

## Discussion Session

Scene-setting by Don Elder  
Transcript

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**Don Elder:** At this stage we're going to move to the discussion section of this session.

So let's have a look at where we are at the moment. We've had some interesting presentations over the last day and a half and some particularly interesting presentations this morning. There are some common themes emerging but there are also some very common questions. What we can clearly see is that we do need an energy "big picture" and I think we can also clearly see that this big picture has to be long term. It's not a short term or a medium term picture. It's a picture that needs a twenty to fifty year window, not a five to ten year window.

I think what is absolutely indisputable, is that in the very long term New Zealand, like the rest of the world, will rely primarily, if not totally, on renewables. So the issue is not, as we sometimes tend to discuss, will the next sources of generation be renewables or non-renewables. But the issue is really how fast and how best will we make the transition from the 29% of renewables in the economy now, to close to 100% and when will we make that transition.

So to answer that question, we need something that the country currently doesn't have. We need a long term strategy that's based on some really good work and bought into by the energy sector and in fact by the majority of the country. That's not a medium term strategy that's based on short term analysis or vested interests. It's not a five to ten year or a ten to twenty year strategy. It's a strategy that involves pictures at five, ten, twenty, fifty, and probably a hundred years out of what the New Zealand energy economy will look like. It's not just a policy that's driven by one aspect of the energy issues for New Zealand. What it has to be is a strategy that is based on a co-ordinated and not a fragmented approach, and a co-ordinated approach to the thinking rather than a fragmented approach amongst the different interests that are involved.

So what's the basis for the strategy? What are some of the things we have to consider? Well, we've heard a lot of them in the last day and a half, and particularly so this morning. We need to consider for a start, as Chris Baker discussed, what is the role of energy in our economy today? What will it be five years from now, ten years from now? Twenty, fifty, a hundred years from now? Where will energy fit in?

Second, how does energy impact (and the availability and cost of energy impact) on New Zealand overall - economically, socially, and of course environmentally? Then we need to look at the demand and the supply. We need to separate out demand and supply in a sophisticated manner, as we've started to see in the last day. Demand needs to be looked at among other things by market, by region, by sector, and, as Lee Wilson just showed, by time during the year, and possibly by hour during the day as well. Supply needs to be

looked at by type of supply available, the technology needs to be looked at by location in New Zealand - where is it located, where could it be located? What's the flexibility? It needs to be looked at by security, also by externalities, external impacts, environmental and other. And also we need to look at the best mix of supply. Not A versus B but how do A, B, C and D best fit together in an overall portfolio.

So overall we need to do what the European community does. They look very clearly at three aspects of energy - they identify them separately, and they balance them. And it was interesting discussing this last year with the Director of Energy for Europe, at a conference I was at. He talked about it and he said "We don't just look at this and that, we don't just look at cost, we don't just look at security. We look at three things. We look at the security of energy supply, we look at the cost of energy, and we look at the externalities, and we balance all of those." So I said to him "What's fundamentally most important?" He said "They're all equal, you have to balance them all." I said "No, no. Come on, really. What's most important?" He said "Well, when it really comes down to it, security's most important. If you haven't got security, you haven't got energy. So I suppose if I had to rank them first, it's very clear that in Europe we put security first, then after that we balance the three of them." We need to do it in New Zealand. We need to take that approach.

Some interesting questions are raised by the briefing paper to the incoming minister who spoke to us yesterday, prepared by the Ministry of Economic Development, the standard briefing paper on energy. There are some key and apparent assumptions either implicit or explicit in there and I'd like to run quickly through them because I think they are assumptions that are quite important for us to consider.

First, the assumption is generally made in looking forwards that the government's national energy efficiency and conservation strategy will be effective, so the targets of a 20% reduction in energy demand due to increased efficiency, and additional renewables at 30 PJ per annum by 2012 will effectively be able to come to pass. In fact the minister suggested yesterday most businesses in New Zealand could get 20-30% energy efficiency improvements if they just thought about it and set about doing it.

Second, the assumption is made that the Kyoto policies will result in a carbon tax. It's not explicit but I think it's probably implicit there will be some industries protected from this tax in some way. I don't know which industries they will be or where they will be, but I think that this assumption is probably made.

Third, there seems to be the assumption that relatively little distributed electricity generation that will occur, so it's still basically the current scenario of centralised generation and transmission of electricity.

Fourth, the assumption seems to be fairly implicit that the Pohokura and Kupe gas fields will come on stream at some point as the newest gas fields and that the cost of those for electricity generation will be less than coal. Therefore gas will be the preferred next best source of generation.

Fifth, there's the assumption, that Chris Baker disputed, that there will be about 90 PJ per annum of new gas discoveries that will keep coming on line. Whereas Chris suggested, at least some parts of the energy sector (and people you would think should know) are suggesting that the number perhaps should be something more like 20 PJ per annum. There is a big difference there.

Sixth, there are assumptions that have , this has been spoken about quite widely recently, that there is almost no coal used for electricity generation now, and the cost of new coal-fired generation is 10-12 c/kWh. Both these assumptions are wrong, as I said yesterday. First, there's about six to seven petajoules of electricity right now that is generated using coal - it goes up or down depending on the year - generation of that sort of order is quite significant. And second, the cost of new coal fired generation, as I'll come to a moment, depending on whether it's existing plant at Huntly or new generation is in the range of probably 4-6 c/kWh, not 10-12 c/kWh. The 10-12 c is probably the retail price that you pay as the consumer, but then that's got line charges, transmission charges, profit, retail charges, everything else added in, same as everything else does, so it's the wrong number, and I don't know where it came from, I don't know why it exists.

Seventh, the assumption is made that the petrochemical industry will basically start shutting down very quickly from about 2005, so that is a very important assumption for the supply of gas.

So there are some very critical questions there. Just to answer some of those quickly and provide a bit of a framework, at Solid Energy we have done a fair amount of analysis over the last couple of years and we have some fairly critical questions to answer ourselves. If coal is going to have to fill a gap of flexibility as a part of that transition, then we need to answer some fairly basic questions about where, how and how best. So we've done a fairly major and significant amount of modelling in a variety of different ways using just some key assumptions. We've looked at a time horizon of twenty years, not fifty or a hundred (but not five or ten either). We've looked at a standard economic modelling including the usual things, and then we've looked at the different fuel sources including gas and coal, and determined the cost and availability that would exist coming from that.

So you've got the proposed combined-cycle station burning gas at Huntly, capacity 400 MW or 1,000 MW in the existing plant at Huntly. All are using gas at capital costs for a new CCGT. I don't know the exact numbers at Huntly, but say somewhere in the order of \$1,000+ per kilowatt for thermal efficiency around the 50%+ mark, whereas the existing Huntly plant runs at around 36% efficiency, but of course the capital's already invested.

Coming across to coal, the existing Huntly plant can theoretically burn 1,000 MW in coal for 100% of the time if it chose to. Capital cost once again is already there but the thermal efficiency is down around 36%. For future options though, in 2010 we could have a new conventional technology 400 MW coal-fired plant at Huntly for about \$2,000/kW, so it is quite expensive to install compared to gas. But the efficiency is 41% with improved technology. Another option using conventional technology, is pulverised

fuel without flue-gas desulphurisation. A small plant of 100 MW would probably be 35% efficiency but at a slightly more expensive capital cost.

But the new coal technology that was talked about yesterday is the integrated gasified combined-cycle plant. Basically you get the gas out of the coal and a number of breakthroughs are available from that. So a 400 MW plant to compare directly to the CCGT for gas is about twice the capital cost of the gas plant, but thermal efficiencies are available up around the 52% mark. So that's the way of the future.

Using that information and looking at what this means in running through the modelling from there, we obtained similar results to those that Lee Wilson presented, analysed in a very similar way. Looking at the gas supply and the gas demand over the next ten years, the first point as Lee said, there is a deficit of gas supply in the short term as Maui declines but other fields come on progressively. This is likely to be met in the short term by Methanex declining, but as gas prices rise, Methanex actually exits eventually and the combined-cycle power stations rely on Pohokura. But the increased deficit of supply from 2011 onwards particularly requires a combination of new gas discoveries and substitute thermal fuels over and above (of course) the renewables that come on stream. But again the question that I believe should be posed, is not is it renewables or non-renewables, but how fast can we make a transition to what will ultimately be 100% renewables. And coming back again, the framework for that decision should be security, cost, and externalities.

So again picking up some of the results that have been presented and looking at these over the course of a year, let's say next year, 2003, what is the possible range of spot prices for electricity throughout the year based on the range of possible scenarios that could be run? We see spot prices down around \$10-30/MWh in the summer period but rising to a very wide range through the winter period of \$50-\$100+ in the middle part of the year, ranging from the 10 to the 90 percentile levels. This really creates the very obvious need, and only one year ahead (not looking five or ten years out) for dry year thermal hedging to provide the flexibility to bridge that gap and in particular to avoid spot prices continuing to rise and go through the roof in the future.

So what is the opportunity for coal as one of the thermal hedge options in the future? We've looked at a 100 MW power plant. This is a very small power plant (not a 400 or 1,000 MW plant) and looked at what would happen if we did or did not have that plant. If we forecast the future price of electricity from 2005 through to 2025, a twenty year window, rising from somewhere about 4.5 cents a kilowatt-hour now rising through 5 c/kWh by about 2007 up to just over 6 c/kWh by about 2020 then staying somewhere around there. That's where the price would go without additional coal-fired generation. What the red bars represent is the relative effect on the New Zealand economy modelled economically of introducing just 100 MW of new coal-fired generation and the implications of that on the control of electricity price and the flow-on benefits through the New Zealand economy.

What you see of course is that in the first three or four years, while the cost of new coal generation is higher than the wholesale electricity price, then it's negative. If you brought it in during that period you wouldn't be bringing in the next best, commercially available alternative. So you'd actually be creating a negative economic benefit. But with coal at about 5 c/kWh, from that point on, if you can bring anything in at 5 c/kWh, then the national economic benefit rises very quickly, through hundreds of millions of dollars a year at 5 c/kWh or thereabouts for just 100 MW of new capacity.

This is a very good example of the impacts of not providing the best economically available alternative, whether it be coal or wind for that matter, and the impacts of allowing the least economically attractive options or less economically attractive options to come in earlier than they otherwise should.

At about 5.2 - 5.25c/kWh the breakpoint occurs and that is where huge amounts of coal-fired electricity capacity become available and we're talking thousands of megawatts available in theory at somewhere between 5 and 5.5 cents a kilowatt-hour. At that point the electricity price either hits five and a quarter cents and keeps on rising through to well over six cents or it can be capped at somewhere at around that level.

I should add, these are economic projections without the imposition of a carbon tax. As was pointed out earlier, a carbon tax would add 1 - 2 cents a kWh to the prices for coal-fired generation. So that means that the red price would continue to rise and coal would kick in at a much higher price, and have much less ability to cause that effect and to reduce the very direct effect or hit on the New Zealand economy of rising electricity prices.

So what are the advances in technologies for coal? Is this a possibility and is it something we should be considering?

Thermal efficiency of coal is quite important, not just because it's a renewable or non-renewable resource, but also because the efficiency dictates the amount of CO<sub>2</sub> given off per unit of useful energy. There's a theoretical barrier for conventional coal-fired technology called the Rankine barrier. I don't fully understand that and won't go into it but it basically says that somewhere around 45% you can't get any more efficient with conventional coal technology. So coming from about 1880 at 5% efficiency through to the present at about 45% efficiency we are now at the Rankine barrier. There are no more theoretical efficiency improvements to be gained in conventional coal-fired generation.

But advanced technologies offer significant improvements by gasification of coals, so you can essentially use a CCGT technology to allow a breakthrough and already coal efficiencies are up to 50%+ and the expectation is that they'll head toward 60%. Going from 35% efficiency for coal to 55% efficiency reduces your CO<sub>2</sub> emissions per unit of useful energy by a factor of half or more. So there are substantial opportunities there that are generally once again a win-win-win in terms of security, cost, and environmental effects.

So that's the future direction. Just to finish with off a couple of key slides. In talking about the thermal hedges, the theme that has come back over and over again from a number of people, is that the flexibility of gas and coal have historically met New Zealand's dry year needs. Maui has been 53% of gas reserves but is now declining. Gas made up 30% of electricity generation in the last year to March and there was a 12% variation in hydro between a wet and a dry year. In the same period coal jumped 52% in its use while gas generation jumped by about 28%. But, as we've just heard, new gas fields are very likely to have much less flexibility.

So from the point of view of coal production, as Chris Baker said, New Zealand has the equivalent of 15 Maui gas fields worth of coal, most in lignite in Southland. But there are two or three Maui gas fields of coal sitting in the West Coast and Huntly, of high grade coal that's currently available at about 5-5.5 c/kWh wholesale electricity generation price level. So the production capacity is available, the reserves are available and in fact the Maui shortfall can be covered by coal at slightly lower cost than new gas fields, but the difference is substantially greater certainty on the fields that are already there.

And just as a point of interest, New Zealand currently produces over 100 PJ/year of coal, a very substantial amount, of which only 6-7% is used for electricity generation.

So that I think helps to set the scene for some of the discussion.

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