional volumes of gas at a market price. Of the additional volumes, 40 PJ of gas will be reserved for Methanex. "While final reserves figures for the incremental gas to be extracted are yet to be determined, there is no doubt that this deal will ensure the maximum economic recovery from the Maui gas field, extending its life beyond 2007 and contributing to New Zealand's security of gas supply," Shell New Zealand Exploration and Production Commercial Manager Ajit Bansal said

The deal also paves the way to remove contractual impediments to allow third party gas access to the Maui pipeline in the near term. The Maui field is jointly owned by Shell (83.75%), Todd (6.25%) and OMV (10%).

Funding Transpower

The Electricity Commission expects to release for consultation a preliminary decision on how Transpower is to be funded, in early August. Commission chair Roy Hemmingway expects the decision to be controversial, but sees that as inevitable.

BBC report on peak oil

The following extracts are from a report by Adam Porter at the Association for the Study of Peak Oil (ASPO) conference in Berlin, 4 June 2004.

If you think oil prices are high at $ 40 a barrel then wait till they are four times that much.

(ASPO) *...includes a diverse range of oil industry insiders. People like Ali Bakhtiari, head of strategic planning at Iran's National Oil Company (NOIC), Dr Colin Campbell, a former executive vice president of Total-Fina, and Matthew Simmons, an energy investment banker and adviser to the controversial Bush-Cheney energy plan. They are united by one idea, that global oil production is about to peak, which in turn will signal the permanent end of cheap oil. And they warn that this is the foundation of the current rise in oil prices.*

"If we price oil correctly, it could give us time to find bridge fuels, fuels to fill the gap between an oil economy and a renewable economy. But I don't see that happening." (Simmons)

"In my opinion, unfortunately, there will be no linear change. There will only be sudden explosive change." (Bakhtiari)

North Sea production is declining at an increasing rate, having peaked in 1999. Not at the predicted flat rate of decline of 7%, but gradually accelerating from 7% to 8.5% to 11%. And the number of major new oil fields discovered around the world fell to zero for the first time in 2003, despite an obvious increase in technological expertise.

The people who will be least affected will be the super poor, who already have no access to energy, and the super rich who do not care if oil is $100 a barrel.
False reserves threaten the security of energy supply, just as do bombs under pipelines.

"Many reserve figures are highly questionable." (Campbell)

"If Saudi does not increase supply by 3 Mbbl/d by the end of the year we will face, how can I say this, it will be very difficult. We will have difficult times. They must invest." (Fatih Birol, chief economist of the International Energy Agency)

"If the real figures were to come out there would be panic on the stock markets, in the end that would suit no one." (Campbell)

http://news.bbc.co.uk/go/pr/fr/-/1/hi/business/3777413.stm

Answering the hard energy questions

Extracted from a *NZ Herald* article by Simon Collins and Liam Dann, 31 March 2004

Answers by:

- Keith Turner, Meridian Energy CEO (Meridian)
- Mark Franklin, Vector CEO (Vector)
- Don Elder, Solid Energy CEO (Solid)
- Peter Griffiths, BP Oil NZ, Managing Director(BP)
- Roy Hemmingway, Electricity Commission Chairman (EC)
- Chris Freear, Windflow Technology, Business Development Manager (Wind)

How bad is New Zealand's energy outlook?

- If we have a dry year again it won't be just savings, it will be blackouts. We've been living on borrowed time and we're lucky that it's wet this year. (Meridian)
- It's not a crisis. (Vector)
- It's as serious as rain — or lack of it — allows. If we have normal or dry years ... then we have significant problems. (Solid)
- The issue is very serious. Whether or not you call it a crisis is semantics. (BP)
- It's not a crisis ... in the short term. There's time to develop other sources. (EC)
- I think it is a crisis. (Wind)

How serious is the demise of Project Aqua?

- Aqua was never a total solution. It was only three or four years of electricity growth. (Meridian)
- It leaves a hole. But it wasn't going to come online fully until 2012, so we have got some time to sort out shorter-term issues. (Vector)
- It makes no difference to the next four to five years and it makes a little difference, but not a lot, to the situation out past 2012. (Solid)
- It's a great wake-up call to the industry and community that it isn't guaranteed that we have a secure energy future. (BP)
- New Zealand needs additional power sources. Without Aqua new electricity will have to come from somewhere else. (EC)
- It doesn't change the situation. Project Aqua was always too little, too late. (Wind)

What is the solution?

- We are inevitably heading towards major coal development. (Meridian)
- Investment in generation. Not just investment in certain types of generation. They've got to look seriously at coal ... gas, wind and geothermal. (Vector)
- The answer is coal, unless there are huge new gas finds. (Solid)
- Security comes from diversity. We need more power generation of a variety of types. (BP)
- New Zealand is underinvested in energy efficiency. A great deal of energy could be saved at a cost cheaper than building new power plants. (EC)
- There is enough wind easily available in New Zealand to take care of growth needs for the next 10 years. To do that you'd need about 8000 turbines scattered throughout the country. (Wind)

Who should pay?

- We can't just go to Government and say fix it ... We desperately need more private capital. (Meridian)
- The logical investor is the industry. (Vector)
- All the generators are now in a position to pay for and develop new coal-fired generation. (Solid)
- Consumers and energy users always end up paying in the end. (BP)
- Electricity should be paid for by the people that use it, not the Government. (EC)
- The people who build generation plants will put the money in. (Wind)

Beware the fossil fools

This was the heading used for a *Guardian Weekly* article (6–12 May 2000) quoting the UK chief scientific adviser, Professor David King, as saying: *The scientific community has reached a consensus. I do not believe that amongst the scientists there is a discussion as to whether global warming is due to anthropogenic effects. It is man-made and it is essentially caused by fossil fuel burning ... and so on.*

[The debate] *is taking place, but is taking place in the media, and it seems to consist of a competition to establish the outer reaches of imbecility."*

The author suggests a four-step check to see where such people part with reality:

- Does the atmosphere contain CO_2?
- Does atmospheric CO_2 influence global temperatures?
- Will that influence be enhanced by the addition of more CO_2?
- Have human activities led to a net emission of CO_2?

Its the RMA, stupid

Opinion

The announcement at the end of March, that Meridian were abandoning Project Aqua, started a paddock-full of hares. We report Minister of Energy Pete Hodgson's views on page 3. But another thread was that this is 'yet another' demonstration that the RMA is holding back national development.

ACT NZ's Rural Affairs Spokesman Gerry Eckhoff jumped in smartly and with near-millennial zeal:

Today's announcement means that coal is the only real alternative to (sic) *meeting New Zealand's energy needs. This will necessitate New Zealand withdrawing from the Kyoto Protocol — which imposes a carbon tax on fuels, such as coal.*

After the preliminaries Eckhoff got down to the real business:

Meridian's withdrawal from Project Aqua highlights yet again the climate of uncertainty that all businesses in this country face under the RMA. There is a real need to totally revisit the RMA in light of Meridian's decision. There are far better alternatives for hydro-generation on the lower Clutha River, but this project could not, or will not, progress until the RMA is changed.

ACT seem to believe that business must have the certainty of being able to enter the planning process with a clear idea of the outcome. The process, in other words, must be no more than a rubber stamp. But is this really in the interests of business, let alone New Zealand? What if coal mines on the Coast mess up tourism; or a hydro scheme rushed through the planning process because we 'Need the Power Now' turns out to cross an active fault? (Remember?)

If development of the lower Waitaki, or anywhere else, will bring broadly defined benefits to a broadly defined group, then how will the RMA process automatically stall that development? And if the benefits are narrowly defined and benefit only a minority, will that benefit really be in NZ's interests?

Interestingly, the ACT press release specifically said:

This whole exercise illustrates the difficulties surrounding the allocation of what is essentially New Zealand's most valuable resource: fresh water.

So if there are admitted difficulties but certainty is needed, who is to get the goodies? Big business or some underfunded group with a less myopic view of the national interest?

Some other responses were also interesting:

...there is a danger that Aqua's failure is assuming cargo-cult status among those who like to get into a stew over power blackouts, raising prices and a rash of smokestacks and whirling wind farms marching across the landscape. At the risk of sounding unduly reasonable, Aqua needs to be seen in context.

Vernon Small, *Dominion Post*, 1 April 2004

Solid Energy would probably need a further 500 workers to service the growth.

Don Elder plays the employment card as part of Solid Energy's Tina campaign, *Dominion Post*, 1 April 2004

The only way Meridian was ever going to get 73% of the river's water was if the regional council had no opportunity to set an environmental flow regime prior the consideration of water applications. The Select Committee's rewrite of the Bill specified that enough water had to be left in the river to protect its ecological and recreational values before hydropower and irrigation could even be contemplated. It is extremely unlikely that an independent Board with the skills and expertise required by the rewritten Bill would agree to the diversion of nearly three quarters of the river's flow.

Jeanette Fitzsimons, Green Party Spokesperson on Energy and Conservation, 29 March 2004

We know that lack of certainty over the electricity supply is hindering business investments in New Zealand, and therefore costing us jobs. Ensuring we have a continuous supply is a major priority for this country.

Andrew Little, Secretary, Engineering, Printing and Manufacturing Union, 29 March 2004

But there will always be a need to consult communities about developments affecting them, particularly major infrastructure projects. People have a right to air legitimate concerns about any proposal. In fact we compromise our ability to make wise decisions if we do not allow such scrutiny. Pete Hodgson (page 5)

And *Environz* (MfE, May 2004) reports that the backlog of RMA cases before the Environment Court has halved since 2001. The Act has not prevented major projects, including consents for at least 20 power generation plants, the Waikato pipeline and the Kerikeri bypass (which was approved in 5 months).

Success is not news.

National interest to be included in the RMA

Finance Minister Michael Cullen has signalled that the review of the RMA will introduce a new balance between local and national interests. "This is particularly important for transport and energy infrastructure," said Dr Cullen. He said that the increasing problem for councils was that they were being asked to consider projects that raised issues of national significance, using an act that provided little or no guidance on how competing national benefits and local costs should be weighed up. Dr Cullen hopes to introduce a Bill in September.

Wind energy growth in the OECD — and NZ

Dr Ivan Petroff

In the recent years electricity generation by wind-power has grown rapidly from its research and experimental stage to commercialisation and maturity. Today it is the world's most dynamically growing energy source. Total installed capacity installed at year's end, for the last five years, is:

1999	13.6 GW	
2000	17.9 GW	
2001	24.3 GW	
2002	31.2 GW	
2003	39.2 GW	(Source: WWEA)

The annual rate of growth is around 30%. Based on a WWEA member survey conducted in February 2004, over 100 GW of wind energy capacity are expected to be installed in 2008, and over 150 GW in 2012.

A closer look at wind energy progress in some OECD countries reveals an extraordinary rate of development:

Year	2003	2002	2001	2000	1999
Country					
Germany	14 610	12 000	8750	6100	4440
USA	6370	4690	4280	2580	2560
Spain	6200	4830	3340	2500	1480
Denmark	3110	2880	2380	2310	1700
Italy	900	790	680	420	280
Netherlands	870	690	480	440	410
UK	650	550	470	410	350
Japan	510	420	280	140	70
Austria	420	140	90	80	40
Sweden	400	330	290	240	220
Greece	380	280	270	250	160
Canada	320	220	210	130	120
Portugal	300	190	130	80	60
France	240	150	100	70	30
Australia	200	100	70	30	9
Ireland	190	140	130	120	70
Norway	100	100	20	13	13
NZ	35	35	35	35	0

Wind energy installed capacity in OECD countries
(End of year, MW)

The achievement of Denmark (3.1 GW) is remarkable, because it is a small country, with a population only slightly bigger than New Zealand (5.3 M) and an area six times smaller. This achievement is a result of a successful government-supported promotion network and the strong business development of the wind farm building industry country.

Wind turbines with capacities of up to 5 MW are already on the market. Projects for wind farms with capacity of 500–600 MW are in progress in the US, Ireland, Canada and other countries. GE Wind has proposed a 468 MW project off the coast of Cape Cod, USA, due to open in 2005.

The dynamics of wind energy capacity building is shown below. Some countries, such as Spain, France, Portugal, Australia, Japan, are maintaining high and steady rate of growth throughout the entire period. Germany and Denmark are slightly decreasing their rate of growth because of reaching a saturation phase.

Country	2003	2002	2001	2000	Average
Germany	22	37	44	37	35
USA	36	10	66	1	28
Spain	28	45	33	70	44
Denmark	8	21	3	36	17
Italy	15	15	63	48	35
Netherlands	27	42	9	8	22
UK	18	16	16	18	17
Japan	22	51	94	109	69
Austria	199	48	22	83	88
Sweden	22	12	22	12	17
Greece	36	1	10	56	26
Canada	46	7	62	3	29
Portugal	54	48	58	32	48
France	61	56	40	172	82
Australia	90	44	140	233	127
Ireland	36	10	5	63	28
Norway	4	471	31	0	126
NZ	1	0	0	0	0

Rate of growth of wind energy in some OECD countries (%)

Austria provides an interesting case for comparison with NZ, with double the population and less than a third of the area. Both countries use hydro for a very high proportion of their electricity generation. Starting from similar levels of wind energy in 1999-2000 (42 MW in Austria and 35 MW in NZ), now Austria has installed 415 MW (tenfold increase), while NZ remained on 35 MW until very recently.

The driving forces behind this progress in the developed countries are:

- The great technological research, development and innovation in the wind energy industry
- The generators' policies of improving the security of energy supply
- The economic advantages of a decentralised energy supply
- Growing public awareness about the global climate change and greenhouse gases emissions
- Supportive governmental policies.

An excellent example of a supportive government policy is the UK Government's Energy White Paper *Our energy future — creating a low carbon economy*. This document sets out a long-term strategy for UK energy policy; 10 % of electricity is proposed to come from renewables by 2010 (an increase of 3 % from previous levels), 15% by 2015 and an inspiring goal of 20 % by 2020.

The UK Government encourages renewable energy and infrastructure investment through a range of measures such as capital grants. It will increase funding for renewables capital grants by a further £M 60 a year (NZ$ 175/yr) until 2006. A Renewables Obligation requires utilities to derive a proportion of their power supplies from renewables: 3% in 2003, rising to 10% by 2010. A price cap will limit the cost to consumers and the obligation is guaranteed in law until 2027. Eligible renewable generators receive Renewables Obligation Certificates (ROCs) for each MWh of electricity generated. These certificates can then be sold to suppliers, in order to fulfil their obligation. Suppliers can either present enough certificates to cover the required percentage of their output, or they can pay a 'buyout' price of £30/MWh or NZ 8.7 ¢/kWh for any shortfall. All proceeds are recycled to suppliers in proportion to the number of ROCs they present.

(Note that that 8.7 ¢/kWh is effectively a surcharge, not a price — EW)

As a result of this policy implementation the UK wind industry is poised for major expansion. A survey carried out by the BWEA shows that 22 new wind projects are due to be built this year, representing some 474 MW of new wind capacity. Total installed wind capacity by 2005 is predicted to be 1.7 GW.

New Zealand

Compared to the other OECD countries, NZ has obviously been lagging behind. The only increase in the 5 years to 2003 was an experimental 0.5 MW turbine installed in Christchurch last year. However, new projects for wind power generation now completed or in progress are:

- The Meridian Energy's Project Te Apiti, north of the Manawatu Gorge 55 turbines 82–96 MW
- The Genesis's Awhitu wind farm 20 turbines, 20 MW
- The expansion of Trust Power's wind farm on the Tararua Ranges near Palmerston North 55 turbines, 36 MW
- The Hau Nui extension 5 MW

Total 150–160 MW

The current commercially viable potential of New Zealand to utilise wind power is estimated to be about 3–4 GW. The NZ wind resource is considered to be one of the best on the planet. Many sites have been identified with 9-10 m/s mean annual wind speed. Wind farms are operational in Europe on sites with wind speed of 6-7 m/s. The difference shows in wind fram performance: typically 30–35% of rated capacity in Europe but 40–45% in New Zealand. That's 30% more energy from the same investment.

The National Energy Efficiency and Conservation Strategy (2002) sets the NZ Renewable Energy Target by 2012 at an additional 30 PJ/yr of consumer energy from renewable sources (including heat and transport fuels). One new wind farm of 100 MW, with a 35% utilisation factor, will generate 3 GWh/yr, equivalent to 1.1 PJ, or 3.7 % of the target. Three wind farms of this size will contribute more than 10% towards this target!

There is an obvious, enormous gap between opportunities and achievements. With a few exceptions, New Zealand electricity generating companies still do not regard wind power as a viable option. The public discussion that followed the cancellation of Project Aqua, focused on coal and gas, instead of addressing the challenges and opportunities of renewables, and particularly wind power.

Research reports identify the main barriers to the uptake of wind energy:

- Cost in comparison with other options (particularly generation by gas-fired thermal stations) and lack of adequate fiscal incentives.
- Perceptions of energy delivery reliability and the necessity to back-up.
- Access to land and transmission facilities *(See page 25 — EW).*
- Resource consent issues — particularly the high risks and cost involved.

Many developed countries have successfully overcome these barriers. The recent technological and market developments in the leading countries, combined with appropriate government policies and incentives, indicate clearly the prospective nature of the wind energy. The time has come for New Zealand electricity generators to overcome these barriers and accept wind energy as a commercially viable option for sustainable energy.

Clean coal research

As EnergyWatch went to press it was announced that Solid Energy, Genesis Energy and Geological and Nuclear Sciences are together investing $M 1.75 in Australian research into clean coal. A seven year programme is anticipated, at a total cost of $NZ 12 million, and will focus on sequestration methods.

The nuclear option

There have been ideas floated that nuclear power would be a good energy option for New Zealand — as well as suggestions that those ideas came from the coal lobby:

> *And always keep a hold of nurse*
> *For fear of finding something worse*
> Hillaire Belloc

Assumptions behind the nuclear push seem to be that electricity generated in this way is free of CO_2 emissions, suitable for base load (indeed, unsuitable for load following), and the technology is both safe and economic. And it may all be working: a *Holmes Show* poll in late March showed 45% approval.

MIT study

A study by MIT (*The future of nuclear power*, 2003, Massachusetts Institute of Technology, ISBN 0-615-12420-8) concludes that viable technologies are available but do not merit unqualified support. MIT did not attempt to compare nuclear with other technologies, seeking a 'best buy.' The executive summary sets the context:

This study analyzes what would be required to retain nuclear power as a significant option for reducing greenhouse gas emissions and meeting growing needs for electricity supply. Our analysis is guided by a global growth scenario that would expand current world-wide nuclear generating capacity almost threefold, to 1000 GW, by the year 2050. Such a deployment would avoid ... about 25% of the increment in carbon emissions otherwise expected in a business-as-usual scenario.

We did not analyze other options for reducing carbon emissions ... and therefore reach no conclusions about priorities...

The study identified four key problem areas:

For a large expansion of nuclear power to succeed, four critical problems must be overcome:

- *Cost: In deregulated markets, nuclear power is not now cost competitive with coal and natural gas. However, plausible reductions by industry in capital cost, operation and maintenance costs, and construction time could reduce the gap. Carbon emission credits, if enacted by government, can give nuclear power a cost advantage.* (A table gives US costs as almost 60% higher than coal)
- *Safety: Modern reactor designs can achieve a very low risk of serious accidents, but "best practices" in construction and operation are essential. We know little about the safety of the overall fuel cycle, beyond reactor operation.*
- *Waste: Geological disposal is technically feasible but execution is yet to be demonstrated or certain. A convincing case has not been made that the long-term waste management benefits of advanced, closed fuel cycles involving reprocessing of spent fuel are outweighed by the short-term risks and costs. Improvement in the open, once-through fuel cycle may offer waste management benefits as large as those claimed for the more expensive closed fuel cycles.*
- *Proliferation: The current international safeguards regime is inadequate to meet the security challenges of the expanded nuclear deployment contemplated in the global growth scenario. The reprocessing system now used in Europe, Japan, and Russia that involves separation and recycling of plutonium presents unwarranted proliferation risks.*

We conclude that, over at least the next 50 years, the best choice to meet these challenges is the open, once-through fuel cycle. We judge that there are adequate uranium resources available at reasonable cost to support this choice under a global growth scenario. Public acceptance will also be critical to expansion of nuclear power. Our survey results show that the public does not yet see nuclear power as a way to address global warming, suggesting that further public education may be necessary.

The summary continued under a heading 'Selected recommendations', which included:

- *The* [US] *government actions we recommend aim to challenge the industry to demonstrate the cost reductions claimed for new reactor construction, with industry assuming the risks and benefits beyond first-mover costs.*
- *The DoE should broaden its long-term waste R&D program, to include improved engineered barriers, investigation of alternative geological environments, and deep bore hole disposal. A system of central facilities to store spent fuel for many decades prior to geologic disposal should be an integral part of the waste management strategy. The US should encourage greater harmonization of international standards and regulations for waste transportation, storage, and disposal.*
- *The International Atomic Energy Agency should have authority to inspect all suspect facilities (implement the Additional Protocol) and should develop a world-wide system for materials protection, control, and accountability that goes beyond accounting, reporting, and periodic inspections. The US should monitor and influence developments in a broad range of enrichment technologies. The DoE R&D program should be realigned to focus on the open, once-through fuel cycle. It should also conduct an international uranium resource assessment; establish a large nuclear system analysis, modelling, and simulation project, including collection of engineering data, to assess alternative nuclear fuel cycle deployments relative to the four critical challenges; and halt development and demonstration of advanced fuel cycles or reactors until the results of the nuclear system analysis project are available.*

Another quote, on safety standards, was:

We believe the safety standard for the global growth scenario should maintain today's standard of less than one serious release of radioactivity accident for 50 years from all fuel cycle activity. This standard implies a ten-fold reduction in the expected frequency of serious reactor core accidents, from 10^{-4}/reactor year to 10^{-5}/reactor year. This reactor safety standard should be possible to achieve in new light water reactor plants that make use of advanced safety designs. International adherence to such a standard is important, because an accident in any country will influence public attitudes everywhere. The extent to which nuclear facilities should be hardened to possible terrorist attack has yet to be resolved.

Carbon dioxide emissions

Two points not directly addressed in the MIT study are the availability of suitable uranium ores (MIT recommend studies) and the real carbon dioxide gains (MIT seem to assume gains). However, another study is much less optimistic here:

<http://home.trouwweb.nl/stormsmith>

The report covers work by van Leeuwen and Smith, and was made using energy units. This approach was chosen because money units leave the essential environmental questions unanswered. In particular, discounting future costs falsifies the fundamental question as to the physical feasibility of a given course. Another problem is that money cannot be used to compare physical processes at different times. This is particularly important in the analysis of nuclear power, where energy 'debts' built up during the early stages of the nuclear fuel chain must be repaid — in full — many generations later. Monetary analysis would make these debts appear negligible.

This study showed that while the supply of rich uranium ore holds out the nuclear energy fuel chain does — after about seven years of operation — produce less CO_2 than a thermal plant. But when the uranium content of ores gets below about 0.05% it becomes doubtful if nuclear power will lead to the production of any less CO_2 than burning fossil fuels.

More on nuclear safety **Opinion**

One website seen in researching nuclear safety claimed that nuclear energy is an order of magnitude safer than natural gas, on a (fatality:energy supplied) basis. The explicit assumptions included:

- There have only been two accidents in nuclear power plants: Three Mile Island and Chernobyl. (This ignores construction, fuel processing and storage accidents. Three Mile Island should not be on such a short list at all — no fatalities or release — but cannot be left out because it is too well known)
- Only 31 people have been killed. (All at Chernobyl. This ignores the tens of thousands who have died since the accident, or will die, notably from Chernobyl but also from other military and non-military sources)

Surely such blatantly self-serving analyses can only give the industry a bad name?

More subtly biased thinking appears in industry calculations of the probability of a release of radioactive material. A crucial but unstated qualification of all such calculations is that the release will be *by a causal chain that has been thought of.* But who would have thought even marginally credible — in advance — the accidents at Browns Ferry (near-complete loss of control and safety systems through a fire in a cable duct, started while looking for draughts with a candle); Three Mile Island (made much worse by operators overriding automatic safety systems); or Chernobyl (deliberate operation to see what would happen in a known unstable mode, with the safety systems designed to prevent such actions turned off)?

A possibly greater safety bias lies in the very nature of nuclear risk, which is the classic example of the 'infinity problem': what should be the policy response to an infinitely small risk having infinitely large consequences? "Do it" and "Don't do it" are equally logical responses. Commercial pressures and the precautionary principle also lead to opposite conclusions, so which to believe?

Common sense

Electricity Commission chair Roy Hemmingway pointed out that nuclear plants are, "way too big" for New Zealand, with some plants generating 1.2 GW on a single shaft. How could New Zealand's electrical system provide that much backup? Energy consultant Bryan Leyland proposed 600 MW stations but Hemmingway said that small plants were untested.

The costly reactor control and safety systems are likely to be just as expensive for a 600 MW station as a 1200 MW station, or twice as expensive on an energy-supplied basis. Perhaps this explains why small stations are untested.

Nuclear power may become a sensible part of a sustainable world-wide energy future, but it is not yet time for a small, none-too-rich country, having massive, sustainable alternatives to jump in.

Let Arthur Williamson have the last word: "Yes go for nuclear power — from the great reactor in the sky!"

(As we went to press there was a report in the Dominion Post (28 June) that the International Atomic Energy Agency do not believe that nuclear energy can be expanded fast enough to solve global warming problems — EW)

Dirty and not-so-dirty diesels

Kerry Wood

New Zealand diesel fuel is said to be so bad that some European manufacturers have been cautious about importing their latest models. A sulphur content of 3000 parts per million (ppm) was permitted until recently. Most of that comes out of the tailpipe as sulphuric acid, and it may cause engine damage. But sulphur content is now understood to be below 2200 ppm and will soon be down to more internationally acceptable levels:

August 2004	500	ppm
January 2006	50	ppm
2009-2010	10-15	ppm

The final stage — to 10–15 ppm — is not yet in regulations, and will be reviewed in 2005.

Emissions testing is to become part of vehicle fitness certification in 2006.

A problem with cleaning up diesel emissions in New Zealand is the very high importing rate of old-technology second-hand cars (a huge 18 400 in March, compared with peaks of only about 12 000/month two years ago). Some are diesels, often Urban Assault Vehicles, and a few will not be able to meet emissions requirements from 2006. And in the mean time they don't help our premature-death rate from transport-related air pollution, which is roughly equal to traffic crash deaths.

Diesel emissions

There are three keys to the dirty diesel problem:

- Clean up the fuel, mainly by removing the sulphur.
- Make sure that engines are well maintained. This will be at least partially addressed when emissions testing is introduced in 2006. Another option is a coarse check of grossly polluting vehicles (visible and invisible, using optical sensors), which can be made on every vehicle passing a check point, without drivers having to stop, or even know that a check is being made.
- Encourage introduction of the latest engine technologies (Euro 4).

A large part of the problem with light diesel vehicles is thought to be lack of maintenance. It is thought that simply changing the air cleaner element would make a big difference to a great many vehicles.

Others, and especially trucks, need more radical and much more expensive attention. The problem is that a diesel relies on compressing air in the cylinder until it is hot enough to ignite fuel injected as a very fine spray, under very high pressure. In an old engine this process can go wrong in several ways:

- Loss of air from the cylinder, and hence pressure and temperature, due to leaks past piston rings and valve seats.
- Poor injection timing due to worn components or poor maintenance.
- A poor injection spray pattern, due to worn or corroded injector nozzles, or incorrect opening or closing pressures.

When a diesel engine is running under part load there is little fuel being injected, so there is plenty of excess air in the cylinder and all may be well. But at full power the cylinder will be below its designed temperature, pressure and air mass when fuel is injected, and will not be able to burn a full charge of fuel without incomplete combustion and smoking. And heavy trucks use full power often. Restricting the fuel quantity helps but makes the truck slower, and a truck with a badly worn engine is likely to be already old and low-powered. The only real solution is an engine overhaul, which will be costly and may well be uneconomic.

Sometimes the problem is made worse by tampering: injecting *more* fuel will make the smoking much worse but will give a bit more power.

Such problems could be at least partially identified by emissions testing and roadside checks, but there is a problem with persistent offenders: the benefits of keeping a worn engine belching are greater than the fines.

Health effects

Breathing diesel exhaust is bad for you because of the sulphuric acid, and because of the PM_{10} (particulate matter smaller than 10^{-6} m). This is mostly tiny carbon particles, but with very tiny traces of aromatics on them, from the fuel. And a tiny carbon particle is an ideal vehicle to carry an even tinier dose of carcinogenic aromatics into your lungs.

Biodiesel is better for two reasons: it has a very low sulphur content and it is slightly oxygenated. As a result unburned carbon is less likely to be emitted as solid particles (but is more likely to be CO). However, quantities of biodiesel in New Zealand are expected to be limited, and not worth the expense of a separate distribution and retailing system. A better option is probably to blend biodiesel into conventional supplies, at a level too low to need engine adjustments or replacement of fuel system seals.

Common rail engines

The situation is very different with the latest engines, meeting the Euro 4 standard. A 'common rail' injection system is usual: the injection pump simply maintains pressure in a common pipe feeding all injectors, without trying to control the injection timing and quantity. When, and for how long, each injector opens is controlled electronically, giving far better control. Sensors measure a wide range of factors, including engine speed, air and engine temperatures and any nasties going down the tailpipe, and adjust the injection quantity and timing appropriate to the accelerator position chosen by the driver. Under some conditions a small charge of fuel may even be injected near bottom dead centre, then topped up near top dead centre!

The next stage, already in New Zealand for evaluation, is a particle filter in the exhaust; but it cannot be retrofitted because it needs a connection to the engine management computer and special arrangements to self-clean when needed by burning off the particulates.

Engine efficiency

Diesel is about 3% more carbon dioxide intensive than petrol, but this is more than offset by the efficiency gains. For their C3, Citroën quote 110 g/km of CO_2 for a Euro 4 diesel engine and 148 g/km for either of two petrol engines. These figures are all for a manual gearbox: the petrol automatic emits 161 g/km. So for modern engines a diesel can save 26% of carbon dioxide emissions.

(EnergyWatch has just replaced the ageing editorial runabout with a near-new Citroën C3 diesel, meeting the Euro 4 standard. It will run on NZ diesel [although it prefers Gull]. It sounds a little agricultural at idle, but otherwise even the driver would hardly know it is a diesel. A fuel consumption of 4.2 l/100 km is easy in congestion-free driving, and beating 4.0 l/100 km (71 mi/gal) is practicable with open road driving and some care. It does all the things you would expect, well: seating 4 or 5, reaching 100 km/h in 13.4 s, towing up to 550 kg and going up most state highway hills in 5th gear.

Fuel consumption is better than for either of the hybrids available in New Zealand, although pollutants other than CO_2 may well be a different story. So why have only a few dozen C3s been sold in the first year? — EW)

Thanks to Bill Ritchie of Citroën NZ for assistance with this article

Still hope for Kyoto?

President Vladimir Putin has reversed months of fervent Russian opposition to the Kyoto Protocol and agreed to speed up ratification of the treaty. The change of heart follows a decision by the EU to drop its objections to Russia jointing the World Trade Organisation. "The fact that the European Union has met us halfway at the negotiations on membership in the WTO cannot but influence Moscow's positive attitude towards ratification of the Kyoto Protocol. We will accelerate our movement towards ratifying this protocol" Putin said. The Russian parliament will now be expected to ratify the treaty.

The ease with which Moscow and Brussels overcame the dispute led observers to conclude that the Kremlin is seeking a warmer relationship with the EU, its new neighbour since enlargement on 1 May.

Guardian Weekly, 28 May–3 June 2004

And in an earlier press release, Minister of Energy Pete Hodgson accused the National party of playing poodle on the Kyoto Protocol. "We have Nick Smith reportedly saying a National government would withdraw New Zealand from the Protocol if the US and Australia do not ratify. Apparently National has now reached the position where it is up to Washington and Canberra to decide what New Zealand should be doing about climate change."

As Hodgson points out, of the 38 developed nations that have emissions targets under the Protocol, only these two currently have governments that do not intend to ratify. "National wants New Zealand to become the third holdout. The damage to our reputation with the rest of the world would be incalculable. Unlike Australia and the USA, New Zealand would be welching on an international commitment we have already made," said Hodgson.

NZ Government, 13 May 2004

(See also 'An alternative to Kyoto?' on page 27 — EW)

Methanol production

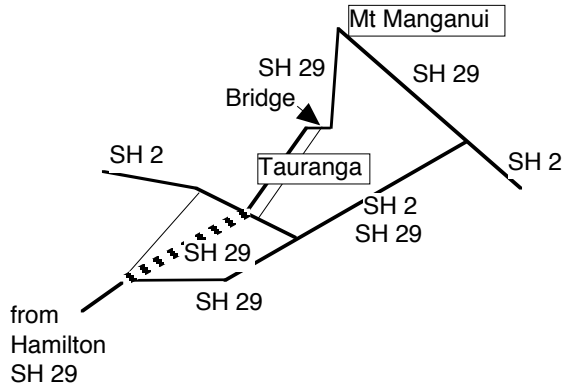
Methanex has contracts for enough gas to make a million tonnes of methanol at its Taranaki plant this year, about 40% of capacity, but only 500 000 t next and none in 2006. They are working to secure other contracts.

The Court of Appeal rejected a claim of Methanex's right to a further review of Maui reserves.

The Dominion Post, 18 & 21 June 2004

Tauranga's tolling tribulations

Kerry Wood



An article in the *NZ Herald* (by Rosaleen Macbayne, 31 May 2004) reports that New Zealand's only toll road not associated with a bridge or tunnel is carrying traffic well below forecast levels. Tauranga's Kopurererua Expressway was originally expected to carry 10 000 vehicles/day (compared, for example, with over 20 000 veh/d on Wellington's Oriental Parade), but forecasts had fallen to 7000 veh/d by the time the expressway opened in July last year.

However, six months after opening and despite a marketing effort, actual numbers were only 2500 veh/d,. Tolls are $ 1.00 for cars and $ 4.00 for trucks (about 20% of traffic). The expressway did not qualify for Transit funding and was financed by a city-backed loan. It cost $M 45 and now has a debt of $M 51. It is expected to make a first year loss of $M 3.8, with revenue of only $M 1.2.

Road layout

The new two-lane expressway is shown hatched on the sketch plan. It brings State Highway 29 some 5 km north-east from Tauriko towards central Tauranga, to link up with Takitimu Drive on the western foreshore of the downtown peninsular. In effect SH 29 is a ring road, running on the west side of the downtown peninsular but avoiding the peninsular entirely on the east side.

The objective of the new expressway was to relieve heavy, stop-start traffic on congested local roads, especially Cambridge and Campbell Roads (shown as fine lines on the plan). This would increase traffic capacity from Hamilton and the Waikato to downtown Tauranga, the harbour bridge and the port at Mt Maunganui. The intention is that over the next ten years capacity will be increased on the rest of the western leg of SH 29, including a duplicated harbour bridge ($M 191 for 4.4 km). Some $M 665 is budgeted for expenditure on roading in the Tauranga area over the next decade.

However, the western bypass is only some 4 km shorter than the existing eastern bypass (SH 2/29), which avoids the downtown area and is both signed and funded as a state highway. The Council seem to have committed themselves to spending nearly $M 250, largely to stop trucks coming through congested local streets.

Unfortunately a toll on the harbour bridge was lifted three years ago — after public pressure — removing a funding source that the Council had been relying on for future road construction. Possibly worse was the loss of the bridge tolling location: bypassing the expressway toll booths is now too easy.

Outcomes

The outcomes so far are:

- The objective of taking through traffic off local roads, including heavy truck traffic to the port at Mt Maunganui, has largely failed. The new route is clearly quicker than existing roads so presumably the failure is because of the tolls.
- The originally expected funding for Tauranga's strategic road network now looks doubtful. Some 45% of the $M 665 needed over the next decade was to have been from tolls. (Was the rest to have come from rates or was there also some Transfund input?)
- A "rural road" has ruined a "pretty" valley for either housing or recreation, thus promoting greater sprawl and longer trips to housing, recreation or both. The result will be more of the traffic that caused the original problem.
- If tolls are acceptable to the Government only when a toll-free alternative is available, any tolled road will tend to be underused, especially at off-peak hours. The *Herald* article notes that many truck drivers are avoiding the toll "on principle."

If drivers avoid an economic toll, that suggests that they perceive their congestion costs as being either less than the toll, or reducible through the political action of boycotting. This leads to a fairly obvious conclusion that road charges need to be difficult to avoid.

A second conclusion from all this is that Transfund NZ were probably right to refuse funding.

Policy implications

There is a weakness in Government policy here. The requirement that there be an alternative route, bypassing the tolling point, makes sense in principle. Under this policy, Wellington's proposed inland highway through Transmission Gully could

be tolled because the existing road would be a toll-free alternative, but tolling an upgraded existing highway would be unacceptable.

But things look different in the more complex case of Tauranga, where the Council have been unable to push heavy through traffic off local roads and onto an existing state highway that is only 4 km longer. Surely tolls need to be an acceptable way of achieving this?

It might help to vary present Government policy in two ways:

- Allow toll locations that will close off an unsuitable alternative route, such as congested urban roads, even if this means that the toll point is beyond the limits of the new road that it is to fund.
- Allow city-wide revenue gathering systems, such as London's new central area charging system, to be used with or instead of tolls, with no need for an alternative route.

Other options

What else could Tauranga Council have done? Presumably they saw heavy trucks causing pollution and congestion on their streets, and obstructing hospital and residential traffic. They must have felt that they had no option. But other options were available — in principle but probably not in practice:

- Divert trucks onto the existing State Highway to the east of the city (4 km longer). This could be done by tolling on the existing single bridge, with a high rate for trucks too large to be 'local' (say over 17 tonnes: in-road axle weighing systems are accurate enough for this purpose, and with electronic tolling vehicles would not have to stop). A more blunderbuss approach would be a height limit on bridge traffic.
- Divert truck traffic to rail. The Port of Tauranga already has an 'inland port' in South Auckland (and Ports of Auckland are developing one too). To shippers it is effectively part of the Mt Manganui facility and the port company is responsible for the rail freight. Another 'inland port' near Hamilton might help Tauranga city, or a simple siding near SH 2 would do as an acceptance point for logs.

It is very easy to see measures such as these as 'too expensive', but the Tauranga figures suggest that a lot of money is to come from rates. That is effectively a subsidy for roading, when a very much smaller charge to truck users (in the form of either a heavy toll or extra distance), or subsidy to the port or rail (for an inland port), would be much more sustainable.

Ratepayers might have preferred it too.

Road tolls coming?

Opinion

Despite hiccups in Tauranga, described in the previous article, some kind of road tolling seems to be the coming thing. The benefits have been known theoretically for many years. To paraphrase a SEF News contributor, if you hand out free bread every day, at the same time, you will get a queue; a queue is an indicator of an underpriced good or service; hence traffic congestion. And of course, more detailed studies have reached the same conclusion.

In the mid-1990s the Ministry of Transport made a series of road pricing studies, demonstrating the problem well: the costs identified were hard or very hard to quantify but clearly very large. They were — and are — real costs, falling not directly on users but on the community as a whole. Non-drivers are contributing as well as drivers, so many of the costs of driving are hidden. If you walk to the supermarket, how much do they charge you for the parking space you do not use?

But that was as far as it got. The costs frightened off the politicians, who could see that particular road leading only to electoral oblivion. So what has changed since the 1990s?

- It is becoming more and more obvious that building new roads attracts enough new traffic to ensure that congestion only gets worse.
- Many European cities have been quietly restricting traffic and improving public transport for twenty or thirty years, with good, popular outcomes. Elsewhere, Mayors Jaime Lerner in Curatiba and Enrique Peñalosa in Bogotá have been doing excellent work, bringing real economic benefits.
- It is now realised that New Zealand traffic kills roughly as many people through pollution as it does through crashes: the problem is bigger than it looks.
- Ken Livingstone was elected Mayor of London, with the authority and the guts to take action. He beefed up public transport and then imposed a daily charge of £ 5 (NZ$ 14.50) for car and truck entry to Central London — and reduced congestion by 30%. *(See EnergyWatch 30, page 9)*

In May one of the architects of the London scheme, Derek Turner, was in NZ to spread the word, saying "you just can't build your way out of congestion," and that London is a guide, not a model. The scheme chosen in any particular city will depend on many local factors. Turner was also upfront about some of the problems that the London scheme has created: buses are now spending too much time at stops because they are ahead of time, and timetables are having to be revised.

By May 24 *The Dominion Post* was reporting

Wellington Chamber of Commerce President Peter Steel as saying that road pricing — paying in some fashion to occupy the road space — had to be considered in the long run.

The Ministry of Transport studies were published in 1995–6 and looked at local and world-wide pollution; noise; crashes; and roading revenue and expenditure. No up-to-date figures are available for most of this, but there have certainly been big changes since the 1993–4 baselines: Allowing 2% for annual traffic growth and another 2% for inflation would have increased the figures 50% by now.

Environmental costs were particularly uncertain, and some had a range of 20:1. The figures given below were the MoT's 'best guess'. They are generally around double the minimum estimate but an order of magnitude lower than the maximum estimate.

The MoT showed that in the early 1990s passenger transport in New Zealand was explicitly subsidised by about $M 77 a year. About half came from Regional Council rates, the rest from road taxation. In contrast, motor vehicle use was supported by hidden subsidies and ignored external costs of at least $ 3 billion/year, an average of 10 ¢/km driven. If costs were shared fairly, truck owners and commuters in the main centres would pay an order of magnitude more. Estimated annual costs were:

		$M/yr
Territorial local authority funds (also used for footpaths, lighting etc)		265
Noise	)	290
Local air quality	) best estimate values	700
Greenhouse gases	)	290
Water quality	)	100
Less roading revenue transferred to the consolidated fund		(208)
Capital charge (6.4 % interest on a depreciated replacement value of $ 25.8 billion)		1650
Total		3087

Motor vehicle subsidies and externalities, c1992

The capital charge is often opposed because 'motorist have already paid for the roads.' In fact they pay for a higher proportion today than they did historically, but still not very much. And a capital charge is a necessary check on over-investment. Costs not included in the MoT studies include 'free' parking (which overseas studies have shown to be an important factor); crash costs imposed on pedestrians and cyclists; and creating barriers to movement. Overall, the true figure today might be as much as $ 5 billion/yr.

The numbers remain uncertain but this is not a reason for delay: better a charge that is only partially right than a non-charge that completely wrong.

Substituting for Aqua

Energy efficiency

The Energy Efficiency and Conservation Authority (EECA) claim that households alone could save two-thirds of the energy 'lost' by the cancellation of Project Aqua, by making realistic changes, introducible within 12 months, at a cost less than a tenth of Aqua:

- Install 5 compact fluorescent bulbs.
- Turn off half of all appliances at the wall, when they are not in use.
- Insulate all pre-1986 hot water tanks.

Businesses could make even bigger savings.

Fitting solar thermal heating to a third of the 20 000 new and 40 000 replacement water tanks installed each year, would reduce demand by 12 MW/yr. Or with incentives and a rapidly growing installation rate an achievable target might be most new houses and half of replacements, reducing demand by 24 MW/yr.

A solar thermal system will save about 2 t/yr of carbon (assuming it replaces a coal-fired power station), or at least 40 t over the system's life. At a current carbon price of $ 10.50 *(see page 25* [Carbon credits] *— EW)* that is a saving of over $ 400. A perfect market would include someone who would pay this kind of sum, and an imperfect market designed with sustainability in mind should make sure that someone *does* pay. This sum is similar to the current EECA scheme (boosted in the recent budget), but would be paid to all purchasers, regardless of whether or not a loan was taken out.

Better thermal performance of new houses will help, with some sort of energy rating system (Building Performance Index etc) to allow the housing market to recognise the benefits. It is prescriptive, but surely it should be acceptable if two conditions are met?

- The required performance is designed to be profitable for say 90% of buildings, based on a design life of say 50 years.
- Building owners have a let-out if they certify that they realise the measures are profitable, but don't want them and don't mind their building being tagged as inefficient (useful for oddballs such as substations and temporary buildings).

Obviously there are many options available, which may be a few cents cheaper or dearer than these measures. The issue is not making choices and saving a cent here or there: it is pursuing all economic measures and saving a million tonnes of carbon here or there, and getting away from an unsustainable paradigm.

California managed to save 14%, in months and semi-permanently. That is *more* than Aqua.

Wind (and other renewables) for sale

Renewable energy operators need new electricity market rules to allow them to compete, and they say the current rules are stacked against them.

The Government has drafted regulations requiring lines companies to accept surplus electricity from small producers, but the renewables producers also want regulations to force the generator-retailers to buy power from local producers at their selling price, through a net metering system. A discussion paper last September proposed:

- Lines companies should provide standard interconnection agreements.
- Interconnection should be no extra charge for generators of up to 10 kW selling up to 10 000 kWh/yr. *(That's only 11% of rated capacity, when a wind turbine might achieve 45% — EW)*
- Generators with capacity above 10 kW should be charged any actual costs of upgrading the network, plus an annual fee of up to 5% of the charge to provide power lines to a consumer in the same area.
- In exchange, lines companies should pay such generators at least 85% of any Transpower transmission charges which the lines companies save by buying power from local generators rather than the national grid.

Feeding to the grid

All this is intended for small-scale generation, which can be treated as 'noise' on the demand profile, but we also need wind farms to enter the electricity market. This raises a forecasting problem: what will be the output of a given wind farm in so many hours time? If the market closes 2 hours before a 30 minute bid period, the forecasting information is going to be 2.5+ hours old at the end of the supply period, so the key factor is the accuracy of forecasts looking 3–6 hours ahead. Two methods are available:

- Persistence: Dominated by the assumption that present conditions will continue. Accurate to ± 10% with about 95% reliability at 3 hours but less reliable at 6 hours.
- Synoptic: Suitable for looking more than six hours ahead, but no better than general forecasts. However, wind speed and direction are two of the more accurately predictable parameters — much easier than rain or sun!

A new method is now coming onto the market: MetService's meso 12 km model (and with higher resolutions for areas of strong interest), which should be appreciably better than the persistence method, useable for up to 12 h ahead.

Carbon Credits

The Government's Projects to Reduce Emissions programme has reached the contracts stage. The intention is to support initiatives that will reduce emissions of greenhouse gases, as part of the Government's climate change policy package.

The initial projects tender round offered four million emissions units, or carbon credits, for 4 Mt of carbon dioxide (CO_2) or equivalent emissions avoided. Businesses, organisations and individuals were invited to submit proposals for projects to reduce emissions in return for a share of the pool of emission units.

Projects are a domestic mechanism to generate Kyoto Protocol emissions units. For an initiative to qualify it must achieve quantifiable reductions in greenhouse gas emissions that would not otherwise occur: it must be shown to be something additional to business-as-usual, that would not otherwise proceed. Emission units are effectively permits to emit greenhouse gases. Each country with targets under the protocol must hold sufficient emissions units to match its emissions during the first commitment period, 2008–12.

Last December, Meridian Energy's Te Apiti wind farm, one of two early projects, was offered a contract to sell its emission units to the Netherlands Government. This was the first sale of New Zealand's Kyoto credits. The average price for that tender round was NZ$ 10.50/t — a good indication of the current worth of emission units.

If the Kyoto Protocol does not enter into force the Government's agreements with project owners will automatically be terminated.

The largest project so far is a proposed electricity and steam co-generation plant at NZ Refining Co's Marsden Point refinery. The refinery proposes to build a biomass boiler, burning wood waste to produce steam for refinery processes, and two electricity generation turbines powered by refinery gas and natural gas, with a capacity of 80 MW. The plant has the potential to reduce greenhouse gas emissions by about 1.2 Mt in the first commitment period. It is scheduled to come onstream in 2007, pending final approval early next year. The plant will also offer opportunities to 'de-bottleneck' the refinery, increasing output by up to 20%.

Other successful project bids are:

- Te Rere Hau Windfarm, New Zealand Windfarms — a proposed 50 MW wind farm in the Manawatu (Windflow Technology).
- Wainui Hill Wind Farm — a proposed wind farm of up to 30 MW on Wellington's Wainui hills.

- Genesis Awhitu Wind Farm, South Auckland — a proposed wind farm of 19 MW on the Awhitu Peninsula.
- Genesis Hau Nui Wind Farm, Wairarapa — a proposed 5 MW extension of the existing wind farm.
- TrustPower's proposed enhancement of an existing hydro generation scheme at Waipouri, near Dunedin. The project aims to increase generation by diverting water from nearby streams into the catchment, using a combination of pumps, water conveyance and a small generation unit. The net increase in output is expected to average 35 GWh/yr.
- Awapuni Landfill, Palmerston North City Council — a proposed scheme for generating electricity from landfill gas.
- Southern Paprika's proposed bio-energy plant to heat glasshouses.
- TrustPower's proposed enhancement of existing hydro generation in Taranaki, by diverting water from nearby streams into the catchments of the Motukawa and Mangorei hydroelectric schemes. The expected increase in output is some 3.5 GWh/yr.
- Toronui Mini-Hydro Power Scheme, Esk Hydro Power — a proposed mini-hydro scheme on the Pask family's Toronui station in northern Hawkes Bay.

MiniWhats

Middle East oil production

OPEC began to boost oil production in May, in response to high prices triggered by a combination of OPEC production cuts, rising demand, especially in China; relatively low inventories; and supply uncertainty. Prices peaked at around US$ 42, in response to the killing of 22 hostages, in an attack specifically targeted at foreign oil field workers. Average OPEC production for May was 28.38 Mbbl/d (4.5 million m^3/d).

The Dominion Post, 10 June 2004

On the shortest day it was reported that oil prices were rising because dealers were sceptical about a planned partial resumption of Iraqi oil production (700 000 bbl/day by the 25th). "Prices still remained supported by fears that global oil production were nearing limits, with the Iraqi halt and a Norwegian strike exacerbating the situation." (Reuters)

Iraqi oil production

In early June Iraq was exporting oil at around 1.6 Mbbl/d, but that ended suddenly when three pipelines were sabotaged. Within a day or two there were calls for increased production from — well, anywhere really. Please.

Pipelines are easily damaged. In remote areas prone to unrest, above-ground pipelines are sitting ducks. And when there is damage a petroleum pipeline will often be underneath a large fire, delaying repairs quite effectively. A local sport in Iran in the 1950s was to light a fire under an above-ground pipeline, get it hot enough for a .303 bullet to penetrate it and then do some target practice. Sabotage can be as easy as that, but taking a little extra trouble and using a few kilograms of explosive ensures a longer repair time: a patch is no longer enough and the pipeline has to be drained and the damaged section cut out.

Ian Shearer FIPENZ

Long-standing SEF member, committee stalwart and general good keen man Ian Shearer has been made a Fellow of the Institution of Professional Engineers of NZ. Well done, Ian. The citation reads:

Ian Shearer is elected a Fellow of IPENZ for his contribution to the advancement of engineering practice and the development of the Institution; specifically recognising his contribution to developments on renewable energy sources and his service to IPENZ in a variety of roles. He is a true champion of sustainability and has been a tireless worker for the development of renewable energy sources in a variety of forums. He has been a stalwart of IPENZ, serving on many taskforces and working groups where he has always supported consideration of the public good. He chairs the Engineering Associates Registration Board and has served on many advisory groups to tertiary education providers.

Typically, Ian points out that the important point is not the award but the trend. SEF committee member Neil Mander is also a recent Fellow, for his work on Engineers for Social Responsibility and Register of Engineers for Disaster Relief, and SEF member Ian Bywater, for work on energy efficiency and renewable energy practice. And ESR stalwart and SEF member Gerry Coates has just retired as President of IPENZ, their first Maori president.

We suggest that the trend here is away from focussing on things like bridge building and running NZED, to a broader view of engineering that includes sustainability and the public good. But the battle is not yet won, and sustainability is not yet mainstream enough for such recognition to be commonplace. Several cheers are in order, for the public good, sustainability and above all, vision-chasers such as Ian.

NZ in the big time?

A study by the Australian Bureau of Agriculture and Resource Economics reveals, "strong LNG demand in Korea, New Zealand and the US would provide an impetus for several new projects." Demand is expected to double in the next decade, to at least 150 Mt/yr. Another customer is China, with two LNG terminals already under construction and an expected demand of 18 Mt/yr by 2015.

The Dominion Post, 10 June 2004

Northern South Island transmission risk managed

Transpower has admitted that it might not have enough capacity to supply peak power to the northern South Island this winter. The problem is limited to some 65 peak hours (based on an anticipated 10% load growth) during the peak period, 17.00–19.00 on weekdays.

The Electricity Commission were quick to broker a management agreement including:

- Lines companies switching off hot water heating at the same time for a few hours, using ripple control.
- Some customers using their own back-up diesel generators.
- Transpower adding more equipment on a Christchurch substation to get more capacity on the transmission lines (This seems to mean new trip switches).
- Timaru being switched to other transmission lines for power supplies (From the 220 kV system from Twizel to the 110 kV system from Waitaki).
- Paying some large electricity consumers to reduce their usage at peak times. Total payment for the winter was thought unlikely to exceed $ 90 000.

The Dominion Post, 5, 8 & 10 June 2004

Greenhouse gas levels jump

The level of CO_2 in the Earth's atmosphere has hit a record high. New data from the US National Oceanic and Atmospheric Administration suggests that the rate of increase may have accelerated in the last 2 years. Recordings from NOAA's Mauna Loa Observatory on Hawaii showed CO_2 levels had risen to an average of about 376 ppm for 2003, 2.5 ppm above the average for 2002. It is not the highest increase in year-on-year levels recorded, but it is the first to be sustained, with 2002 levels also up 2.5 ppm. The average annual increase over the last few decades has been about 1.5 ppm. Pieter Tans, chief scientist at NOAA's climate monitoring and diagnostic laboratory suggests that economic development in China and India. Tans says it is too early to conclude that we are into a new trend, but Charles Keeling at the Scripps Institution notes that global warming itself could increase the amount of carbon dioxide released from the oceans and soil. "People are worried about feedbacks," he says.

New Scientist, 4 March 2004

An alternative to Kyoto?

UK Prime Minister Tony Blair has launched a new alternative to the Kyoto Protocol, the Climate Group. The group is funded by the Rockefeller Brothers, EU charitable funds and the German government, and made up of leading companies, countries, local governments and environmental groups. It aims to push forward on reducing carbon emissions whether Kyoto comes into effect or not.

Blair said that next year, when it is the UK's turn to chair the G8 group, he would make climate change the top of the agenda. He said the UK government has committed itself to a 60% CO_2 emissions reduction by 2050.

Guardian Weekly, 6–12 May 2004

Auckland's Eastern Highway "won't happen"

Auckland MP and Green Party associate transport spokesperson Keith Locke has accused John Banks and Barry Curtis of misleading the public over the proposed Eastern Highway. "The two mayors are presenting the Eastern Highway as a done deal," he said. "This project has no chance of going ahead and it is just absurd for Mr Banks to say that 'in three year's time the eastern corridor will be being built'."

Locke pointed out that Transfund does not have funding for the highway approved in any of its advance plans, and is now bound by a new Land Transport Strategy, in which every project has to meet a set of environmental sustainability, social and economic criteria, which the Eastern Highway clearly doesn't.

Domestic energy efficiency funding

More than 6000 low-income families will have warmer, drier, healthier homes as a result of a near-doubling of funding for home energy efficiency retrofits in the 2004 Budget. Funding for the promotion of solar water heating is also doubling.

EnergyWise Home Grants are available to organisations that install insulation and other energy efficiency measures in older homes. Funding for 2004-05 will be $M 5.3. With matching funding from community trusts, energy companies and councils, this will retrofit more than 6000 homes/yr.

There is also funding of $ 700 000 for the Ministry of the Environment to investigate improved uptake of home energy efficiency improvements and cleaner heating sources. This would help communities improve air quality, particularly in winter, and help consumers save on power bills.

Funding to encourage greater use of solar water heating is doubling to $ 400 000. EECA and the Solar

Industries Association will evaluate the financial assistance scheme for solar installations that has operated in 2003-04 before finalising the details of the 2004-05 promotion.

"Hot water heating accounts for up to 45% of a home energy bill, so it makes sense to use more solar power," Hodgson says.

NZ Government, 23 May 2004

Electricity, Energy and the Environment

The Parliamentary Commissioner for the Environment has released a final assessment framework document under this title, following the draft framework published in June 2003. The purpose of the framework is:

to certify that energy services from electricity are provided in an environmentally sustainable manner through ongoing environmental performance assessments of New Zealand's electricity sector.

The Commissioner has a statutory duty to provide regular reports assessing the performance of the Electricity Commission in the context of the Government' Policy Statement for Electricity.

Tax breaks for gas

The Government has introduced tax 'sweeteners' stated to be worth $M 20 — plus up to $M 100 in revenue losses — for gas exploration. The sweeteners include $M 15 spent on seismic mapping of 14 sedimentary basins, and $M 5 on marketing. The revenue losses would apply to gas discoveries made after the end of June and before December 2009. The Petroleum Exploration Association described the package as encouraging but expressed disappointment that oil was not included.

The Dominion Post, 15 June 2004

EnergyWatch

Our next issue will be in September.

CRL Energy have not responded to our invitation to publish a response to Steve Goldthorpe's article, 'The Hydrogen economy' (EW 32, March 2004, p 13).

We have some problems raised in this issue which we would like to cover later, if we can find a coherent explanation for a not-too-technical audience:

- We hear that the Tararua windfarms are on the wrong side of a grid restriction of some sort, and by feeding into the grid they may block a *larger* feed from somewhere else. What is this restriction? Why does it block a larger feed from elsewhere? What would be the cost of removing it? How many other such restrictions might be lurking in the Transpower grid?
- Why were Transpower announcing for the first time a grid restriction on supply to the northern South Island, (page 27) only a few weeks before they expected it would happen?
- What is the meaning of the statement on page 11, about Saudi Arabia's Ghawar oilfield?
  There is also a risk that the [oil] *field can become unstable and collapse.*

Any offers?

SEF Conference 2004

Thur 18 to Sat 20 November 2004

The 2004 Conference of the Sustainable Energy Forum will be held in Wellington, on Thursday 18 to Saturday 20 November 2004, with a field trip on Sunday 21.

- Twin themes of energy efficiency and sustainable energy supply
- A public lecture on Thursday evening
- Papers on Friday and Saturday
- A field trip to the Manawatu wind farms
- The SEF AGM

Make a note in your diary

SEF membership

Memberships are for twelve months and include four copies of EnergyWatch.

Membership rates, including GST, are:

Unwaged/student	$	22.50
Individual	$	45.00
Library	$	56.25
Corporate	$	250.00

Mail the form below, with your payment or order, to The Sustainable Energy Forum Inc, P O Box 11 152, Wellington.

A GST invoice or receipt will be sent on demand.

Name: _____

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E-mail: _____

Membership type _____

Amount enclosed: $ _____