20 August 2024

Electricity Authority
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Submitted via email to fsr@ea.govt.nz

Consultation Paper – Addressing larger voltage deviations and network performance issues in New Zealand's power system

Introduction

1. Thank you for the opportunity to submit on the consultation paper 'Addressing larger voltage deviations and network performance issues in New Zealand's power system'.[1] This submission is not confidential and can be publicly disclosed.
2. Orion owns and operates the electricity distribution infrastructure in Central Canterbury, including Ōtautahi Christchurch city and Selwyn District. Our network is both rural and urban and extends over 8,000 square kilometers from the Waimakariri River in the north to the Rakaia River in the south; from the Canterbury coast to Arthur's Pass. We deliver electricity to more than 225,000 homes and businesses and are New Zealand's third largest Electricity Distribution Business (EDB).

Orion summary points

3. We have reviewed the consultation paper, and our specific responses to the 18 questions posed by the Authority as well as other feedback we consider appropriate to the consultation are set out in Appendix A.
4. We are committed to working collaboratively with the Authority and other industry stakeholders to develop a robust, flexible, and future-proof framework for voltage management that supports innovation while maintaining network stability and reliability.

Concluding remarks

5. Thank you for the opportunity to provide feedback on this consultation.
6. If you have any questions or queries on aspects of this submission which you would like to discuss, please contact us on 03 363 9898.

Yours sincerely,

Connor Reich

Regulatory Lead – Electricity Authority

[1] https://www.ea.govt.nz/documents/5152/Paper_2-_Addressing_larger_voltage_deviations_in_New_Zealands_power_system.pdf

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Appendix A

Submitter	Orion New Zealand Limited ("Orion")

Questions	Comments
Q1. Do you consider it likely that distributors will, in the absence of a Code requirement, place voltage support obligations on some or all generating stations and energy storage systems (when discharging) that connect to their networks? **Please give reasons for your answer**	Yes, we believe that distributors are likely to place voltage support obligations on generators and energy storage systems (when discharging), particularly those 5MW and above. While to-date, Orion has taken a hands-off approach to ensuring compliance with fault ride-through and voltage support, we intend to implement such obligations in the future. Our Network Code already requires high voltage installation owners to coordinate with us regarding connection, operation, and modification of their installations. For new connections in the future, we would continue to impose restrictions and require compliance with AS/NZS 4777 for smaller connections; for larger connections, as noted above, we require feasibility studies and request that generators share their controller settings. However, we have concerns about the practicality and fairness of implementing these obligations, as placing voltage support obligations on existing distributed generation would be challenging and potentially expensive, necessitating a scheme to compensate generators for the additional costs. There's also uncertainty regarding when voltage support would be required – during peak times, non-peak times, or both.

Q2. Do you agree generating stations and energy storage systems connected to local distribution networks at the GXP voltage (which varies by local distribution network) should be required to support voltage, or do you consider the obligation should be placed on generating stations and energy storage systems connected at a uniform voltage (eg, 33kV)? **Please give reasons for your answer.**	We agree that generating stations and energy storage systems should be required to support voltage, but we believe the obligation should be based on the point-of-common coupling voltage, which is likely to be at the GXP level, rather than the connection voltage level. The point-of-connection voltage often depends on transformer ownership, which can lead to inconsistencies in voltage support obligations. For example, on our network, the connection at one location is at 33kV because we own the 66/33kV transformer. However, the voltage we're concerned with is 66kV, as these are dedicated transformers. At another location, where the customer owns the 66/33kV transformer, the connection is effectively at 66kV. This distinction is crucial because it affects how voltage can be controlled and regulated. Generators connected at 66kV can directly manipulate voltages at that level, while those connected at 33kV may have limited ability to regulate the 66kV voltage. This raises important questions about voltage control versus VAr Dispatch Schedule System, and who should bear the responsibility and costs for maintaining uniform voltage. Orion's view is that if uniform voltage support is required across the network, there should be a clear mechanism for compensation, as the primary value accrues to Transpower. If Transpower wishes to opt out of this responsibility, it's important to understand why and determine who should bear the associated costs. This issue highlights the need for a more comprehensive discussion about the allocation of responsibilities and costs in maintaining voltage stability across the network. Any solution should consider the varied nature of local distribution networks and ensure that voltage support obligations are placed where they can be most effective and efficient.
Q3. Do you consider there should be a capacity threshold (eg, a nominal net export or nameplate capacity of 5MW or 10MW) for generating stations and energy storage systems connected to local distribution networks to support voltage?	While we agree that a capacity threshold should exist, we believe it should be relative to each distribution network, rather than a fixed value. Specifying a minimum number may not accurately reflect the impact on our network and could lead to unintended consequences. For instance, new generators might install just below the minimum capacity to avoid regulations.

Please give reasons for your answer, including any implications of having / not having a capacity threshold.	We propose that everyone connecting at certain voltage levels (e.g., 11, 33, 66kV) should be required to support voltage, regardless of capacity. This aligns with our response to Option 3 (Q14) – we should avoid implementing unwieldy limits. Drawing parallels with the Authority's consultation on Option 3 and the proposed revision to the 30MW threshold, we believe taking a wide-net approach to what is included would make the regulations more future-proof. This approach would prevent us from repeating past mistakes of implementing minimum numbers that later require revision to the Code.
Q4. What do you consider to be the pros and cons of requiring generating stations / energy storage systems connected to local distribution networks to have a reactive power range of ±33% rather than the +50%/-33% range specified in clause 8.23 of the Code?	The proposed ±33% reactive power range is generally reasonable and achievable, based on our conversations with solar developers.
Q5. Do you agree the Authority should be short listing the first voltage-related option to help address Issues 2 and 3? **If you disagree, please explain why.**	Yes, we agree that the Authority should shortlist the first voltage-related option to address Issues 2 and 3. While we support placing voltage support obligations on generators, particularly those 5MW and above, we have concerns about the practicality and fairness of implementing these obligations on existing distributed generation. The varied nature of local distribution networks and the need for a comprehensive approach to voltage support that doesn't rely solely on fixed capacity thresholds should also be considered.
Q6. What do you consider to be the main benefits and costs associated with the first voltage-related option?	No comment.

Q7. Under the first voltage-related option, what costs are likely to arise for the owners of distributed generation, embedded generating stations, and energy storage systems with a point of connection to the local distribution network?	While we don't have specific cost estimates, we anticipate that owners of existing distributed generation, embedded generating stations, and energy storage systems could face significant costs if required to retrofit their systems to meet new voltage support obligations.
Q8. Under the first voltage-related option, what costs are likely to arise for the owners of energy storage systems with a point of connection to the transmission network?	No comment.
Q9. Do you agree the Authority should be short listing the second voltage-related option to help address Issues 2 and 3? **If you disagree, please explain why**	Yes, we agree that the Authority should shortlist the second voltage-related option, but we have several concerns about its implementation: • We question how this option would be implemented in practice, as it adds complexity to the process. • Our preference is for the System Operator to engage distributed generators to provide GXP voltage support. Distributed generators on our network are generally close to a GXP and can provide support. • If implemented as written, this option would require distributors to control, manage, and set power quality limits in our networks. We would intend to leverage the EEA Power Quality Guidelines to assist with this. • We agree with the cons set out by the Authority; implementing this option would require capabilities (processes, tools, and methods) that could be difficult for distributors to obtain and would be inefficient to duplicate across all distributors. This could be an argument for implementing a Distribution System Operator (DSO) function to assist EDBs with replicating the traditional System Operator function.

	• We question how the amendment to Part 8, requiring the System Operator and distributors to coordinate reactive power flows at GXPs in either direction, would function in practice. This would require dynamic operating envelopes and could have implications on whether a DSO would be needed to bid reactive power in. • We note that the proposed amendment to Schedule 12.6, requiring distributors' voltage support assets at a GXP to be capable of operating within a power factor range of 0.95 lagging to 0.95 leading, would not apply to Orion, as our voltage support assets are not at a GXP.
Q10. What do you consider to be the main benefits and costs associated with the second voltage-related option?	The main benefits of the second voltage-related option include improved voltage stability and better coordination between the System Operator and distributors. However, implementing this option would incur significant costs for distributors, and is not a 'quick fix' solution: • A distributed energy resources management system (e.g., DERMS) allowing for real-time visibility and forecasting would be required at the distributor level. This would replicate System Operator functionality. Implementing this for all distributors would be inefficient compared to developing a DSO function. • As mentioned in our response to Q9, substantial investments in new processes, tools, and methods would be necessary for distributors to effectively manage voltage support across their networks. • There would likely be ongoing operational costs associated with the increased complexity of managing voltage support and coordinating with the System Operator.
Q11. Under the second voltage related option, what costs are likely to arise for the owners of energy storage systems with a point of connection to the transmission network?	No comment.

Q12. Do you consider it likely that distributors will, in the absence of a Code requirement, place fault ride through obligations on some or all <30MW generating stations that connect to their networks? **Please give reasons for your answer.**	Yes, we do consider it likely that distributors will place fault ride through obligations on some or all <30MW generating stations, in the absence of a Code requirement. However, we prefer a Code requirement on fault ride through obligations for <30MW generating stations. In the absence of a Code requirement, we can request compliance, but we can't enforce this requirement on connected generating stations. However, we note that to-date, we have not had an issue with generating stations meeting fault ride through obligations on our network. We consider this relatively easy to implement, with no excessive costs, down to the 10MW level, as standard inverters meet Code requirements. Having a clear Code requirement on all <30MW generating stations would ensure consistency across the industry and provide a basis for enforcement, which is crucial for maintaining system stability and reliability.
Q13. Do you consider it appropriate to include in the Code fault ride through curves for generating stations connected to a local distribution network at a nominal voltage equal to the GXP voltage, which take into account network protection considerations? **Please give reasons for your answer.**	Yes, we consider it appropriate to include fault ride through curves in the Code for generating stations connected to a local distribution network at a nominal voltage equal to the GXP voltage. We agree that network protection considerations must be taken into account, but note that these are traditionally focused on the transmission network, not distribution. This may require substantial process and system changes to accommodate. Additionally, local protection should be required for DER and embedded generation. Including these curves in the Code would provide clarity and consistency for all stakeholders. However, the Authority should ensure that the requirements are appropriate for distribution networks and don't place undue burden on smaller networks.
Q14. Do you consider there should be a threshold based on connection voltage and capacity (eg, a nameplate capacity or nominal net export of 5MW or 10MW) for generating stations connected to distribution networks to ride through faults?	While we believe that a threshold is reasonable, we suggest it should be more relevant to voltage rather than capacity. It's important to note that connecting small capacity installations to large voltages is generally uneconomic. Drawing parallels with our response to Q3, we advocate for an approach that would make the regulations more future-proof. This approach would prevent us from repeating past mistakes of implementing minimum numbers that later require revision to the Code.

Please give reasons for your answer, including any implications of having / not having a capacity threshold.	We question the actual risk if 5MW and 10MW generating stations are not compliant, for the System Operator. While we acknowledge the risk if grouped 5MW and 10MW generating stations fail and create an avalanche risk, we question if there is a genuine risk of network failure? On our network, during disturbances that we have observed, load typically falls; DER are not significant enough to become a problem. However, it's worth noting that the impact of voltage dips can vary, depending on how strong the network is in the area that the generators are located, as different areas will experience different voltage dips. Our observations noted above primarily relate to situations in the summer when large quantities of irrigation load are lost due to pumps tripping; we're not certain if this has the same response in other distribution networks. While having both a voltage and capacity threshold could simplify compliance for smaller generators, it might miss some important contributors to system stability. Conversely, not having a threshold ensures all generators contribute to system stability but could place undue burden on very small generators. We believe a voltage-based threshold might be more appropriate, ensuring that generators connected at higher voltages have ride-through capabilities regardless of their capacity.
Q15. Do you agree the Authority should be short listing for further investigation the third voltage-related option to help address Issue 4? **If you disagree, please explain why.**	Yes, we agree that the Authority should shortlist the third voltage-related option for further investigation.
Q16. What do you consider to be the main benefits and costs associated with the third voltage-related option?	From Orion's perspective, we do not anticipate significant costs associated with the third voltage-related option.

Q17. What costs are likely to arise for the owners of (single site and virtual) generating stations under the 30MW threshold if these generating stations must comply with the fault ride through AOPOs because they are connected to a distribution network at a nominal voltage equal to the GXP voltage?	No comment.
Q18. Do you have any comments on the Authority's assessment of options to help address Issues 2, 3 and 4 identified in our 2023 Issues paper?	Yes, we believe the Authority's assessment of options to address Issues 2, 3, and 4 is reasonable.