

**IN THE MATTER** of the Resource Management Act 1991

**AND**

**IN THE MATTER** of applications submitted by New Zealand Energy Limited for a change or cancellation of conditions to existing resource consents 101987/1, 101990/1, 101991/1, 101992/2, 101993/1, 102264/1 and for new Land Use Consents 104088 and 104089, new Water Permits 104090 and 104091 and new Discharge Permits 106031, 106032 and 106033, all relating to the Raetihi Hydro Electric Power Scheme, Raetihi.

## **PETER TILL - RUAPEHU DISTRICT COUNCIL**

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### **INTRODUCTION**

My name is Peter John Till. I am currently the Chief Executive of Ruapehu District Council. I have been the District Engineer since my employment by Council in September 2004. I am an electrical Engineer by training and have been associated with various Hydro Power Schemes for various employers. Notably:

- Opunake and Patea (31MW) for South Taranaki Electric Power Board (1985 to 1989)
- Mangahao (30MW), Piriaka (1MW), and Kuratau (6MW) for King Country Energy (1989 to 2001)
- Large Schemes in Northern Iraq (eg Derbendikhan 800MW) for Australian Power and Light and the UNDP ENRP (2001 to 2003)
- Director of "The Lines Company" owner of three small schemes 2011 to present.

I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note, and I agree to comply with it. I confirm that I have considered all of the material facts that I am aware that might alter or detract from the opinions expressed here.

The evidence I am about to give is within my area of expertise and represents my best knowledge about this matter. To my knowledge, I have not omitted any material facts that might alter or detract from the opinion expressed here.

My evidence is around the quantity of water requested by the applicant and the use made of it. My thoughts are around:

- 1 The use made of the existing permitted quantity of water.
- 2 The effect of full utilisation of the permitted quantity.
- 3 The effect of the increased volume of water if it is granted.

## **1 The Existing Quantity of Water Used**

### **1.1 Peak Production**

- 1.1.1 I believe that the applicant uses less than half the permitted quantity at present. I base this on the basic equation for Hydro Plants

- 1.1.2 Output in Kilowatts = Volume of water in cubic metres per second x height in metres x gravity (9.81) x efficiency
- 1.1.3 Taking the current consent condition for 600 litres per second, or 0.6 cubic metres per second. Refer page 12 paragraph 51 of Anne Glakin's section 42 report on water quantity dated 1 October 2013. This is the total of the Makotuku, Makara, Makariti and the unnamed tributary of the Mangaone.
- 1.1.4 The height available is 116 metres. Refer page 5 of the scheme description provided by MWH for NZ Power dated June 2007.
- 1.1.5 Efficiency should be greater than 85%
- $0.6 * 116 * 9.8 * 0.85 = 580\text{kW}$
- 1.1.6 The reported output of the station at present is 250kW (page 5 of MWH report).
- 1.1.7 So the present peak production of 250kW is less than half the production suggested by the peak possible permitted flow of 580 kW. It is possible the scheme is less efficient than current rules of thumb suggest but the solution to this issue is in the hands of the owner not the Regional Council.

## 1.2 Total Annual Output

- 1.2.1 The annual production of the scheme is 1.75 GWh or 1,750,000 kWh (page 5 of MWH report).
- 1.2.2 If one considers a 250kW generator running 24 hours a day 365 days a year then the total output would be  $250 * 24 * 365 = 2,190,000$  kWh.
- 1.2.3 The ratio of these two figures is known as the plant factor. It is 80%. This figure is high compared to a lot of other power schemes. Generally comparable figures are around 60%. This indicates that there is room for a larger generator depending on the economics of the particular installation. The actual flow is likely to be very stable.

## 1.3 Conclusion

- 1.3.1 I believe NZ Energy is using about half of the permitted quantity of water. This is based on a theoretical study as summarised above. I have carried out casual observation of the water races and these tended to confirm my thoughts. I have not actually measured the flows. I have read the documentation and did not find any reference to actual measured flows in the water race.
- 1.3.2 It is possible to conclude that the current resource consents are not being used effectively by the current scheme. An increase in efficiency would negate the need for resource consents to take additional volume.

## 2 **Effect of Full Utilisation of the Permitted Quantity**

- 2.1 The network of water channels that stretch across the Waimarino ring plain are obviously well tuned to the actual volume of water in them. The vegetation has adapted and the erosion stabilised.

- 2.2 If the volume of water flowing doubled then the water would flow faster. The actual level would not rise greatly but the effect of the water would change because the speed would increase.
- 2.3 Vegetation would change resulting in erosion which would take a while to re-stabilise. This may potentially create significant in-stream effects.

**3 Effect of Flow Applied For**

3.1 If the new consent is granted in total and the new flow is fully utilised then the effects on the scheme will be significant. Page 8 of the MWH report provides a brief overview.

- (a) Replacement of the turbine
- (b) Monitoring software
- (c) New Screen cleaner
- (d) New control and monitoring equipment at the Makariti
- (e) Excavation of canals
- (f) Excavation of pond

3.2 In my opinion the last two items would be significant impacts on the area. The impact would depend on how the work was done but does need analysis.

3.3 To put the effects into perspective the total length of the canals is 4.6km. If a cubic metre was taken every metre of trench length then the total volume of fill removed would be 4,600cubic metres. This is several hundred truck loads. The Ruapehu District Plan requires a Resource Consent for removal of 1,000 cubic metres of material within the Rural Zone per calendar year. Does the excavation of the canals require resource consent from the Regional Council and what is the wider effect of the removal of so much material?

3.4 The head pond itself is, I believe, the subject of a conservation order. Any increase in live storage would require some sort of consent. A proper analysis would be needed.

3.5 A theoretical “rule of thumb” for power station construction is that the flow in the penstock should be less than three metres per second. If the flow is greater than this then the flow becomes turbulent and the system inefficient. The diameter of the penstock is 530 mm (MWH report page 4). Therefore the radius is 0.265 m. Based on three metres per second and the cross sectional area (pi times radius squared) the maximum volume that could be usefully conveyed by the existing penstock is:

$$\begin{aligned}
 \text{Volume per second} &= 3 \times 0.265 \text{ squared} \times \pi (3.14) \\
 &= 0.66 \text{ cubic metres} \\
 &= 660 \text{ litres per second}
 \end{aligned}$$

3.6 Interestingly this figure is close to the present Resource Consent total figure. It does indicate that the effects of an increased allocation have not been comprehensively analysed.

3.7 If the increased flow was to be used then a 1MW Generator, four times the size of the existing unit, would be appropriate. The effects of this replacement could be material. Whilst the turbine is briefly referred to in the MW report the Generator is not.

3.8 I have not seen an analysis of these effects in the material supplied to me. I submit they would be material.

#### **4 Conclusion**

4.1 In my opinion the potential adverse effects of the proposed activity will be more than minor.

4.2 Based on the above calculations the application to take an additional volume of water is unnecessary as the requirement for greater volume could be met through increased efficiencies.

4.3 As such the Ruapehu District Council request that the applications submitted by New Zealand Energy Limited be declined.