

**From:** Dan Twigg

**Sent:** Wednesday, 31 October 2018 4:25 PM

**To:** 'fyi-request-8904-b045d02b@requests.fyi.org.nz' <[fyi-request-8904-b045d02b@requests.fyi.org.nz](mailto:fyi-request-8904-b045d02b@requests.fyi.org.nz)>

**Subject:** Schedule of the nominal capacity of the HVDC link over time from the beginning to the current day.

Nicky, this email is a response to your Official Information Act request received on 18<sup>th</sup> October 2018 (the contents of your request are set out below).

**Part 1 of your request.**

You have asked for detailed outage information and the effect on capacity back to 1965. We do not have such data prior to 1993.

What is provided in the following table are the general maximum ratings through time, as major changes occurred, with approximate dates. Note: this does not include every single time HVDC ratings changed but captures the major changes. You requested "specific dates (not just "in 1965") and specific voltages/currents/capacities"; the table below may not literally meet that description, but we think it may be information sufficient for your purposes. To provide the information of changes on specific dates would require considerable work – the information does not actually exist, but can be calculated – and we would likely impose a charge for its production. Doubtless you will advise me if anything further is required.

Year Range	Pole 1 Technology	Pole 1 Power	Pole 1 Voltage/Current	Pole 2 Technology	Pole 2 Power	Pole 2 Voltage/Current	Pole 3 Technology	Pole 3 Power	Pole 3 Voltage/Current	Bipole Power Limit	Comment
1965-1973	12 pulse Mercury Arc Valve utilising two 6 pulse valve groups in series	300MW North 0MW South	+250kV/1200A North	12 pulse Mercury Arc Valve utilising two 6 pulse valve groups in series	300MW North 0MW South	-250kV/1200A North	-	-	-	600MW North 0MW South	Original HVDC link. Cook Strait Cables 1, 2, 3 installed.
1973-1992	12 pulse Mercury Arc Valve utilising two 6 pulse valve groups in series	300MW North 300MW South	+250kV/1200A North -250kV/1200A South	12 pulse Mercury Arc Valve utilising two 6 pulse valve groups in series	300MW North 300MW South	-250kV/1200A North +250kV/1200A South	-	-	-	600MW North 400MW South*	Southflow controls modification performed.
1992-1996	12 pulse Mercury Arc Valve utilising four 6 pulse valve groups in series/parallel	540MW North 540MW South	+270kV/2000A North -270kV/2000A South (limited to 2000A by transmission line)	12 pulse Thyristor Valve	700MW North 666MW South	-350kV/2000A North +333kV/2000A South	-	-	-	1240MW North 600MW South*	Hybrid HVDC project upgrade. Cook Strait Cables 4, 5, 6 installed.
1996-2007	12 pulse Mercury Arc Valve utilising four 6 pulse valve groups in series/parallel	540MW North 540MW South	+270kV/2000A North -270kV/2000A South (limited to 2000A by transmission line)	12 pulse Thyristor Valve	500MW North 489MW South	-350kV/1430A North +342kV/1430A South (limited by single Cook Strait cable)	-	-	-	1040MW North 600MW South*	Last original Cook Strait cable fails.
2007-2012	12 pulse Mercury Arc Valve utilising two 6 pulse valve groups in series	200MW North 0MW South	+270kV/741A North	12 pulse Thyristor Valve	700MW North 666MW South	-350kV/2000A North +333kV/2000A South	-	-	-	1040MW North 600MW South*	Half of Pole 1 permanently shut down. Remaining half pole made temporarily available for 200MW northflow only.
2012-2013	-	-	-	12 pulse Thyristor Valve	700MW North 666MW South	-350kV/2000A North +333kV/2000A South (limited by single Cook Strait cable)	-	-	-	700MW North 666MW South	Pole 1 permanently shut down.

2013- Present	-	-	-	12 pulse Thyristor Valve	500MW North 489MW South	-350kV/1430A North +342kV/1430A South (limited by single Cook Strait cable)	12 pulse Thyristor Valve	700MW North 700MW South	+350kV/2000A North -350kV/2000A South	1200MW North 850MW South*	Pole 3 project completed.
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\* South power limits are generally determined by AC system constraints, not HVDC system constraints

**Part 2 of your request.**

With regard to your question relating to switching, some background will be helpful. Cable 4 is permanently connected to Pole 2 and Cable 6 permanently connected to Pole 3. Only Cable 5 can be switched between poles. However, Transpower does not have switchgear for this action. To switch Cable 5 requires a piece of buswork to be removed and replaced at each cable station. For practicability reasons this can only be carried out during a bipole outage, something which is undertaken only occasionally.

Assuming your reference to “parity” is in fact to ‘polarity’ we confirm the polarity is switched on each pole/cable whenever a power direction change is required. A 5 minute discharge period is required before the polarity is swapped, to allow the space charge in the Cook Strait cable insulation to dissipate. Changing polarities in a timeframe faster than 5 minutes can damage the cable insulation. Further, the polarity on each pole is the same at Haywards and Benmore – the voltage will just be slightly lower at the receiving end due to voltage drop over the line/cable (which is dependent on current loading).

In the South Island, the Pole 2 conductor is on the westward side of the towers and the Pole 3 conductor is on the eastward side of the towers. In the North Island, the Pole 2 conductor is on the eastward side of the towers and the Pole 3 conductor is on the westward side of the towers.

Section 28 of the Official Information Act provides you a right of review by the Ombudsman (if desired) of any decision by Transpower’s relating to this response to your request.

Yours sincerely

**Dan Twigg**  
 Governance and Administration Manager  
 Transpower New Zealand  
 Waikoukou  
 22 Boulcott Street  
 PO Box 1021  
 Wellington 6011

021 380 123

Dear Transpower New Zealand Limited,

*The link started in 1965 as 300MW via ±250KV and 1,200 amps, for both pole 1 and pole 2. Then there came adjustment to the mercury valves, allowing a different voltage and current capacity (270KV and 2,000 amps, though 1,600 amps was the preferred upper bound), then the introduction of southward power flow (with its own capacity), then operational constraints due to a Cook Strait cable failure, etc. then repairs, then pole 1 was stood down "indefinitely", then it wasn't, then some mercury valves were removed and others replaced by silicon-based thyristors and a new voltage and current capacity allowed except that was not for both poles, and later was (?), and it is all confusing since PR releases reported in the news media are rarely specific, and alas, I haven't kept a folder full of clippings over the years.*

*So, I am requesting a schedule of the nominal capacities as they varied over time, both for pole 1 and pole 2, both northwards and southwards, and regarding "pole 3" as being the new name for pole 1. This would be with specific dates (not just "in 1965") and specific voltages/currents/capacities, made more complex by changes to the capacity of the undersea cables and the use of the "ground return" should one pole (which?) be unavailable for an extended period. Planned outages for maintenance, etc. would be included, but not half-hourly data on actual usage. This is for nominal capacities as the link's abilities are changed from time to time.*

*To reduce puzzlement, is it the case that the switches selecting a Cook Strait cable for pole 1 and for pole 2 at each end of the undersea cables are used always to maintain parity over the whole link, or can the parity be swapped? That is, suppose one faces north from Benmore and finds pole 1 on the left of the power pylons and pole 2 on the right (which is it?), will this parity be the same on arrival at Haywards? This is particularly relevant when the poles are operated at different voltages.*

Yours faithfully,

Nicky McLean