Comments on the draft of "Powering Our Future"

Rev 1, Fri, Mar 30, 2007

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Introduction

This is only a brief commentary as it would take many days to work through the strategy and comment comprehensivly on it. I have therefore concentrated on what I believe to be the major shortcoming in the strategy and then on various aspects on which I have specialist knowledge.

I have read - and written - many reports of this type over the last 40 years. This report stands out of from the others because it is wordy, repetitious short on hard information, treats supposition and uncertainty as fact, and ignores options that should be considered.

In my view, if New Zealand's Energy Strategy proceeds as outlined in this document, it will be a disaster for New Zealand.

The major shortcoming.

The strategy takes the view that climate change (more properly described as "man-made global warming") is real and dangerous and carbon emissions are a major problem. Following on from that there is an unstated belief that New Zealand will benefit greatly if it reduces its manmade emissions - even though this may be very expensive.[1]

The scientific evidence supporting the belief that climate change is real and dangerous is not strong. The science is full of uncertainties and a careful reading of the latest IPCC "Summary for Policymakers" reveals that they are saying no more than "we are 90% sure that more than 51% of the recent warming is man-made". They also point out that the world is warmer than it was 500 years ago - the middle of the little ice age. They suggest that the world might be warmer than it has been in the last 1300 years but without providing any hard evidence.

The evidence that is provided goes back only 100 years and relies on the surface temperature record (which shows more warming than do the satellite records - the only records that take account of the temperatures all over the world). There are many uncertainties in the surface temperature records and in the way the data has been collected and processed. These uncertainties are so great that the surface temperature record alone should not be relied on as the basis for future policies. Both the surface temperature records and the satellite temperature records show that the world has cooled since 1998 and that temperatures have been steady since 2002. 2006 was cooler than 2005.

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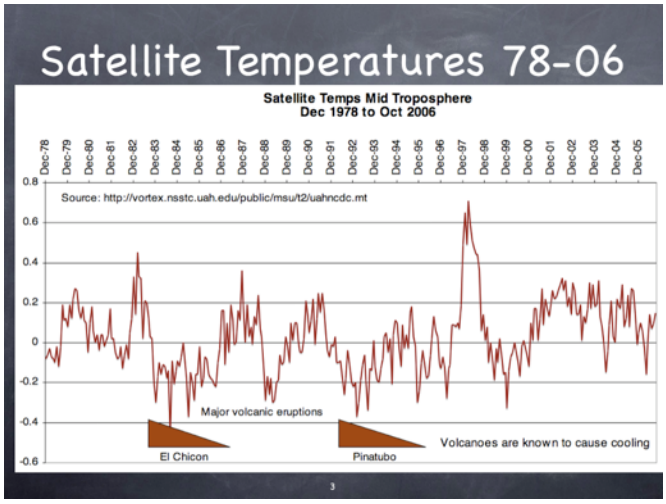
1 To put it in perspective, last year China added 102,000 MW of new generating capacity, more than the total installed capacity in UK and Ireland and exactly twice Australia's total. Most of this was coal-fired, and only one 1000 MWe nuclear plant started up. The announcement said that Beijing would resist international pressure to slow its growth in energy demand and CO_2 emissions. The 2006 power increment is likely to account for some 500 million extra tonnes of CO_2 emissions annually.
China Electric Power News in FT 7/2/07.



All predictions of future temperature rises are based on the outputs of computer models. these models have never been "validated" in the sense that other computer models are validated by demonstrating that they can make accurate predictions into the future and that they accurately represent whatever is being modeled. For instance, it is well known that cloud formation is a critical factor in climate modelling. Yet, when I was at a climate science conference in Stockholm in September 2006, Professor Lennart Bengtsson, a leading modeler told us that models still could not handle clouds in a satisfactory manner.

The only rational conclusion that can be drawn from this and other studies of the predictive accuracy of climate models is that they should not be relied on for policy making. Yet, it seems to me, the whole of the Energy Strategy is based on the assumption that the “scenarios” and "projections" made by the climate models and modelers are in fact "predictions". For very good reasons the IPCC carefully avoids the words "validated" and "predictions" when discussing climate models.

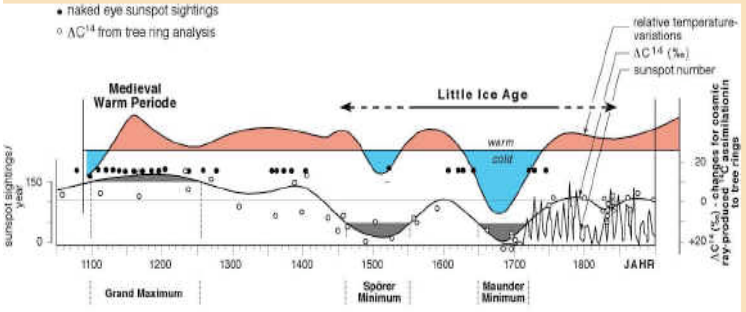
It is well known that, all other things being equal, doubling in the level of carbon dioxide in the atmosphere would produce a temperature increase of less than one degree centigrade. The models "project" much higher temperature rises by assuming that other factors - such as water vapour and clouds - will amplify the temperature rise from carbon dioxide. To my knowledge, there is absolutely no hard evidence to support this assumption. It is purely an assumption built into the computer modelling.

When all this is taken into account it becomes obvious that the theory that an increase in carbon dioxide will cause dangerous global warming is not supported by hard evidence. The strongest claim supporting this seems to be that it is the “consensus view” of many climate scientists. The consensus view of scientists has been shown to be wrong many times in the past[2] and there is no reason to assume that, on this particular occasion, it will prove to be correct. In fact, there is not much evidence to support the claim that it is a consensus view. Many leading climate scientists have challenged that openly and many more have serious doubts about it.

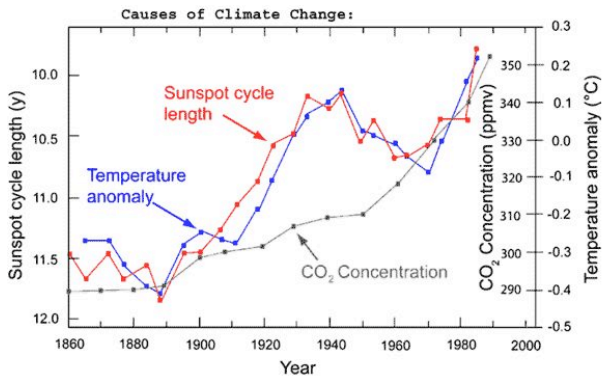
There is a theory that satisfactorily explains recent climate change and, unlike the carbon dioxide driven theory, climate change in the past. This is the this theory that solar emissions related to the sunspot cycle have a major influence on our climate.

[2] e.g Galileo and Continental drift - there are many other examples

The IPCC has ignored this theory and has, instead, only studied direct solar radiation. It claims to have shown that this is only has a small influence on the climate and they use this as "proof" that carbon dioxide must be the major driving factor[3]. Svensmark and others have been researching the effect of cosmic rays on cloud formation and climate for many years and, according to a recent paper published by the Royal Society of the United Kingdom, have been able to demonstrate this effect at a laboratory scale. Other studies show a very close to linkage between climate and cosmic ray intensity based on research into stalagmites from a cave in Oman and the close correlation between the length of the sunspot cycle and temperatures over last 150 years.

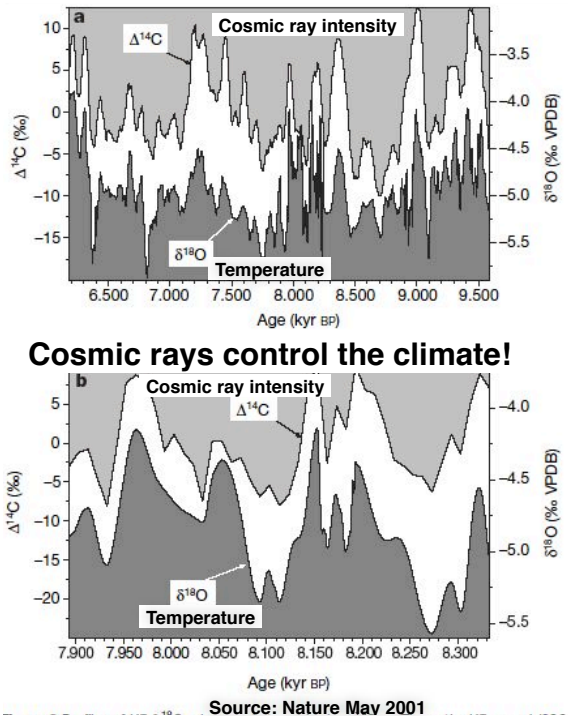


Correlation between temperature variations and the number of observed sunspots (after Eddy, 1976, and National Research Council, 1994)



From "Cosmoclimatology" A&G Feb 2007.

Henrik Svensmark draws attention to an overlooked mechanism of climate change: clouds seeded by cosmic rays.



Abstract

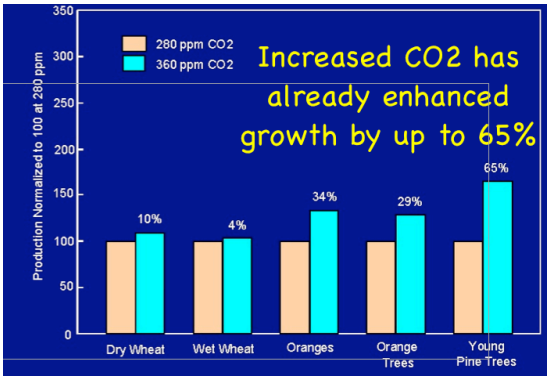
Changes in the intensity of galactic cosmic rays alter the Earth's cloudiness. A recent experiment has shown how electrons liberated by cosmic rays assist in making aerosols, the building blocks of cloud condensation nuclei, while anomalous climatic trends in Antarctica confirm the role of clouds in helping to drive climate change. Variations in the cosmic-ray influx due to solar magnetic activity account well for climatic fluctuations on decadal, centennial and millennial timescales. Over longer intervals, the changing galactic environment of the solar system has had dramatic consequences, including Snowball Earth episodes. A new contribution to the faint young Sun paradox is also on offer.

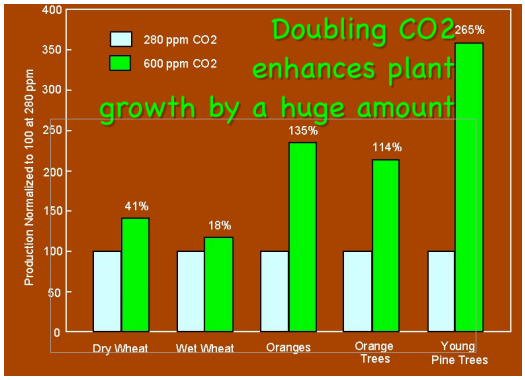
[3] Prof Bengtsson told me that he agreed with my suggestion that sunspot related effects should be used an input into models. This is strong evidence that climate modellers (and the IPCC) have never taken the sunspot theory seriously.

Recent studies show close correlation between the sunspot cycle and river flows in Africa and South America. In South Africa, Will Alexander has shown that river flows correlate closely with the sunspot cycle and, as a result, he was able to predict recent flooding in central and North Africa when everyone else was predicting continued drought. Studies by Peter Mason on the inflows into Lake Victoria show that they too are closely linked to the sunspot cycle. Another recent study shows the same effect on one of the rivers of the Amazon basin[4]. A similar effect was detected in the inflows to the South Island hydro catchments but now that NIWA no longer releases data, it is not possible to determine whether or not that effect is still evident.

While correlations do not prove causation, (any more than they do with carbon dioxide) the fact that the sunspot related correlation with temperature is close and has occurred for thousands of years indicates that this theory should be seriously considered by the IPCC and the government of New Zealand. The sunspot theory predicts that we are entering a cooling phase and that climate will cool until 2030. The fact that the world has not warmed since 1998 lends credence to this prediction. If this cooling trend continues then, at some stage, the "catastrophists" in the climate science community and the government will be forced to admit that the computer models are wrong and that an energy policy based on fears of dangerous man-made global warming is a waste of money and effort.

On seldom hears of the positive effect of increased CO2 even though it is established beyond doubt that it enhances plant growth[5].





The increase in CO2 over the last 100 years has enhanced plant growth by between 4% and 60%. If the CO2 level doubled, plant growth would be even greater. To an agricultural nation like New Zealand, this is very significant. It should be a factor when estimating the cost of man-made global warming.

It is important to acknowledge these uncertainties in the Energy Strategy and to acknowledge that if cooling continues for more than say, two more years (to give a total of 10 years of a cooling trend), then the theory, the science and the computer models supporting claims of dangerous man-made global warming will have to be re-examined.

A possible explanation of the belief in dangerous man-made global warming is that the government has been badly advised by its scientific advisors. As Professor Hans von Storch emphasized at the climate science conference in Sweden in September, the primary duty of any scientific advisor is to report on the science objectively and to make sure that the

[4] I can provide copies of these papers if needed.

[5] Commercial greenhouses endeavour to maintain a concentration of 900 ppm and one that I know of spends almost a million dollars pa to this end. As a result their production increases 30-40%. This is achieved **without increasing the amount of water needed by each plant.**

politicians understand the uncertainties in the science. It is for the politicians to decide how they will handle the uncertainties. Many climate scientists have taken it upon themselves to hide the uncertainties from the politicians and to put forward supposition as fact. This is wrong.

The whole thrust of the energy strategy indicates that the government is unaware of the uncertainties and the fact that there is an alternative theory. This inference is supported by the fact that the government has promoted the movie "An Inconvenient Truth" as good science. In fact, as LordMonckton has pointed out[6], it is riddled with errors and exaggerations. Every error exaggerates the supposed problem.

A recent programme from ITV 4 in the UK has attracted widespread attention. It features leading climate scientists who explain why they do not believe that CO2 causes dangerous warming and point out many weaknesses in the arguments put forward by the IPCC and in "An Inconvenient Truth". It has attracted worldwide interest and is being shown in many countries. After the program was first shown, feedback to the TV station was 6:1 in favour of the programme. My own experience as a frequent lecturer on the subject supports the view that, in spite of the campaigns by the press and the Government, the public of New Zealand are inclined to be sceptical.

In a recent Oxford-style debate in New York the motion was: "Global Warming Is Not a Crisis." Three experts argued in favour of the motion; three argued against it. In a vote

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6 Monckton said that Al Gore:

- " implied that a Peruvian glacier's retreat is due to global warming, failing to state that the region has been cooling since the 1930s and other South American glaciers are advancing (Polissar et al., 2006).
- blamed global warming for water loss in Africa's Lake Chad, though NASA scientists had concluded that local water-use and grazing patterns are probably to blame (Foley & Coe, 2001).
- inaccurately said polar bears are drowning due to melting ice when in fact 11 of the 13 main groups in Canada are thriving, and polar bear populations have more than doubled since 1940 (Taylor, 2006).
- said a review of 928 scientific papers had shown none against the "consensus". In fact only 1% of the papers were explicitly pro-"consensus"; almost 3 times as many were explicitly against (Peiser, 2006).
- implied that changes in temperature followed changes in CO2 concentration in the past 500,000 years, but in fact temperature changes preceded changes in CO2 concentration (Petit et al., 1999; Mudelsee, 2001).

Were these and other serious errors accidental? It is unlikely. Every single one of the errors magnifies, overstates, or exaggerates the supposed problem. Not one of the errors understates it.

The film also omits to make any of the following balancing points. It:

- never acknowledges the indispensable role of fossil fuels in alleviating hunger and poverty, extending human life spans, and democratizing consumer goods, literacy, leisure, and personal mobility.
- never acknowledges that there are many environmental, health, and economic benefits of climatic warmth and the ongoing rise in the air's CO2 content.
- extreme weather events declined dramatically during the 20th century.
- neglects to mention why America is the biggest CO2 emitter: the world's largest economy, abundant fossil energy resources, markets integrated across a continents, and a mobile population.
- Gore impugns the motives of so-called global warming skeptics, but fails to point out that the scientific method requires constant skepticism. Any scientist who is not a skeptic is a mere politician.
- never acknowledges the special-interest motivations of those whose research grants, industrial privileges, regulatory power or political careers depend on keeping the public scared about the climate.
- never addresses the obvious criticism that the Kyoto Protocol, if all signatories complied, might reduce temperature to 2050 by a climatically-insignificant 0.07C, at a cost of hundreds of billions.
- fails to mention the societal factors that nearly always overwhelm climatic factors in determining the risk of injury or death from hurricanes, floods, droughts, storms, wildfires, or diseases.
- ignores climatic factors in determining the risk of injury or death from hurricanes, floods, droughts, storms, wildfires, or diseases.
- says 48 Nobel-laureate scientists accused President Bush of distorting science, but omits that the scientists were members of a political group set up to promote a Democrat presidential candidate."

(From www.scienceandpolicy.org)

before the debate, 57 percent believed there is a crisis. Afterwards, only 42 percent still believed there is a crisis – a very significant swing to the sceptical view. Highlights of the debate can be downloaded at:
http://www.npr.org/templates/story/story.php?storyId=6263392

When a 6th grade class in the USA was given the opportunity to have an open debate on man-made global warming, the students agreed that "the science is not settled.

The New Zealand public should be exposed to both sides of this debate and, like the 6th graders in America, invited to come to their own conclusions.

I strongly recommend that a comprehensive and objective investigation be carried out into the credibility of the science underlying the theory that man-made carbon dioxide causes dangerous global warming before any of the policy actions aimed primarily at reducing man-made CO2 emissions are implemented.

A rational approach to an Energy Strategy.

As I see it, the only rational objective a National Energy Strategy can have is to make sure that New Zealand has a reliable and economic supply of energy.

Although it is widely suggested that the world is running out of energy resources, there is little hard evidence to support this. It is certainly not true in New Zealand. Increased exploration and superior technology gives us access to energy reserves that, thirty years ago, were unknown and if found, would have been ignored as impossible to get. Then there is nuclear power and fusion power. Fusion power is almost certainly within the 2050 time horizon. It promises all the power we might ever need with minimal environmental effect, so it is the ultimate in sustainability.

There is one thing we can be absolutely sure of: no one can predict exactly where our energy resources will come from in fifty years time - any more than they could have done so in 1906 when Henry Ford said “If I had asked people what they wanted, it would have been faster horses”. One thing that history does teach us is that human ingenuity and technology has the potential to provide sufficient energy for our needs. All that is needed to make sure that this happens is political stability, common sense, property rights and the rule of law.

Suggested Strategy

To me, the only rational way of developing a long term energy strategy (or to be more correct, range of strategies) is to take a pragmatic view and start with a base case that is solidly founded on a range of least cost options. Having done that, these options can be compared with options - which will almost certainly be more expensive - that take account of, for instance, the government's conviction that "the science is settled" on manmade global warming, that we must reduce our emissions of carbon dioxide and that renewable energy sources are preferable to sustainable energy sources.

That, in summary, is why I believe very strongly that the base case should be firmly founded on an option that provides New Zealand with the energy it needs at the lowest possible cost. Without this, it is impossible to have any idea of the extra cost imposed by policies that bring in other factors. The need for everyone to know the extra cost associated with the options is, by itself, sufficient to justify having a rational base case.

Scenarios

The first step in developing the energy strategy should be to develop a range of scenarios covering the likely requirement for various forms of energy over the next fifty years. These

scenarios must cover all currently viable forms of energy and must consider the effects of likely technological changes.

Likely technical changes include:

- a switch to electric cars that could result in a substantial reduction in our consumption of liquid fuels and an increase of 20% or more in our consumption of electricity7;
- increases in energy efficiency leading to an increase in electricity consumption8;
- increasing numbers of people "telecommuting" leading to a reduction in transport fuels that is much greater than the increase in domestic electricity consumption;

In parallel with establishing energy demand scenarios, we need to investigate the range of energy resources available to us. These energy resources include:

- hydropower;
- domestic gas and oil;
- imported gas, oil and coal;
- domestic coal - including lignite;
- nuclear power;
- intermittent energy sources such as wind power, solar power, tidal and wave energy;

And so on.

An analysis of demand against available resources will lead to a practical set of scenarios that can be costed out. These form the base case against which other options can be compared.

A range of alternative energy scenarios can then be developed based on assumptions such as:

- sustainability (whatever it means) is all important;
- the international price of oil will increase again;
- the international price of oil will continue to decrease because more reserves have been found;
- large quantities of gas and oil are discovered in the Great Southern Basin;
- we are provided with convincing evidence that the computer models of climate can make accurate predictions and also provide convincing evidence of dangerous man-made climate change;

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7 It seems to me that the promise of electric cars is much greater than generally realized. With modern lithium ion batteries, prototype cars with a range of more than 100 kilometres are now on the road. At least one battery manufacturer is talking of producing batteries with twice the capacity and half the cost. That amounts to four times "the bang for the buck". If this is correct, hybrid cars will soon give way to electric town cars. Add to that, the promise of Professor Boys' inductive battery charging technology that makes it easy to recharge vehicle batteries by driving the car over a doormat sized pad that will sense that the battery is flat and recharge it without any human intervention. If these are installed in parking buildings, then the effective range of electric cars used for commuting is doubled. The outcome would be a reduction in transport fuels and air pollution - all achieved without any intervention or need for subsidies. To me, these developments hold far more promise than the much hyped "hydrogen economy". See, for instance, http://money.cnn.com/2006/05/04/technology/business2_wrightspeed/

8 Regarding energy efficiency, it is commonly believed that an increase in energy efficiency will lead to a reduction in demand for electricity. A few moments reflection reveals that this is most unlikely to be the case. A classic example is home heating by gas or by reverse cycle air conditioner. A ducted gas heater is probably about 80% efficient. A reverse cycle air conditioner will have the coefficient of performance of about 3.5- that is to say, for every kilowatt of electricity it needs, it produces 3.5 kilowatt of heat. 1 kW of gas will produce 0.8 kW of useful heat from a ducted domestic heater. 1 kW of gas into a CCGT will deliver 0.4 kW into a reverse cycle air conditioner and that will produce 1.4 kW of heat. In industry, their desire to reduce costs by increasing process efficiency has led to a steady swing away from coal, gas and steam to electricity because that leads to producing a better quality product and reduces costs because for instance when producing powdered milk, mechanical vapour recovery (that uses electricity) is more efficient than thermal vapour recovery that uses steam. There are many other examples.

this in turn could lead to a scenario based on assuming that and economical way of sequestering carbon is developed. This would then release a sustainable supply of energy from coal.

a carbon tax is imposed and drives out many of our productive industries and, by damaging the economy, also results in reduced use of energy;

- there is an intensive and successful drive for energy efficiency.

Recommendation

I recommend that the whole approach to developing the terms of reference and the National Energy Strategy be re-examined on a rational basis. Meeting our legitimate needs for energy is important; minimizing damage to our economy is important; and, most of all, it is important that we know exactly what might be costing us - or what we are forgoing - in order to meet the current government's beliefs regarding dangerous man-made global warming and sustainability. Unless this is done, the strategy will turn out to be yet another expensive exercise in futility and it will be more misleading than useful.

Specific Comments

Page 11 nuclear power

This paragraph demonstrates, more than anything, ignorance of the state the art of modern technology for nuclear power stations. A study in Australia has shown that modern nuclear power stations are competitive with low-cost Australian coal if carbon tax is included. There are no solid grounds for claiming that there is a risk from terrorist attack - if terrorists want to get hold of weapons grade plutonium or uranium, it is much easier to smuggle it out of Eastern Europe than it would be to try and steal and separate radioactive waste.

There are no technical problems in the disposal of radio active waste. In any event, it is something that must be solved because by far the greatest quantity of radio active waste that needs to be disposed of comes from past weapons making programs. Disposal facilities that are needed for this waste would have to be increase in the size by 10% or so to cope with future waste from nuclear power stations for the next 100 years.

The grounds for opposition to nuclear power generation are political and emotional and not based on an analysis of the real risks, or on science, technology, environmental considerations and economics.

It should be remembered that a larger nuclear power station North of Auckland - as was planned for in 1975 - would provide virtually all of the electricity needed for Auckland and the North. If it is built, there will be no need for the 400 kV transmission system. If the savings in transmission cost - probably in excess of $1 billion- are credited to the cost of nuclear power, it would, for sure, be very competitive with large scale coal fired generation in the South Island and a new direct current link to Auckland.

I believe that there is no justification for excluding consideration of nuclear power in the New Zealand Energy strategy and, based on my experience while presenting a number of public lectures, I am sure that a large proportion of the voters in New Zealand believe that nuclear power should be considered as an option. It should not be forgotten that over the last three or four years public opinion on nuclear power in Europe and the United States has swung from strong opposition to general acceptance that it is as safe and acceptable. Many

of the European countries that had decided to shut down to nuclear power generation are now carrying out life extensions and uprating the nuclear reactors and are contemplating adding new reactors. The government of New Zealand should take note.

Page 19
It is said that "It is also important to remember that the predicted costs and risks of inaction are unacceptably high". This statement is made without any justification. The much criticized Stern report - which relies on very low discount rates, assumes that the expensive mitigation measures will actually make a substantial difference and totally ignores the beneficial effects of increased carbon dioxide on plant growth - says no more than there is not much difference between action and inaction.

Page 23 Figure 4.3
The curve "future emissions if no abatement measures are taken" ignores the fact that aviation efficiency, increased diesel uptake, petrol vehicle efficiency and electric vehicles are all likely to happen without any action by the government. Most of them are determined by factors beyond our control and are driven by technological progress and simple economics.

Page 24- primary energy supply by fuel type.
This diagram gives an alternative scenario in 2030 but fails to tell us how much more energy will be needed by then. It is therefore difficult to draw a comparison between the two. However it does indicate a 15 times (or greater) increase in wind and wave power over this period. It appears to achieve this while reducing the amount of energy from coal and oil in spite of the fact that such a massive amount of intermittent energy requires substantial backup which, for 6000 MW of intermittent generation, would be at least 4000 MW. This is discussed in more detail later on.

Page 26
Section 4.4.2 mentions by fuels. All the evidence points to the fact that growing crops to make biofuels is bad for the environment, deprives the local populations of much needed food and in most cases, does nothing to reduce carbon emissions. The only beneficiaries are those that grow rich on the billions of dollars in subsidies paid for biofuel production.

This sad this part of all this is, as Fred Pearce wrote in the New Scientist (23/9/06) "Biofuels will trash rainforest, suck water reserves dry, kill off species and, worst of all barely slow down global warming." He then goes on to say "Producing 10% of the world's transport fuels from crops would require 9% of the planet's agricultural land."

Substituting biofuels for food crops has driven up the price of staple foods: the price of palm oil - a very important source of food and nutrition in Southeast Asia and in Africa - has increased by 50% in the last 12 months. In America and Europe, the price of corn has increased and grain reserves have lower than they have been for many many years. Given than what we are told about global warming causing more severe droughts, a logical response would be to make sure that grain reserves are held at a safe level.

Page 41- generation table
I note that about 650 MW of the capacity proposed for 2008 and 2009 will come from wind. This means that the firm capacity from wind will increase by less than 100 MW. 85 MW more comes from geothermal (now that the Geotherm group has gone into receivership) and there is Fonterra's 30 MW thermal plant proposed for Whareroa. During the same period, we can expect peak demand to increase by about 400MW. Clearly, the proposed new generation will result in difficulties in meeting peak loads on cold, windless days.

What this does is highlight the fact that, while proposing large amounts of wind and other intermittent renewables, this document says little or nothing about the need for backup plant. The fact is that this backup plant will have to be fired by gas or oil or coal. It would be sensible and rational to re-commission the Marsden B plant on oil do the job that it was originally built to do - provide backup capacity in dry years and when the supply to Auckland is under strain.

Page 44

From my knowledge of the industry, encouraging lines companies to get into generation will not make a lot of difference. The reason that there is not enough investment in generation - especially of the type that we need - is more to do with the Resource Management Act and the reluctance of the generators to have the market getting to a situation where, most of time, there is an adequate reserve margin and competition operates to drive price down to a level that they regard as insufficient.

Regarding "generation sources" on the same page, I would point out that the rest of the strategy document seems to ignore the need for fossil fuel-based backup generation for wind power - in the meantime but for many years into the future.

Regarding distributed generation, I can claim to have some experience in this field as I am 25 % owner and operator of the 950 kW Onekaka small hydro scheme that is connected into the NTL power system in Golden Bay. Much as I would like to say that it is not true, this (quite typical) scheme contributes little to the security of supply in Golden Bay because, all too often it is producing less than 150 kW or so. If it were a 950 kW wind farm, it would frequently be producing nothing at all.

From what I have learned as a member of the Common Quality Advisory Group I am sure that large amounts of distributed generation a most unlikely to make any contribution towards security of supply and managing frequency, voltage and reliability. One problem that is often totally disregarded is that if there is a system collapse in the area, then the main system has to re energize the distribution system with its total load. Only when it has done that can the distributed generation start up and re-synchronize. Therefore, regardless of how much distributed generation capacity there is, the main system must be able to supply the total load. Another problem is that in the event of a system disturbance, most distributed generation units will trip off very quickly. This definitely applies to co-generation plants whose primary objective is is to supply the local load and cut adrift from the grid if it appears to have problems.

From my experience with lines companies, there are not many serious barriers to distributed generation from that direction. However, some lines companies charge distributed generators for connecting into their system (this is in addition to the costs of the connection equipment and lines which are legitimate costs). I believe that this is wrong because, to be consistent the lines companies should also charge Transpower for feeding power into their system. They don't.

Page 46

I believe that the expectation that there will be substantial conventional "demand side response" is not well founded. While there is no doubt there is a certain amount of load that can be shed easily and painlessly it is ridiculous to expect commerce and industry to have its operation disrupted every time the system frequency drops by a small amount. In this respect, we must remember that with large amounts of windpower, frequency disturbances will become more and more frequent.

There is an aspect of demand side management which has been seriously neglected for the last eight or ten years. It is that the fact that, as a result of an initiative I made about 12 years ago, there are about 250,000 ripple control relays for domestic water heaters that incorporate under frequency elements that can quite easily be set to shed water heating load if the frequency drops below, say, 49.8 Hz. If these relays were extended to the 1,000,000 or so electric water heaters in New Zealand (most of which have obsolete relays) and also used to control commercial air conditioning, a dip in the frequency would shed several thousand water heaters and a number of commercial air conditioning units would be unloaded for between two and five minutes. No-one would notice and no-one would be inconvenienced.

This is one aspect of demand side response that could be implemented quickly and, if implemented, could lead to the huge reduction in the current $50 million cost of maintaining frequency in New Zealand. Unfortunately, this very valuable, effective and simple initiative appears to have got lost in the system.

Page 48
If investors in new generation face a price signal that reflects a carbon tax or other imposition, then, because of the way the electricity market works, all consumers in New Zealand or will see it reflected in their power prices most of the time. The fossil fuel generators will bid in at a price that includes the cost of carbon tax and if the fossil fuel generator is setting the price, all generators utilizing renewables will receive windfall profits. As many new fossil fuel generators will be needed to backup intermittent renewable generation, it does not follow that such a tax would favour wind and wave generation. If, as they should, the developers of the wind and marine generation have to pay their share of the cost of backup plant, a carbon tax could result in less wind power than would otherwise be the case.

On page 49 it is claimed that electricity demand is expected to grow at around 1.3%. This represents about 100 MW per annum. A more generally accepted figure for expected load growth is 850 GWh pa. To generate this at 50 percent plant factor requires 200 MW; therefore the 1.3% figure appears to be wrong.

I know of no evidence to support the claim that future improvements in efficiency (presumably energy efficiency) will lead to a lower demand growth in electricity. As I have explained already my expectation is that improvements in energy efficiency and a movement towards electric cars will increase the need for electricity rather than decrease it.

The projection that approximately 1200 MW of new capacity using fossil fuels will be needed is, in my opinion, too low. Firstly, it ignores the fact that the existing Huntly and New Plymouth stations are old and are unlikely to remain in reliable operation beyond 2020 and 2012 respectively. The TCC and Otahuhu B CCGTs will be obsolete and decrepit before 2020 - especially if they have to back up windpower. These too will have to be replaced . If as implied by figure 4.4 on page 24, the percentage of energy supplied by wind and wave power increases from 0.3% to 6% (a total capacity well in excess of 6000 MW) there will be a need for something like 4000 MW of fossil fuel plant purely to backup this intermittent generation. So we could need in excess of 6000 MW of fossil fuel plant instead of the 1200 MW suggested.

Where will this be, what will it burn and how much will it cost? The Strategy must address and answer this question.

On page 58 it is mentioned that the Parliamentary Commissioner for the Environment is reporting on wind and small-scale generation. Previous reports by the Parliamentary Commissioner have demonstrated conclusively that his office does not have the expertise

needed to comment intelligently on electricity supply. I suggest that these reports be taken with a large grain of salt and not weighed against reports from organizations with a solid background in the problems and costs of generating and transmitting electricity.

Regarding "valuing lower emissions energy" on page 50, I strongly recommend that no effort be made to do this until it has been established beyond reasonable doubt that man-made carbon dioxide causes dangerous global warming. If this cannot be shown, putting a price on low emissions energy will be a hugely expensive and totally futile exercise.

Regarding table 4.1, I see little prospect in getting 5800 GWh of hydropower under the present regime and present government. From personal and painful experience I know that the Resource Management Act has made it uneconomic to develop small hydro power below about 10 MW[9] and almost impossibly difficult - as Trustpower have found - to develop larger schemes. Given the government's attitude to large hydro, I see no prospect that the economic resources we have already studied on the Clutha and other rivers in the South Island can be developed to their potential of 1000 MW or more.

I am more inclined to agree with the figures regarding geothermal energy - but only if the government makes it easier to develop this most excellent resource. To do this the consenting authorities must have a consistent attitude towards resource depletion and allow the take of geothermal fluids to be averaged over one or more years. If this is done, geothermal plant will be able to assist in dry years, supply additional electricity during the winter high demand period and, possibly, back up intermittent generation. This woujld substantially increase its value. To give an example of what could be done, I know of one geothermal station sitting on a field with a proven potential of at least 75 MW. Under a rational regime, it could provide up to 100 MW in fact, it has been an enormous and expensive effort to get it upgraded to 25% that capacity.

To increase our wind generation from the present 610 GWh to 9200 GWh requires an expansion from 300 MW to 4500 MW or more. This represents a line of wind turbines something like 700 kilometres long. It also means that several thousand MW of additional transmission capacity would be needed - even though it contributes very little to the firm capacity of the system. Little of this 4500 MW could be transferred over the DC link so it will have to be in the North island. "Where" is the big question. The backup plant will also have to be in the NI. Where will it be and where will the fuel come from? Will all this wind generation, transmission and backup plant be less expensive than a nuclear station north of Auckland? Most unlikely.

Figure 4.1 on page 52

This shows "stand alone" costs of generation from various sources. The implication from on page 26 is that using the lower cost sources will lead to lower costs to the consumer. This is definitely not the case. When expanding a power system the objective is to find the "least cost system development" that gives the lowest long term price of electricity delivered to the consumer. If such a study is carried out - as it should be - it will become obvious that, for instance, massive quantities of wind power - even if it is cheap - push up the price of delivered power by a large amount because of the need for backup generating plant, additional transmission lines and for the extra cost of operating a system where a large proportion of the generation has a rapidly varying and unpredictable output.

I suspect that a "least cost system development plan" based on using coal and large hydropower (or nuclear and hydro) would be significantly cheaper than one based on renewables. In fact, I suspect that carbon would have to be valued that something between

[9] In the case of Onekaka this added something like 20% to the cost of building and operating the scheme. If we had known in advance how much it would add to the cost, the scheme would not have been built.

$40 and $50/tonne for the renewable option to compare with the other options. Studies are needed.

Page 53 points out that many renewable energy resources are remote from major load centres and will require a robust transmission grid. The cost of this grid must be included in the cost of moving to renewables.

Page 54 I am surprised at the degree of faith in "carbon capture and storage". It is strange that it is assumed that this technology will mature rapidly and would become cost-effective relatively soon. On the other hand, it seems to have been assumed that nuclear power will cost the same as it did 20 years ago - ignoring improvements made and proven since then and improvements now being adopted for new designs of stations now under construction.

On page 56 marine power is mentioned. I have some experience in this having worked on the design and detailed specifications for a tidal power station in northwestern Australia where the tidal range was in excess of 8 metres. The target price we had to beat was 45 Aust cents per kWh. In spite of the fact that we had an excellent site with natural upper and lower ponds, we could not get the scheme close to this price.

The latest information on the much larger Severn Barrier in the UK is that it would be marginally economic - but only if a large carbon tax were imposed on conventional generation. That being the case, they would be better off building an equivalent nuclear power station and leaving the estuary as it is. Exactly the same reasoning applies to New Zealand.

Regarding wave power, Professor Norman Bellamy of Coventry University spent 20 years developing wave power. He developed an early version of the "Pelamis" which is now being trialed off Portugal. As result of this experience he is extremely pessimistic about the possibilities of economic electricity supply from wave power. The reason for the recent interest in marine power (and solar power) is the very high subsidies available from governments that believe in dangerous man-made global warming and that technologies like this will be effective in combating it. There is no evidence to support this belief.

Conclusion

I believe that New Zealand would be better off without any strategy than it would be with the one outlined in this document. I am happy to provide documentation backing the statements I have made and to discuss them with MED staff.

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