

Climate Change and Maui Gas: The Determinants of Wind Energy's Future in New Zealand

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Abstract

The nascent New Zealand wind industry faces a very stringent cost target of 5-6 c/kWh. The economic rationalism which has transformed our economy since 1984 means that wind energy can not expect the subsidies and other targeted measures which have stimulated the industry in other developed nations particularly Germany, Denmark, USA and UK.

Furthermore the gas industry has remained relatively untouched by this economic rationalism. In particular:

- the government has, in violation of rational economic principles, not yet applied the polluter-pays-principle to carbon dioxide emissions. Thus the gas industry, along with all fossil-fuel industries, gets a free ride on the economic costs of climate change. Meanwhile wind energy receives no extra value for the fact that it does not emit greenhouse gases
- take-or-pay gas contracts dating back to 1974 transferred risk to the NZ taxpayer. This is effectively a subsidy, which has been retained by the private sector as the contracts have been on-sold at various times since then. The net result is that gas can be seriously undervalued by major energy players who thus have great flexibility to undercut wind power projects.

The combination of these two factors puts a severe constraint on the short-term market for wind energy. The outlook for wind energy is thus very much dependent on the outlook for climate change policy and wholesale gas prices.

Introduction

In 1991 the New Zealand government passed a world-leading piece of legislation, the Resource Management Act (RMA). Its primary purpose is the promotion of the sustainable management of natural and physical resources. Adverse effects, including potential ones, must be avoided, mitigated or remedied. And carbon dioxide (CO₂) from burning fossil fuels is a "contaminant" under the RMA because it alters the balance of the air's natural constituents and is likely to have an adverse effect.

In 1994 these definitions were put to the test in the hearing into the proposed Taranaki Combined Cycle power station. During the hearings the Minister for the Environment announced that:

"Industry has been given a window of three years in which to start to lower carbon dioxide emissions. If they do not, they face a carbon charge at the end of 1997 Today's announcement should be seen by industry as a clear signal that the Government wants to see emissions coming down by 1997."

After the hearing the Minister for the Environment ruled in early 1995 that the Taranaki consent holder must remedy the CO₂ emissions once they take emissions from New Zealand's generation sector to a higher level than they were prior to commissioning the station.

This ruling was weaker than that recommended by the Board of Inquiry which was to remedy the emissions, period. But it was a landmark decision, a first in New Zealand (if not the world) for applying the polluter-pays-principle (Refs. 1 and 2) to CO₂ emissions. Taken together with the commitment to a carbon charge in 1997, it seemed that the government was serious about meeting its commitments under the Framework Convention on Climate Change (FCCC), at least in terms of its "net" interpretation of the emissions targets.

But since then we have had the Southdown gas-fired station built with no CO₂ remediation requirements, and numerous other gas-fired projects are being planned on a similar basis such as the 400 MW plant at Te Rapa dairy factory. Within a few years we are likely to have a glut of gas-fired generation, driving wholesale electricity prices down. There is a real prospect that in the year 2000, instead of achieving emissions stabilisation (our year 2000 target), we will have hydro lakes spilling water in the summer so that new gas-fired stations can stay on line to repay their owners' capital.

How has this happened? When the fundamentals should be so right for wind power projects in New Zealand, how is it that so little has been achieved while gas-fired construction proceeds apace? And what can the new wind energy association do to redress this imbalance? This paper attempts to answer those questions.

New Zealand's Climate Change Policy

New Zealand's per capita greenhouse gas (GHG) emissions are high by international standards. On a gross basis in 1990 they were **second** highest in the world (22.6 tonnes/yr per capita). On a net basis they were 17.4 tonnes/yr per capita, **third** highest in the world. This compares to a global average of about 5 tonnes/yr per capita. In order to achieve the ultimate objective of the FCCC the global average must reduce to less than 2 tonnes/yr per capita, perhaps zero net.

On the other hand, New Zealand's per capita CO₂ emissions are about 15th or 20th in the world, 7.5 on a gross basis and 2.3 tonnes/yr per capita on a net basis. Shortly after we signed the FCCC in 1992, our government proposed that we meet the year 2000 target in terms of net CO₂ emissions. This was because we seemed to have a natural advantage in forestry. This advantage, which makes our net emissions much lower than our gross, would also (it was thought) make it quite easy to meet the year 2000 target. Large-scale forestry developments were expected which would mop up 80% of the expected 20% increase in gross CO₂ emissions. "Voluntary agreements" were proposed which would deal with the other 20% of the 20% increase. By these two measures alone, the government proposed to return net emissions to their 1990 levels by the year 2000. Business could carry on pretty much as usual, no real changes in our energy policy would be needed and only organisations like Greenpeace and Solar Action, who bother to read the FCCC and check the definition of words like "emission", would be offended.

In 1994, as noted previously, the government added a commitment to a low level carbon charge in 1997 to bolster these two measures.

However this strategy has back-fired badly on the government. Forestry developments have failed to materialise so that absorption is expected to be lower in 2000 than previously forecast. Voluntary agreements have failed to achieve their objective, so that the expected increase in gross CO₂ has gone up to 22% instead of down to 16%. As a result net CO₂ emissions are increasing by more than 60%. If anything this illustrates the danger of picking a small number to use as the base case.

In summary it has become apparent in the last few years that, by whatever measure one chooses, our GHG emissions are **getting worse** by millions of tonnes per year. This is shown by the following Table 1 where all figures, taken from Ministry for the Environment data (Ref. 3), are given on a CO₂ equivalent basis:

Measure of New Zealand's Emissions	1990 Emissions (kilotonnes/yr)	Projected Increase from 1990 to 2000	
		(kilotonnes/yr)	(percent)
Gross GHG	77,040	3,091	4.0%
Net GHG	59,334	2,196	3.7%
Gross CO ₂	25,475	5,611	22.0%
Net CO ₂	7,769	4,716	60.7%

At the same time, the landmark decision on the Taranaki power station has not been taken up as a precedent for other gas-fired power stations. Recognising that this introduces anomalies, the Ministry for the Environment established a working group on CO₂ policy which reported last year on the desirability of introducing a tradeable carbon certificate (TCC) system in the year 2000. Between now and 2000 it recommended no change to the government's existing policies (which included introducing the low level carbon charge in 1997).

But in 1997, confronted by the failure of its existing policies, the government has given in to pressure by industry lobby groups to defer action on climate change. The upcoming Conference of the Parties to the FCCC in Kyoto has been used as an excuse to backtrack on the commitment to a low level carbon charge. This is difficult to understand, given that the Kyoto meeting will focus on targets after the year 2000, whereas the government's commitment had been limited to achieving the first, year 2000, target.

Thus we have arrived at a point, five years after Rio, where we in New Zealand have no value being placed on the fact that wind power does not emit CO₂. This compares with values in some other countries as follows:

Country	Policy or Measure	Additional Value of Wind Power (c/kWh)
U.S.A.	renewable tax credit	2.5
U.K.	non fossil fuel obligation	2-3
Denmark	carbon tax, subsidies, regulated wind power prices	10-15
Netherlands	subsidies, regulated wind power prices	10-15
Germany	subsidies, regulated wind power prices	10-15

While we are unlikely to get as much here, a serious response on climate change would see about 0.5 c/kWh being added to the value of wind power. This is the sort of cost which tree-planting to achieve CO₂ absorption would add to the cost of gas-fired power.

But quite apart from the magnitude of the price signal, there would be an important symbolic value if the government showed willingness to implement its stated climate change policies. If it is 0.1 c/kWh or 1.0 c/kWh, the fact that it is non-zero would send an unambiguous signal to the energy sector that renewable energy, including wind power, and energy efficiency is the way of the future.

To date there has been no such signal. The government's recent backtrack on the low-level carbon charge does not bode well for the short term. A decision is promised in 1998, but the implication is that that would be contingent on something concrete coming out of Kyoto. Given the time-scale at which Kyoto is aimed (2010 and beyond) this seems very unlikely.

So what can the newly-formed NZWEA do to alter this bleak outlook for New Zealand's climate change policy?

There are times when an industry sector group must put on its lobbyist hat and unashamedly speak its truth. This is such an occasion. There is considerable obfuscation on this whole issue and the government, by and large, manages to get away with this. There are certain key facts which the New Zealand public is unaware of and NZWEA should lend its voice to public education so that pressure is put on the government to take action. These facts are:

- the FCCC obliges us at least to aim to return emissions to their 1990 levels by the year 2000
- New Zealand signed this document, but, unlike the US and Europe, we have not honoured it: the government has done nothing beyond exhortation to achieve the target
- consequently it looks like we will miss the target
- the present debate between the US and Europe is about methods to go beyond that target to achieve emissions reduction. Our failure to work on the first target undermines the validity of any input we make to that debate. It also damages our clean-green image
- the polluter-pays principle is economically rational and consistent with the RMA
- the Taranaki decision has set a precedent for the application of that principle. The precedent could be extended at low cost to all new gas-fired projects but this is not happening
- the government's actions to date simply amount to procrastination which makes the burden on future generations (of emissions reduction) greater. This is the antithesis of sustainable development
- meanwhile wind power projects are in a state of limbo for want of an extra 0.5-1.0 c/kWh, but gas-fired projects are proceeding apace based on a resource which will be depleted in about 10 years.

Maui Gas

The Maui field and the other major gas fields in New Zealand have been developed in accordance with take-or-pay contracts which date back to the 1970's. These contracts were initially with the Crown and thus transferred risk to the NZ taxpayer. This is effectively a subsidy, which has been retained by the private sector as the contracts have been on-sold at various times since then. The net result is that gas can be seriously undervalued by major energy players who thus have great flexibility to undercut wind power projects.

To illustrate this point consider the capital component of a combined-cycle gas-fired power station. At \$1200/kW and 80% capacity factor, the owners only need to receive 2.8 c/kWh to pay back their capital at 10% discount rate over 10 years. By comparison a wind farm needs to receive about 5.5 c/kWh to pay back its capital over 20 years (O&M costs are additional). At 45% thermal efficiency the gas component adds an energy cost in accordance with the following table:

Gas Cost (\$/GJ)	Components of Electricity Cost (c/kWh)		
	Capital	Energy	Total (excl. O&M)
\$0.00	2.8	0.0	2.8
\$1.00	2.8	0.8	3.6
\$2.00	2.8	1.6	4.4
\$3.00	2.8	2.4	5.2
\$3.40	2.8	2.7	5.5
\$4.00	2.8	3.2	6.0

From this table one can see that, at anything less than \$3.40/GJ, a gas-fired project can undercut wind power assuming other O&M costs are of a similar magnitude.

In this context it is important to recognise that natural gas has traditionally been viewed as a by-product in the petroleum industry. More of a nuisance than a valuable commodity in its own right, it is often flared off, and this is still the case in oil-rich nations. The history of the Maui gas field contains many echoes of this counter-intuitive reality of petroleum economics. Firstly the Labour government in 1974 entered into the Maui take-or-pay contract on the assumption that growing electricity demand would necessitate many new gas-fired power stations. At the time this was thought by many to be a wasteful application of a premium fuel, but the nature of the take-or-pay contract is such that if you are not using it you might as well be flaring it.

In the event, electricity demand did not grow at the expected rate and the 1978 oil crisis put a premium on liquid fuels instead. The synthetic petrol plant at Motonui came along as an alternative use for the gas. Its 48% thermal efficiency in converting gas-to-gasoline was, perversely, a point in its favour. Here was something which would use the gas quickly enough to fulfil a large chunk of the take-or-pay contract.

Now, 16 years later, the Motonui plant is nearing the end of its life and the electricity industry is taking over the role originally envisaged for it. If the Motonui plant closes in 2003 as anticipated, electricity generation will become the main user during the final years of the take-or-pay contracts. Thus history is set to come full cycle.

The point of this potted history is that all the while the pressure has been to find something which will use the gas quickly enough. It is inherent in the contracts that have underpinned the Maui field development that, at the margin, the **opportunity cost of gas is effectively zero**. Indeed it is possible that the marginal value of gas could be negative, in the sense that it costs money to leave it in the ground. This is because higher value products from the gas stream, the condensates which provide valuable liquid fuels, justify extracting the gas even if there is no use for it.

Gas-fired Power in the Wholesale Electricity Market

From the foregoing it can be seen that, for certain players in the gas industry, there is tremendous latitude in the price they can charge for natural gas. If such a player has an interest in a new gas-fired power station, they might budget on selling power at 4-5 c/kWh (valuing the gas at \$2-3/GJ). If there were to be an electricity market downturn the player with the gas contract may accept the risk that his return would be reduced below \$2-3/GJ. However large or small this risk may be, one can see that he can be far more indifferent to the risk than a wind farm developer. A wind farm developer will not be able to finance his project unless he has long-term hedging contracts which guarantee his power price for at least 10 years.

By contrast a gas-fired project developer with the right gas contracts may not even need to obtain full hedging cover. The risk of prices falling below 4 c/kWh may be deemed so small that he will prefer instead to gamble on prices rising by simply selling on the spot market.

Summary

Climate change and Maui gas are the determinants of wind energy's future in New Zealand because, in the absence of action on climate change, wind energy can not compete with gas-fired projects. While there are Maui take-or-pay contracts sloshing around in the system, as there could well be until the original contracts expire in 2007, the gas will be used increasingly for power generation.

This is not to say that wind power will automatically displace gas-fired power if a low level carbon charge or TCC scheme is introduced. In the short term this is simply impractical on a large scale. However action on climate change would undoubtedly accelerate the development of wind power in New Zealand. It is difficult to imagine another policy issue which could have such an effect. The elimination of Trans Power's fixed charges, for example, would equally benefit small gas-fired cogeneration stations and thus would not improve wind power's competitive position with gas.

By contrast continued inaction by our government will continue to send the message to our society, and in particular the investment community, that business will be as usual at least until the Maui contracts expire. That is another decade which would be lost to wind power's progress in New Zealand.

Conclusion

Two months ago Randy Tinkerman, a San Francisco-based wind power management consultant, wrote in an Internet newsgroup posting:

"We will never compete with natural gas until the world legitimizes externalities, so stop the charade and fight the real battle."

This paper has been written as a similar call to action for the newly-formed NZWEA. Fossil fuels will always undercut the solar-based options in an unregulated market competition. Because they can be so readily extracted from their underground stores, they are inherently cheaper than the options which harness solar energy sustainably. It is a bit like a bee-keeper trying to sell honey in a market which allows people to sell stolen honey. The stolen honey

will always be cheaper, no matter how industriously the bee-keeper works to get his prices down.

I am not saying that the fossil fuel companies are thieves. They have worked hard and well to extract their products from the ground. If anyone can be accused of theft, we must all face that charge, for we may be stealing from future generations not only:

- their access to the valuable chemical properties of fossil fuels, but also, and more immediately,
- the most fundamental security that a stable, benign climate provides.

Burning fossil fuels to produce CO₂ is pollution. It is also a form of laziness, and theft from future generations. I believe that the polluter-pays-principle must be applied to achieve our internationally agreed emission targets. An economic instrument such as the proposed TCC scheme would put wind power on a level footing so that it can make its maximum contribution.

Solar energy, especially its indirect forms such as wind power, hydro power and biomass fuels, in combination with energy efficient technologies, can provide the safe transition path away from the threats of climate change and depletion posed by fossil fuels. But they can only make their maximum contribution if the governments of nations ensure that there is an energy market where polluters pay. It helps to remember that environmentalism is largely about long-term economics. The economic question is simply pay now or pay later.

Only governments can step beyond the short term preoccupation with how much things cost now, because unlike individuals, a nation can expect to endure into the 22nd century. Therefore it is the government's role to ensure that the actions of present generations do not undermine the security of future generations. It is time the New Zealand government accepted its responsibilities in this regard.

References

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