



To	<b>Chris Evans</b>
From	Ray Brown
Date	27 July 2009
Subject	<b>Hydro Developments Ltd Effect on Transmission</b>

## 1 Background information from the 2009 and 2008 Buller Electricity Asset Management Plans:

Buller Electricity has two 26 km long 33kV lines (Robertson – Ngakawau circuits 1 and 2) that head north from Robertson St (the 110 kV grid exit point) to a new zone substation at Ngakawau substation which is not far from the old demolished substation at Granity. A single 33kV line continues northward over the Karamea Bluff to the Kongahu zone substation.

In 2009/10 Buller Electricity plan to upgrade the 33kV conductor between Waimangaroa and Ngakawau substation for Solid Energy requested load increases at a cost of \$420,000. It is not clear from Buller Electricity’s Asset Management Plan (AMP) whether this conductor upgrade will allow for the potential HDL generation at Granity and at the Weka power station. Buller also plans to bus (connect) the two existing 33 kV circuits together at Ngakawau (\$400,000) this financial year.

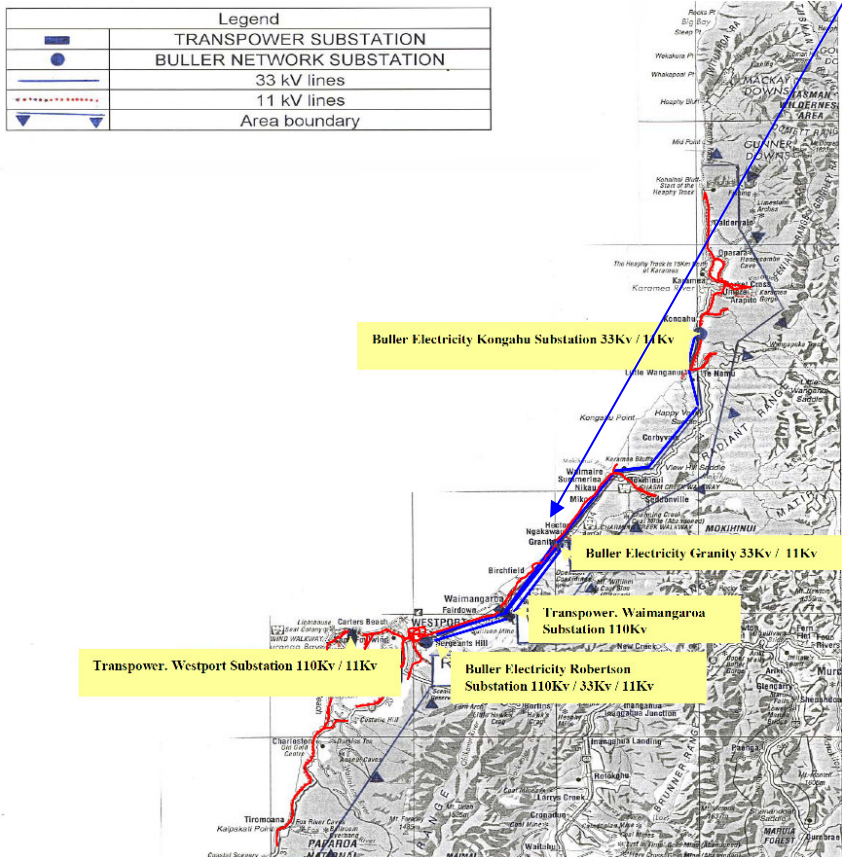


Figure 1 – Buller Electricity’s Network from their Asset Management Plan 2008

## 2 Information From the HDL Consent Application and Integration into Local Network

From the HDL application page 9 a base load generation level of about 25 MW is anticipated with potential for about 50 MW during and following heavy rainfall.

*“HDL has worked with Buller Electricity Ltd (BEL) to determine the optimum way to inject the electricity generated by the Project into the local distribution network. By the time the Project power comes on stream BEL will have upgraded the existing coastal transmission network to a capacity required to transmit the base load. BEL is confident that there will be a number of options available for distributing the extra power produced by the Project during periods of heavy rainfall. The best option cannot be determined until a number of improvements to the local distribution network, currently under consideration by BEL, are resolved.”*

From this and given the asset information from the AMP, this tells us that the two 33 kV lines from Robertson St to Ngakawau are adequate to export the first 25 MW of generation from the HDL proposal. Even without detailed information on the conductors used on the two BEL 33 kV lines to Robertson St, I am confident that the 33 kV lines could transport 25 MW to the Robertson St Grid Exit Point (GXP).

The Robertson St GXP substation has two 110/33/11kV 20/35 MVA transformers. These could be upgraded at minimal cost (<\$60,000) to 35 MVA continuous rating each to be adequate to export any excess generation over load even if the scheme was generating 50 MW.

It is less clear whether the two existing 33 kV lines could export 50 MW from the site, and the text in the application implies that they can not. However, I am confident that at some cost they could be upgraded or replaced so that they could export 50 MW to the Robertson St GXP. The environmental effects of doing this upgrade/replacement would be negligible and will probably be a Permitted Activity given the minimal height of the 33kV poles required.

Also from the application page 9: *“This application includes consents to build spur lines to connect to the existing transmission lines. BEL advises that the best practical option is to connect Weka Power Station to SENZ’s 33 kV line that serves Stockton mine. This will require construction of 500m of overhead 33 kV spur line from the Weka power station to connect to SENZ’s 33 kV line near No 4 Station (the building on the decommissioned aerial ropeway that is visible from Millerton township). Granity power station will be connected to BEL’s coastal transmission line. This passes through Granity less than 50m from the Granity tunnel portal...”*

This simply means that minor extensions to the existing 33 kV lines will be needed to connect the scheme’s power stations.

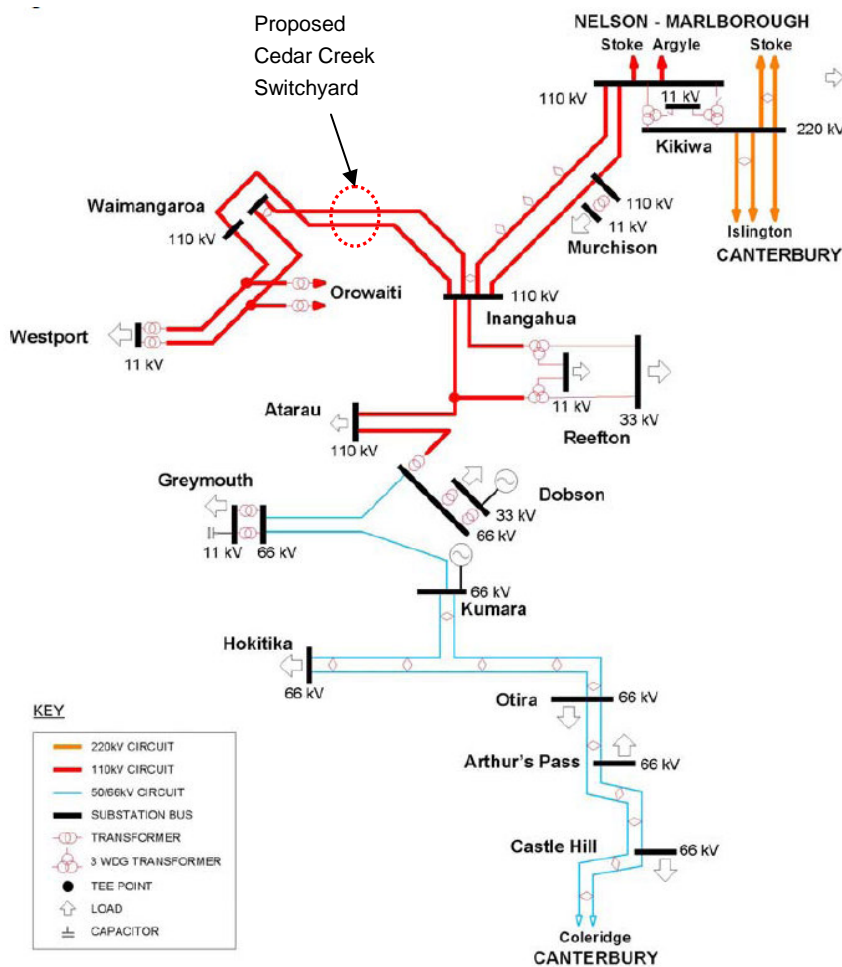
The second attachment to this memo was provided by HDL on 23 July and shows the proposed connection of the Weka Power Station to the SENZ 33 kV line. It is not clear how the HDL reservoir will affect the placement of the proposed Meridian Mokihinui Hydro Proposal transmission poles. In order to avoid any potential issues it may be necessary for a deviation of the MHP line if practical, or taller poles, might be required. However this requires further information and assessment from HDL and HDL has certainly not discussed either of these options with Meridian.

### 3 Potential for Wider Power System to Accept all Three Power Generation Schemes

From the application page 9 *“It is not anticipated that approval of Meridian’s proposed Mokihinui Power station or the Trustpower development of the Arnold River scheme will in any way affect the viability of the Project. Given the anticipated growth in electrical demand of the Nelson region, which is reliant on a significant portion of remote electricity generation, there is a need for generation closer to the demand.”*

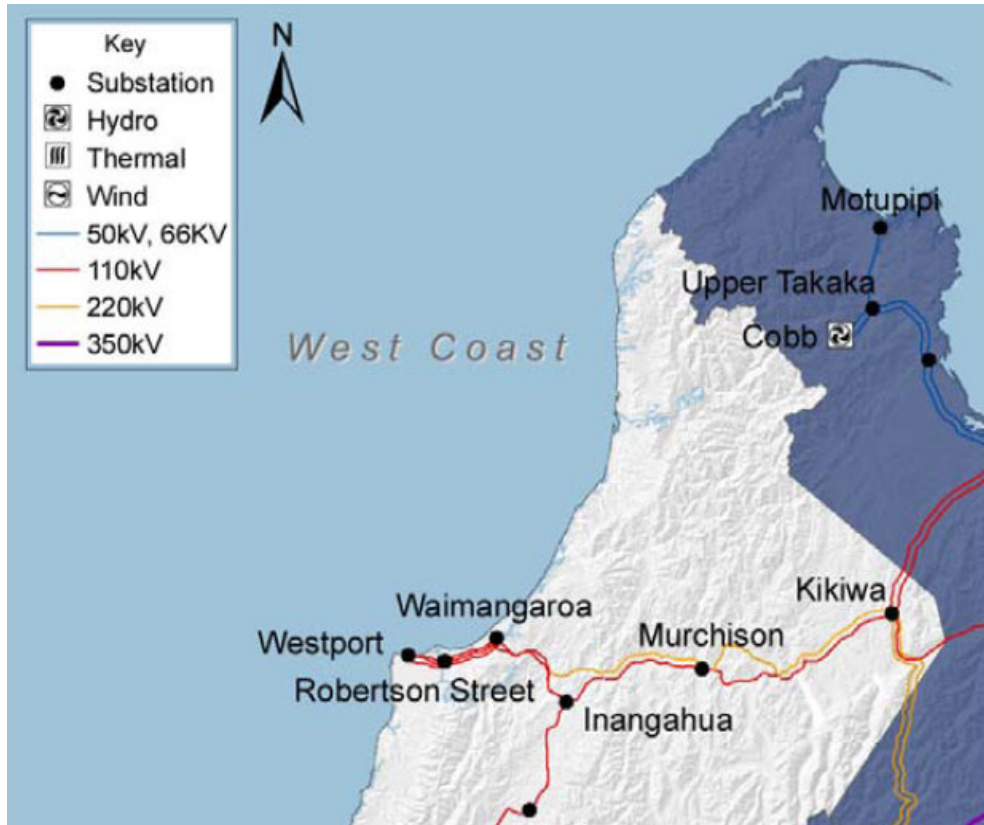
I do not entirely agree with the first sentence but agree with the second. The existing transmission grid with all components in service (as shown by PB Power Ltd studies for Meridian) can manage the Arnold and Mokihinui schemes generation however it is not clear whether it could handle the addition of the HDL scheme (see attachments from PB Power Report). Note that the existing grid will operate close to its limits under some scenarios with both Arnold and MHP operating at full generation as shown in the diagrams in the attachments. No-one has studied the impacts of all three schemes as far as I am aware. I am confident that the existing transmission grid could not handle all three schemes generating at maximum output, and that HDL schemes or other West Coast generation would need to be constrained at times of peak generation availability unless Transpower’s transmission grid is upgraded.

### 4 Potential to Upgrade the Existing Power System to Accept MHP, Arnold and HDL

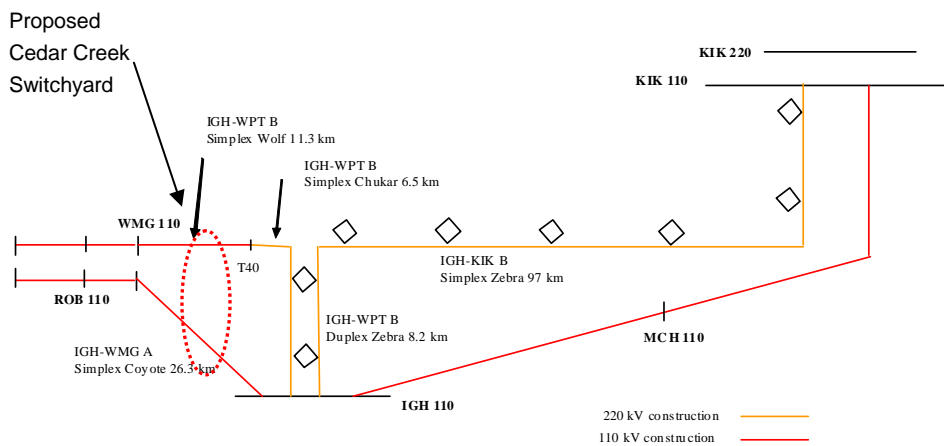


**Figure 2 – Transpower West Coast Transmission Grid**

Figure 2 shows how the transmission grid to the West Coast is **operated**. The majority of the West Coast power supply comes from the Waitaki Valley via 220 kV lines to Kikiwa. There it is converted to 110 kV where it is transmitted to Inangahua via two 110 kV lines. Two 110 kV lines then supply Buller Electricity’s Robertson St (Transpower Orowaiti) substation and Westport. In Figure 4 I have indicated the point where Meridian proposes to connect MHP to the 110kV Transpower grid through a new switchyard called Cedar Creek Switchyard.



**Figure 3 – Transpower West Coast Transmission Grid – Geographical Representation**



#### Figure 4 - Transpower West Coast Transmission Grid – Physical Construction

Figures 3 and 4 show how the transmission grid to the West Coast is **constructed**. One of the lines between Kikiwa and Inangahua and part of the way towards Waimangaroa is constructed for 220 kV operation but operated at 110 kV. This line is currently limited to 76 MVA between Inangahua and Waimangaroa and to approximately 58 MVA between Inangahua and Kikiwa.

There are a number of potential options to upgrade the transmission between Kikiwa and Cedar Creek. Which option Transpower would adopt would need discussion with Transpower and it is not clear whether HDL have initiated these discussions.

One option is to operate the existing Kikiwa to Inangahua to Cedar Creek proposed switchyard at its designed rating of 220 kV. This would increase the rating of the line from 76 MVA to approximately 388 MVA from Cedar Creek to Inangahua and 232 MVA from Inangahua to Kikiwa. This would increase the power export capacity from the West Coast to the Nelson Marlborough region by 100 - 300 MW. The exact improvement in export capability would require power system studies, however my guess would be at least a lift of 150 MW export capability would be provided by this change. This would provide more than enough capacity for the addition of the HDL 50 MW scheme.

This option would require the addition of 220 kV / 110 kV transformers at Cedar Creek switchyard and potentially at Inangahua, as well as new 220 kV equipment at Cedar Creek, Kikiwa and potentially Inangahua substations. The total cost may be in the order of \$15m.

I note that in response to a s92 request HDL replied "*HDL's intention is to embed power into the local network and the company has no desire to pursue connection into the National Grid while the local network has the ability to cater for the power generated by the project.*" The local network that HDL proposes to connect to is supplied by the Transpower Westport and Orowaiti/Robertson St substations. According to the Transpower 2009 Annual Planning Report table 17.3, the Peak Offtake from these substations is projected to grow to 10.1 MW and 11.3 MW. Clearly even at peak load only the base level of HDL generation (25 MW) power will be exported to the national grid. At trough load and peak HDL power output the export from the local network to the national grid will be in the order of 35 MW. It is not apparent that HDL has considered that its power will be exported into Transpower's grid and what the impact will be on the grid.

Note that the existing Kikiwa to Inangahua 110 kV line's towers, constructed for 220 kV, are actually constructed as double circuit 220 kV towers but are only strung with one circuit on one side of the 220 kV towers. Other transmission upgrade options include stringing (adding insulators and conductors) to the unstrung side of this line to provide two 110 kV circuits on it. This would double this line's capacity however a new or replacement line might be needed at least to Cedar Creek from the end of the upgraded line in order to export the additional power. Costs may be of a similar level of magnitude to the 220 kV option i.e. in the order of \$11m

#### 5 Summary

The existing Buller Electricity Network could accept the power from the HDL proposal and export it to the Transpower Robertson St / Orowaiti substation. Some upgrades or replacement of the 33 kV lines from Granity to Robertson St would be required to export the full 50 MW capacity.

The wider power system however could not accept the combined capacity of MHP, Arnold and HDL when all schemes are generating at high levels. Significant upgrades to the transmission system would be required to export the excess generation capacity to the Nelson region, however the upgrades though costly, should have relatively minor environmental effects.

**Attachments**

- 1) Excerpts from PB Power Ltd Report "Mokihinui Hydro Plant Connection Study" 22nd August 2008
- 2) HDL Description of Stockton Plateau Transmission Lines



