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19 June 2025

Transpower NZ Ltd (as Grid Owner)
By email: grid.investments@transpower.co.nz

System Operator feedback on Transpower's consultation paper "HVDC Link Upgrade Programme: Major Capex Proposal short-list consultation"

Transpower in its role as System Operator welcomes the opportunity to respond to the Grid Owner's consultation on the HVDC Link Upgrade Programme Major Capex Proposal short-list.

With the intertwined nature of the HVDC control system, elements of the electricity market design, and operational practices it is clear there is a benefit to Aotearoa New Zealand from a close working relationship between the HVDC project team and System Operator function. We look forward to the part we will play in delivering those benefits for Aotearoa New Zealand.

The System Operator's responses to the consultation questions are:

Q1. Are there any additional factors we should consider regarding our identified investment need?

No.

Q2. Do you have any additional information that could materially affect our electricity demand forecast or generation assumptions?

No.

Q3. Do you agree with our application of short-listing criteria to reduce the long list of options into a short list?

Yes. We note criteria 5 "provides system security" could have explicitly included reference to enabling wholesale electricity market functionality. We believe this is implicit in the comment "Has benefits for system operation (e.g., controllability)". As noted in our

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response to question 4, the System Operator believes it is important to the success of the HVDC upgrade project for close collaboration between the System Operator and Grid Owner HVDC upgrade project team to occur to deliver the best possible outcomes for Aotearoa New Zealand.

Reflecting lessons learned from the Pole 3 project it would be beneficial for the System Operator to provide input to the HVDC project team on control system features specific to market and system operation before completion of the requirements phase of the project. We note the, understandable, difficulties experienced in the Pole 3 project trying to modify the HVDC control systems from the specifications contained in the tender documents. Our recommendation of enabling System Operator input at an earlier stage in the HVDC upgrade project is designed to mitigate this issue.

Q4. Do you agree that we should be incorporating other related HVDC projects due at the same time with the cable replacement?

Yes. The System Operator agrees there are benefits to upgrading the HVDC control systems concurrently with the cable replacement. We note the Grid Owner should plan the HVDC outages to be at a time of year which is less likely to be impacted by operational conditions and should include some contingency in its planning to allow for the possibility some outages may not be able to proceed as planned due to operational conditions. Ideally the Grid Owner would plan these outages with a minimum lead time of 2 years. The longer than normal lead time is required to ensure the market can co-ordinate generation outages, fuel stocks, and generation patterns around such material outages. The System Operator's outage coordination and assessment engineers and the Grid Owner's HVDC project team should work closely to optimally plan the required HVDC outages.

Further, the System Operator notes there are risks associated with the proposed approach. The risk of a related HVDC project, or the cable replacement project itself, delaying the return to service of the HVDC must be managed to minimise this possibility. We acknowledge this risk is largely inescapable because of the need to align either the new control system with the old cables, or the old control system with the new cables.

The System Operator and the Grid Owner's HVDC project team need to work closely together to ensure the new HVDC control system enables existing and any known future operational and electricity market design needs. For instance, the HVDC's roundpower and frequency keeping control (FKC) modes enable instantaneous reserve sharing between the North Island and South Island. Potential future market initiatives which could be delivered before completion of the HVDC upgrade project include the Electricity Authority signalling the existing multiple frequency keeping arrangement will be repurposed as an intra-dispatch

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intermittent generation balancing product. The exact implementation of this change is not yet known but if a national market is proposed this will be contingent on the capability of the HVDC.

A lesson we learnt from the Pole 3 project is the benefit of close working relationships between the System Operator and the Grid Owner's HVDC project team during the requirements gathering, design, and tender phases of the Grid Owner's project. As noted in our answer to question 3, once these project phases are complete it is much more difficult to change the HVDC control system to reflect market and operational requirements. The examples in the previous paragraph illustrate this point.

Q5. Do you agree with the options we've shortlisted?

Yes.

Q6. Do you consider our proposed weighting of the scenarios to be appropriate?

No comment.

Q7. Do you consider our use of a 30-year calculation period and a standard discount rate of 5% to be appropriate?

No comment.

Q8. Do you have any feedback on our analysis of the quantified costs and benefits for this project?

As mentioned in our response to Q4, the realisation of several benefits of the HVDC are materialised through the System Operator's modelling of the asset and operational tools which reflect the assets capability. Provision to ensure the full benefits of the HVDC upgrade project are realised should be included in the Grid Owner's project planning.

In our 23 August 2024 submission[1] to Transpower's discussion paper "Cook Strait HVDC Submarine Cable Replacement and Enhancement" we noted:

[1] SO feedback to GO HVDC paper 23Aug2024.pdf

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> *Over frequency reserve (OFR) is procured by the system operator to manage over-frequency on the system following an instantaneous loss of a large industrial load or the HVDC.*
>
> *The system operator procures OFR on a 'firm quantity procurement' basis (tender). Costs for OFR procurement are allocated to the HVDC owner.*
>
> *A lack of over-frequency reserve (OFR) in the sending island can limit HVDC transfers. Increasing the potential maximum HVDC transfer from 1,200MW to 1,400MW will also increase the amount of OFR required to be procured to enable increased HVDC transfers. As system operator we have not undertaken an investigation into the implications of increased OFR procurement.*

And

> *Total bi-pole transfer is treated as an extended contingent event (ECE) risk*[2] *by the system operator. ECE risks are covered by the Automatic Under-Frequency Load Shedding (AUFLS) scheme. Increasing the potential ECE risk from 1,200MW to 1,400MW increases the potential maximum ECE. Consequently, the impact of this on the AUFLS scheme and the system operator's tools will need to be assessed.*

No allowance appears to have been made for increased OFR costs or investigations into the impacts a higher HVDC transfer could have on AUFLS in the cost benefit analysis undertaken. The System Operator does not believe this omission to be material.

Further, no allowance appears to have been made for any System Operator costs arising from changes to tools, such as may be incurred, to model and operationalise the upgraded HVDC equipment. The magnitude of these costs will not change the conclusion, because they will be significantly less than the $83.4 million additional net market benefit Option 3 will deliver over Option 2. However, it is important to note that some System Operator costs will almost certainly exist, will need to be funded, and will need to be factored into the project plan.

Additionally, we note that no allowance has been made for the costs likely to be incurred by the Grid Owner commissioning the upgraded HVDC 'in the market'. To commission Pole 3 the Grid Owner undertook a suite of activities, including standing up a trading function to

[2] Credible Event Review - Scope Dec 2024 (transpower.co.nz) pg 7

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engage with market participants to enable the required commissioning activities to be completed. However, we note the costs which will be incurred by Option 2 or Option 3 commissioning activities are likely to be broadly similar. Meaning it is unlikely to impact the Grid Owner's analysis.

Q9. Is our conclusion, that Option 3 (replacing the cables with 1400 MW capacity) offers the greatest net benefit, reasonable?

Yes.

Q10. Are there any additional sensitivities that we should test?

No.

We look forward to engaging with the Grid Owner's process and supporting it to deliver optimal outcomes for electricity consumers across Aotearoa New Zealand.

Yours sincerely,

PP

Rebecca Osborne
Head of Market Services
Transpower NZ Ltd (as system operator)