Commerce Commission
P O Box 2351
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For the Attention of: Kade Sheely

18th December 2017

Dear Kade

Assessment of Wellington Electricity CPP readiness expenditure

The Commerce Commission (Commission) has asked Strata Energy Consulting (Strata) to review Wellington Electricity's proposed earthquake readiness/resilience related expenditure proposed as part of its CPP application. This paper provides Strata's findings and recommendations from its review.

Strata reviewed Wellington Electricity's CPP proposal document[1], business case[2] and other relevant documents provided to Strata by the Commission. Strata provided a summary of issues identified in its review of the documents. On 13th December 2017 Strata met with Wellington Electricity to discuss the identified issues. Following the meeting Wellington Electricity provided additional information to Strata. We have taken the discussions and additional information into consideration in finalising our opinions and recommendations.

The following table sets out the issues and questions that Strata Energy Consulting identified in its review. The table also includes further information and explanations provided by Wellington Electricity and Strata's recommendations to the Commission.

[1] Main-proposal-Wellington-Electricity-5-December-2017
[2] Earthquake Readiness Business Case -December 2017_CC171129

Establishing a view of Wellington Electricity's BAU capex

Location	Extract	Issue	Comment
Main proposal 1.4	The first step in this process is to seek regulatory approval for the additional readiness funding required in the short term to improve response and restoration times following a major earthquake. Extract from the draft proposal (page 3): Longer term resiliency planning continues in parallel as part of the Wellington Lifelines programme3 and any investments that arise out of that planning will be the subject of future funding applications which are outside the scope of this business case.	CPP benefits may be doubled up with future resilience projects	It is important for the Commission to consider that the scope of the CPP application covers only short-term actions. Wellington Electricity are signalling that longer-term resilience measures may be subject to further CPP applications – the relationship between the current and potential future CPP applications for improved resilience, is unclear. For example, there may be an overlap of the benefits claimed for both proposals. The benefits for the current CPP under consideration can only be delivered if electricity supply is available from the transmission connection substations, such as Central Park. A future CPP may claim the same benefits to support investment in improving the resilience of transmission connection and offtake arrangements. Wellington Electricity discussed this issue at the 13th December meeting. Wellington Electricity demonstrated that it had given some consideration to the interaction of the current and future projects. The issue concerns the scenarios that each programme is seeking to address. The current CPP application will not deliver any benefits if transmission substations are unavailable to supply electricity, therefore the quantification of the benefits should consider this potential limitation. Wellington Electricity told us that it has done this by avoiding reliance on the full unquantified benefits for the current CPP as these would be credited to the future projects. The Business Case is based on a 7.5 magnitude earthquake on the Wellington fault. Wellington Electricity has also assumed that, under this scenario the *transmission network will remain*

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			largely intact, or at least be able to be restored quicker than our distribution network, we have assumed supply from their GXPs continues to be available under the earthquake scenario.[3] <u>Strata's conclusion</u> 1. The choice of scenario for the business case is reasonable given that it aligns with the Lifelines study. 2. The assumption that transmission will remain available, or be swiftly restored is reasonable given the information Wellington Electricity has sourced from Transpower. 3. The benefits calculated for the current application do not rely on the delivery of future projects. Strata considers that there is no reason for the Commission to decline or adjust the CPP application on the basis of this issue.
Main Proposal 3.2	The proposal to seismically strengthen our substation buildings is primarily driven by an impending change to our seismic building standard to bring all zone substation and important buildings up to 67% of NBS. This standard is consistent with peer utilities. Learning from Orion's experience after the 2010/2011 earthquake sequence led us to consider a	Basis for using 67% of the standard	Explanation of why Wellington Electricity decided the standard was changed and how the 67% value was determined. Is 67% the optimum value or would a lower value deliver almost the same benefits - do we see this analysis anywhere? Note that Wellington Electricity says that the 67% is consistent with peer utilities – yet it is managing this within the DPP. The reasons why Wellington Electricity is different from its peers in requiring additional revenue to meet the 67% is needed. Jacobs noted that [4] *Transpower strengthen their buildings to 75% whereas WELL go to 34%. They also try to take their*

[3] Business Case Page 10

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	further increase in strengthening standards for earthquake-risk buildings to 67% of the NBS. Our current programme addresses "earthquake prone" buildings (ie: <34% NBS), and we plan to extend that programme to strengthen all significant substation buildings.		*essential buildings to 100% where reasonable.* So where did Wellington Electricity 67% come from? Ninety one buildings have been prioritised as critical using a combination of: • equipment failure's impact on network criticality: tie point between zone substations, first sub out from a zone substation or forms critical node in the network; • connected load and critical consumers: high load substation that would be difficult to back feed, feeds critical consumers e.g. pump station, hospital, phone exchange; and • public and worker safety: substation is on a major or busy road/pedestrian access way, close to parks/schools, feeding a busy/congested public area. Wellington Electricity, as Orion did, has chosen 67% of the building standard as this takes the buildings out of the earthquake risk band. This decision is supported by reference to Orion's experience with substations at this level. <u>Strata's conclusion</u> The choice of 67% appears quite arbitrary and could be fine-tuned to reflect a risk based approach, as Transpower appears to have done. However, given the commonality of the substation structures and the experience in Christchurch, setting an objective of taking the buildings over the EQ risk threshold is reasonable. Strata considers that the there is no reason for the Commission

[4] Jacobs-letter-WE-earthquake-readiness-independent-review-27-Oct-2017

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			to decline or adjust the CPP application based on this issue.
Business Case 5	Planning is for bringing additional critical spares into the region in acknowledgement of transport links to access spares being unavailable.	Spares not specifically for Wellington	The Business Case assumes that the benefits delivered by spares are calculated on the assumption that they will be for the sole use of Wellington electricity. In discussions with Wellington Electricity we have identified that the spares could be used for emergencies in other regions. If this assumption is correct, the benefits apply to a wider area than the Wellington region, and could therefore be greater. Does this also mean that the costs should be shared by others? In other words, are the store of emergency spares, and perhaps the mobile generators and substations shared resources? <u>Strata's conclusion</u> In times of emergency, electricity distributors actively provide resources and support to assist their peers. Whilst some of the initiatives in the CPP application could be used to support other regions, the predominant value is to the Wellington Region. Strata considers that there is no reason for the Commission to decline or adjust the CPP application based on this issue.
Main proposal 2.1	While much of this loss can be attributed to asset damage, the duration of outage is increased by Wellington being cut off from the rest of the country by severed transport links. This would make restoration efforts very difficult and	Restoration benefits may be overstated	The business case benefits are predominately due to reduced supply restoration times. If the access risk is to some extent mitigated by the new highways, the restoration time benefits are likely to be significantly reduced. Wellington Electricity should take this into account in the CBA. Wellington Electricity provided the following explanation to

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	exacerbate what would already be a desperate situation for many of the most vulnerable members of our society. A delay in the restoration of the initial 60% of electricity without		address this issue: *Transport assumptions are discussed in a number of places including section 2.10 of the business case* *"Transport between these islands would be compromised and transport into the region is severely restricted. The Hutt Valley is the worst impacted with transport links into this area expected to be out of service for up to 12 weeks. These estimates were sourced from the most recent Lifelines draft study into the impact on transport routes.*
Business case 2.2	supply is valued at around $110 million a day (section 3.2) In March 2013, Wellington Lifelines published results of this impact as modelled by Opus.9 It concluded that the region could be split into seven 'Islands' that will have no road access between them for an extended period (months rather		*The latest study is yet to be published, though WELL has had access to draft findings".* *The latest study, yet to be published, includes the completion of Transmission Gully. This was also assumed for our analysis. (Note refer figure 2 of the business case reflects the earlier OPUS report).*
Business case 2.8.1	than weeks), with some roads into the region being closed for up to four months. In March 2013, an Opus report11. noted: • the region may become isolated by normal road access for up to 120 days. This is due to likely landslips on State Highway 1 from Paekakariki to Pukerua Bay; the Paekakariki Hill Road; the Akatarawa Road,		*For the purpose of our analysis, we assumed the Petone to Grenada link road is not complete. This is mainly because of the uncertainty whether this project will proceed at all, and the long construction time (5-10 years) which reduces the impact of the project on the NPV analysis. The recent 15th December Dominion Post article supports this view of project uncertainty and also raises concerns over the resiliency of the planned route.* <u>Strata's conclusion</u> Wellington Electricity use of the unpublished update of the Lifelines study for the Business Case is appropriate. The inclusion of Transmission Gully when calculating the benefits of

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	and State Highway 2 over the Rimutaka Hill. • in addition to isolation, the region may become fragmented due to landslips on the Haywards Hill section of State Highway 58 and the Horokiwi area of State Highway 2, in addition to other regional fragmentation.		the proposed projects is also appropriate and satisfies Strata's issue relating to the Western Coast. Given the uncertainty of other roadway projects, Strata considers that it is appropriate to exclude them from the benefits calculations. Strata considers that Wellington Electricity provides a satisfactory explanation to address this issue.
Business Case 3.1.1	The Electricity Authority has defined the value of any expected unserved energy to be $20,000/ MWh17. This figure was originally set in 2004, so for the purposes of this business case it has been inflated to $28,278/ MWh assuming the average inflation rate of 2.7% pa.	Use of VoLL may be overstating the benefits	Strata questioned the use of VoLL for disaster situations. Is it appropriate to use the pre-earthquake MWh as the load that is lost? The Electricity Authority undertook a review of the VoLL in 2012, this included a survey approach which demonstrated a broad range for VoLL across customer categories. In a disaster situation, the value of electricity for basic essential services in likely to be very high but the value for discretionary uses such as entertainment may be near zero. Wellington Electricity provided the following additional information: *We recognised the inherent uncertainty associated with using a single figure VoLL in the business case – excerpt from section 3.1.1:* *"We consider this value to be a fairly narrow proxy for the total cost of supply interruptions. For instance, it does not capture the variability between types of loads, or the changes in value*

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			attributed to electricity supply interruptions for extended durations. Nor can it capture the wider societal and economic impacts that an event such as a major earthquake could have on the Wellington region. However, it provides us with a useful tool to measure the relativity of options and provides assurance that we are investing in the right solutions to improve our ability to respond." *In addition, we included the results of sensitivity analysis on the VoLL which used upper and lower bound values of $45,000/ MWh and $15,000/ MWh respectively. As noted in section business case – section 3.3.9:* *"we are of the view that it is highly unlikely that the value of unserved energy would fall as low as $15,000/ MWh in the Wellington region."* *This sensitivity analysis showed that the proposed investments were largely economic under the lowest value in all cases with the exception of the mobile substation options.* *As stated clearly in the business case, we recognise that the codified figure of $20,000/ MWh, inflated for CPI to $28,278/ MWh is a narrow proxy for the total cost of supply interruptions. It is for that reasons that we sensitised the results against a range of values and this range is well within the very wide publicly documented ranges.* <u>Strata's conclusion</u> We accept that Wellington Electricity had to use an economic value in its quantified benefits calculation. In the absence of any sources of post-earthquake VoLL the only option is to use, as Wellington Electricity has done, the Electricity Authority's value with a range of values for sensitivity testing.

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			Wellington Electricity NVP analysis includes the following assumptions: • that there is a need to restore full load to the area; • earthquake return period of 1 in 300 years; and • a VoLL of $28,278 per MWhr (with sensitivities of $15,000 and $45,000 per MWhr). Wellington Electricity NPV analysis includes the following assumptions: It is likely that, following an earthquake, the value of restoring full pre-earthquake capacity ($/MW) might be quite different to restoring say half pre-earthquake capacity. This is because the first half of capacity will include more essential and critical uses of electricity supply. Wellington Electricity provided the following assessment of the unquantified benefits from swifter restoration of supply: *Whilst we did not specifically articulate the full range of unquantified benefits, both the Proposal and the Business Case were framed within this wider context. For example, section 2.1.2 of the Proposal and section 2.5 of the Business Case discussed the wider economic impacts including reference to the BERL report which cited a permanent loss of GDP in the region of $30-$40 billion*. *Discussions with stakeholders and the subsequent letters of support clearly demonstrate that the wider social and economic benefits are well understood by our community and business leaders.*

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			For clarity, we include the full list of unquantified benefits that we consider make up the additional benefit to that represented by the value of unserved energy, and that were referred in different places throughout the proposal and business case. In summary, these include: • Non Quantifiable Benefits not captured by value of unserved energy; • Emergency services – maintaining supply, or earlier restoration of supply, to emergency services (such as the hospitals in the region) will enable those services to assist people in need - hampered to the least extent manageable by power outages; • Quality of life– water, heat, lighting, cooking, sewerage; transport, communications. It is likely that, following a major earthquake, many people will need to recover, and await assistance and replenishment of supplies, in their homes. Maintaining supply, or earlier restoration of supply, improves living and recovery conditions; • Social stability – safety, isolation, stress; • Business continuation; • Government and associated departments continuation; • Population growth or mitigating population loss; • Investor confidence; • Permanent GDP loss - $30-$40 billion; and • Intention to share the spare equipment with other EDBs for use in disaster events that reduce their ability to restore power supply to their customers – this provides wider risk reduction benefits.

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			<u>Strata's conclusion</u> Strata considers that, whilst in its opinion, sensitivity testing and calculation of quantifiable benefits could be refined and improved, the unquantified benefits will be significantly high enough to provide the justification to support the investment. Strata considers that it is the unquantified benefits that are the primary driver of resilience investment for catastrophic earthquake events. As Wellington Electricity list of unquantified benefits shows, these benefits will be sufficiently substantial to justify the proposed investments. Strata considers that the there is no reason for the Commission to decline or adjust the CPP application based on this issue.
Business Case 3.1.1	For the purposes of this analysis, we have used an estimate of the avoided unserved energy (outage duration multiplied by lost load) and valued that at a pre-determined "value of unserved energy."	Value of load is likely to have been overstated	Wellington Electricity has used the pre-earthquake loadings multiplied by the VoLL to calculate the benefits of faster restoration. The post-earthquake loadings will be significantly lower than the pre-earthquake loading. This is because the earthquake damage will have eliminated a large proportion of economic activity. A return to pre-earthquake loadings could take many months or even years to achieve. In response to our questions on this point Wellington Electricity provided the following response: *Orion restored the vast majority of the people who needed to be connected within 2 weeks of the 22nd February 2011*

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			earthquake (a magnitude 6.3 event). There was an approximate 10% long term reduction in energy usage from the earthquake – refer Orion 2017 AMP figure 5-4d. This means this load effectively disappeared over the long term (although load is now approaching pre earthquake levels due to growth in areas outside the CBD where commercial and residential load have relocated to). At a high level, approximately 80% of this 10% long term reduction was attributable to the Christchurch CBD, with the remainder in the red zoned eastern suburbs. People still lived in these red zone suburbs initially and wanted the power to be restored. "Approximately 50% of the 6000 red zone connections remained active immediately following the earthquake". The value of load disappearing in the red zone suburbs is relatively small (less than 20% of 10% of the Orion load). It was noted that commercial business load in Christchurch relocated to the suburbs outside the red zoned CBD. *It will take longer to restore load in Wellington due to topology and road access issues, hence the clear driver to hold more spare equipment. There is no guarantee the Wellington CBD will be red zoned for a number of reasons (including limited space to move the CBD and the need to provide access to the South and East of the city). It is difficult to forecast red zoned areas especially with a number of a fault lines running through the region. Strata's question relates specifically to the mobile substation and switchboard in Lower Hutt. Based on the Orion experience and assuming the Lower Hutt and Petone area is not red zoned, our view is the long term reduction is likely to be small and will have minimal impact on the NPV analysis.*

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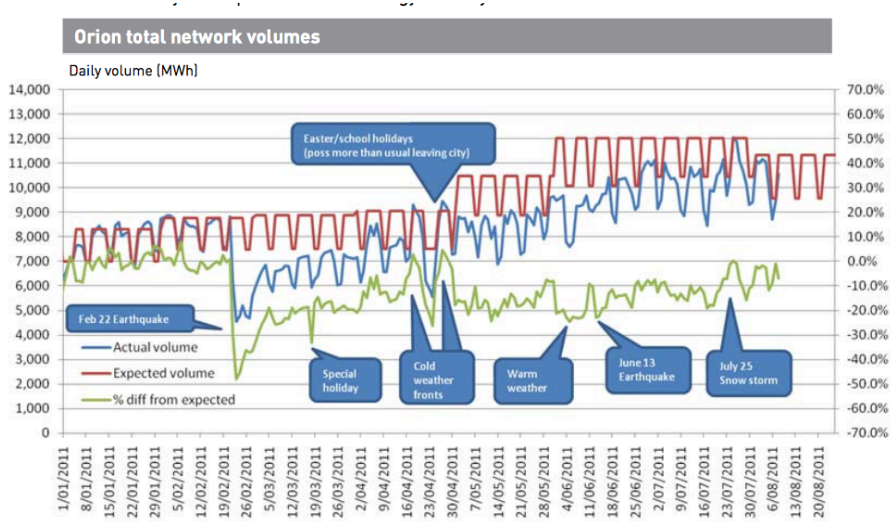
			The chart below shows the effect of the Christchurch earthquake on the network's load.  Source: Orion 2012 AMP The post-earthquake loading appears to be around 20% of pre-quake levels for three to four months. <u>Strata's conclusion</u> For a major earthquake in Wellington, the post-earthquake demand could be much lower than was the case in Christchurch given the vulnerability of CBD and industrial areas indicated in the Lifelines report for the region. The potential high level of evacuation and damage to residential properties could also impact on electricity demand. If this is the case, the calculated benefits of all the options other than the 'do nothing' option would be much lower.

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			The sensitivity of the NPVs could have been tested against a range of post earthquake demand values to provide additional sensitivity analysis. However, in Strata's opinion, the non-quantified benefits will, on their own, be sufficient to support the investment and therefore there is no reason for the Commission to decline the proposed investment for a potential over estimation of the quantified benefits.
3.4	There are delivery risks in the seismic strengthening programme as completing the required work on 91 buildings over a three-year period is a significant step up in delivery. We are preparing for this change by: • ensuring we have design and construction capacity available ahead of approval; • grouping buildings into similar construction and age categories so that we can develop standard designs for the strengthening work; and • working with all councils to streamline the consenting	Deliverability	Wellington Electricity has identified delivery risks for completion of the 91 building reinforcement projects. The Jacob's review of options and costs appears not to have included an assessment of the deliverability of the preferred options. This is a key assessment for the verifier to perform and provide advice on. The absence of this assessment for the substation reinforcement and data centre expenditure is a concern. It would have been valuable if Jacobs had undertaken a deliverability assessment. – Can this be done? <u>Strata's conclusion</u> Strata considers that there are risks that the full 91 building reinforcement projects will not be completed in the proposed timeframes. Strata does accept that Wellington Electricity is and will continue to make every effort to ensure that the programme will be delivered on time. Strata recommends that, for a major earthquake resilience investments, the Commission stipulates the 'non-substitutability"

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	process. The forecast of expenditure was based on our assessment of delivery resource capacity and availability over the next three years.		so that any underspend against these projects could not be used for other work.
Business Case 3.6.1	Each data centre will have back up generation (500 kVA) which has already been purchased so is not included in these costs.	Data centre generators	If Wellington Electricity has already purchased the generators for the data centres, this suggests that it was intending to invest in the data centres under its DPP. The Commission needs to be certain that this was not the case. We recommend asking Wellington Electricity for the business case and expenditure approval documentation for the purchase of the three generators. Jacobs[5] questioned *whether WELL had considered portable standby generators for each of the data centres. WELL noted that they have four already and two would be deployed at the data centres.* This suggests that Wellington Electricity may be relocating its existing generators to the Data Centres and that these were not purchased specifically for this purpose. This was confirmed with Wellington Electricity and the following response was provided. *After the Kaikoura earthquake, Wellington Electricity purchased 5 x 500kVA and1 x 350 KVA generators from Orion as a risk mitigation. This was an opportunity initiated by Orion who had surplus plant and we entered the purchase agreement which has*

[5] Jacobs-letter-WE-earthquake-readiness-independent-review-27-Oct-2017 Section 2.5.1

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			a strong mutual aid focus to share generation between the businesses should the need arise for more sets. This provides a degree of redundancy and diversity for this resource between the two businesses. It also outlines the close working relationship we have established from our dealings on discussing readiness issues. One generator has been already used as a backup generator for our Control Room in our Petone offices and the others were purchased to deploy in outage situations. These purchases were not linked to the data centres at the time of purchase. <u>Strata's conclusion</u> We consider that Wellington Electricity has provided a clear explanation that satisfies our question regarding the purchase of the generators.

Concluding comments

Thank you for the opportunity to undertake this assessment of Wellington Electricity's CPP application. Please contact me if you require any additional information.

Regards

Bill Heaps
Managing Director
Strata Energy Consulting Limited