Josie Beruldsen

From: Josie Beruldsen
Sent: Friday, 26 June 2009 11:23 a.m.
To: 'bryanleyland@mac.com'
Subject: Further question from the Board of Inquiry for the proposed NPS for renewable electricity generation

Hi Bryan,

Thank you for attending the hearing for the proposed NPS for renewable electricity generation on Tuesday. The Board would like to ask one more question from you:

Can you please provide the Board with your understanding of cost per KW hour for thermal and for pump storage.

If you could email this information onto me, I will pass it onto the Board.

Kind regards

Josie Beruldsen
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Josie Beruldsen

From:	Bryan Leyland [bryanleyland@mac.com]
Sent:	Monday, 29 June 2009 10:19 a.m.
To:	Josie Beruldsen
Subject:	Re: Further question from the Board of Inquiry for the proposed NPS for renewable electricity generation
Follow Up Flag:	Follow up
Flag Status:	Red
Attachments:	EEA Renewables Leyland sml.pdf; ATT00001.htm; Options for future power generation EEA09 Leyland.pdf; ATT00002.htm

Dear Josie,

In fact, the question is not all that easy to answer. But I will try because it is an important aspect of the investigation.

Coal-fired generation and gas-fired generation both cost between six and eight cents per kWh. For this price, you get a power station that, more than 98% of the time will be available to provide full output if called upon -- if it has adequate warning. From cold, the start-up times for the stations would be between six and eight hours. From what is called "hot standby", the start-up time would be two or three hours. If the unit is already running at less than full load, a coal fired station can pick up a load at 10 to 20 MW per minute but a combined cycle station would be slower. There are major problems with two of our three combined cycle stations in New Zealand because their boilers are not designed for frequent and rapid load changes. Therefore, the owners will be most reluctant to try and balance the changing output of wind farms. If they do try, the reliability will go down by quite a large amount - possibly leading to an early death - and the cost of operation will increase. I am not sure whether this applies to the newest combined cycle station at Huntly, but it probably does.

Our existing thermal stations plus our hydro stations can cope with the normal and fairly predictable variations of load on our system. As the proportion of wind increases, it will become more and more difficult and expensive.

It is almost impossible to give a cost per kWh for pumped storage. I have been involved in proposals for the three pumped storage stations in New Zealand. The most attractive option is to add a pump to the existing Tokaanu power station at a cost of just under $1000/kW. If this was installed, Tokaanu station would always be available to cope with varying demands and the fluctuating outputs of wind farms -- by generating up to 240 MW and pumping at up to 60 MW. So it could cope with a 300 MW swing in wind farm output or in demand. It cannot do that at the moment because, very often, it has insufficient water in its storage pond.

If we assume that the station is pumping 20% of the time, it will consume 105 GWh. 25% of this will be lost in pumping and generating losses, so its output is roughly 80 GWh. At a 10% return on the estimated capital cost of $50 million, and a price during the pumping of four cents/kWh, the cost per unit generated works out at 11.5 cents. So the station is unlikely to be economic purely on the basis of pumping when the electricity cost is low, and generating when it is high.

Pumped storage stations are installed primarily because of their rapid response to load changes. In a country with a large amount of nuclear power which cannot change output by a large amount in a short time without causing problems, pumped storage is very valuable. Spain is now installing large amounts of pumped storage to balance windpower. But, as you can see, the balancing comes at a high cost. In New Zealand, the cost of wind power at the station gate is at least 11c/kWh and it could easily be nearly twice that Europe and Spain. So the surplus windpower that is used for pumping is expensive and the 75% of this power that is returned to the system when it is needed is even more expensive.

I hope this gives a reasonable explanation. If not, I will be happy to explain further.

I also attach a copy of a recent presentation and the associated paper for the Electricity Engineers Association conference earlier this month.

I will also give a response regarding the terms of reference of the enquiry -- and, in particular, the definition of "small" hydro and what could be done to reduce the high costs dissociated with regulatory approval.