

SolarZero submission on Potential solutions for peak electricity capacity issues

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About solar Zero

SolarZero has 12,000 solar and battery system deployed across Aotearoa New Zealand. The systems are managed as a virtual power plant (VPP) and SolarZero runs one of the largest VPP in the world. The VPP operates in the electricity reserves market and can provide a peaking plant into the wholesale market (over 30MW tested in mid Dec 2023). SolarZero has two non-network solutions; Upper Clutha and Coromandel. During Cyclone Gabrielle around one third of solarZero's North Island customers lost grid power but all the households kept their lights on and the fridge cold, in some cases for more than seven days.

We would be happy to meet and discuss this submission.

Introduction

The security standards assessment document¹ suggests that the rational level of security that the market will provide is that the lights can go out for 22 hours per year. The 22 hours figure is based on a cost-benefit analysis using the cost of a gas peaker plant. As events on the 9th August 2021 demonstrated, even three hours of outage time for around 1.5% of households is unacceptable from a political/societal perspective. Twenty-two hours of outage would be totally unacceptable to society and would result in political intervention.

The gap between what is rational from a market perspective (22 hours) and what is acceptable from a political perspective (well less than 3 hours for 1.5% of households) is what needs to be bridged, somehow.

The Authority's approach to bridging this gap is information and cooperation. In other words, the Authority hopes that the lights will stay on by encouraging the industry to hold hands at critical times. This does not seem to be a very good way to keep the lights on, particularly given that market participants are meant to be in a competitive environment.

To bridge the gap between 22 hours and well less than three hours for 1.5% of households, some kind of additional mechanism is clearly needed.

The challenge the Authority faces is that as a legacy New Zealand has had sufficient capacity to meet peak for at least the last three decades, if not longer. That legacy, which is a carryover from pre-market days, has now gone. Some 1,000+MW of thermal plant has retired and has largely been replaced by variable renewables coupled with some geothermal.

The Authority needs to grasp that the days of surplus capacity to meet peak are now over. The legacy is now gone. The market has not supplied the necessary capacity. The evidence is clear: Without an additional mechanism winter peak will struggle to be met.

¹ https://www.ea.govt.nz/documents/166/Security_standards_assumptions_document.pdf

There are resources available that can be used in extreme situations. The owners/operators of these resources may not participate in the market under normal circumstances but are prepared to provide a service for very rare, short duration (e.g. an hour or two) periods.

An off-market mechanism is critical for innovation

It is now clear that the electricity industry is going through a once-ever step change in innovation. The Electricity Authority controls the pace of innovation in the electricity sector. Companies such as SolarZero can only innovate as fast as the market rules/the Electricity Code allow.

Over the winter of 2023 SolarZero piloted using distributed household batteries to provide the equivalent of a dispatchable peaking plant. This highly innovative approach was successful – the technology works. But there is no market mechanism to enable the product. In fact, SolarZero needed a market/system operation “hack” to enable the distributed battery solution to be dispatched in a way that was (kind of) compatible with market rules. Innovation is happening but the market rules are an issue.

The executive summary of the consultation document states (P2):

The Electricity Authority Te Mana Hiko is conscious that initiatives implemented to manage near-term issues, say the next one to two years, should not disincentivise innovation and investment for the medium and long term. The timeframe needed for the development and commissioning of new physical resources is such that the near-term problem becomes one of coordinating the currently available resources as efficiently as possible. Incentives must avoid ‘locking in’ current technologies and business practices at the expense of medium and long-term innovation.

As a recognised innovator in the industry the above paragraph makes no sense to SolarZero. Now is the time for the Electricity Authority to rapidly develop the appropriate rules to support innovation. The idea kicking the can down the road “*at the expense of medium and long term innovation*” makes no sense and runs counter to the innovation that needs to be enabled **right now** to help keep the lights on.

As SolarZero has proved over winter 2023, innovative technologies can help provide winter peak, but the Electricity Code and market structure are not encouraging of the technology. It would be unfortunate if the lights go out and innovative technology is not used just because the rules are not right. In our opinion that would be viewed by politicians and the public as unacceptable. The Authority needs to **rapidly** enable new technologies and harness some existing resources in innovative ways.

An off-market mechanism is an excellent way to bring forward new technologies, test them and see what rule changes are actually needed. An off-market mechanism should therefore be seen as an integral part of the process of innovating the market rules. It should be seen as a key part of the electricity market development as the market moves from its current state to a future state that is very different, i.e. a distributed energy future.

The market works most of the time but the rules need to be perfect for the market to work all of the time

The electricity market is an artificial construct. The idea that an energy only market will work 100% of the time requires the rules and systems to be perfect. The perfect set of rules have not yet been fully developed in New Zealand. For example, SolarZero has proved that it can contribute 30MW for two hours but the only way it can do so is via a “hack” of existing rules.

An off-market mechanism enables the Authority to explore what changes to rules are actually needed. Rather than being seen as a failure of the market to perform, an off-market mechanism should be seen as a means for understanding and developing rules for the future. As rules are developed resources in the off-market area can be moved into the market.

The market may be playing out as expected

Even with imperfect rules, what we may be seeing is the market playing out as expected.

New Zealand had sufficient capacity to meet peak in the lead up to the market being created in the mid 1990s. That capacity was well in excess of the 22 hours deemed economically efficient in the 2012 and 2017 security standards assumptions documents (see appendix at the end of this submission). The market is playing out as expected: Less margin and possibly heading towards the 22 hours identified in the 2012 report. If that is the case, then a new mechanism and new rules are required to get the shortage number to a level that is acceptable from a political and societal level.

As mentioned elsewhere in this submission, the events of 9th August 2021 shows that society has a very low tolerance of a widespread outage. The evidence is clear: The market as it is structured cannot provide the level of reliability society demands, i.e. the 22 hours in the 2012 and 2017 reports is not an acceptable figure. Hence the need for the Authority to use coordination mechanisms and to explore other options as per this consultation process.

Excluding distributed energy resources

The document states in a number of places: *Dispatch notification participants would not be able to participate in the scheme due to the lower dispatch-compliance requirements associated with dispatch notification.* Is it the intention of the Authority to exclude distributed resources? That seems odd, given that the Authority was involved in a pilot with Ara Ake, SolarZero and Transpower that proved that distributed energy resources can provide peak capacity and can be dispatched via the DNL mechanism, and potentially, although not tested, via the DNG process also. SolarZero cannot understand why the Authority would choose to exclude distributed energy resources. We hope that we have mis-understood the Authority’s intent. Surely the Authority would want to enable distributed energy resources?

A simple off-market mechanism is needed

Given that the market rules are not perfect and/or the market is playing out towards the 22 hours deemed “efficient”, politically unacceptable shortages may occur during this coming and subsequent

winters. To keep the lights on and avoid political involvement in the market, the Authority needs to rapidly develop a simple mechanism that can call upon resources, such as SolarZero's distributed batteries and other distributed resources around the country. The owners of these resources may not be market participants and may not wish to be a participant on a day to day basis. The resources are there and available². The Authority needs to work through how to harness those resources.

A simple off-market mechanism is the best option. As outlined above such a mechanism could serve an innovation and development function, as well as providing an immediate solution for the winter peak issue. It could be used to understand the technical details of new approaches and the rules that are needed. As the rules are developed in the market the resources could be moved out of the off-market mechanism and into the market proper. In this way the off-market mechanism should be seen as a testing arena, providing an innovation space with the aim that in time, and in a considered manner, the necessary rules are developed for the market itself.

Timeliness

It is now nearly 3 years since 9th August 2021. Many reports have been written including three consultations by the Authority. If left long enough politicians will be forced to act as a consequence of another event like on 9th August. The industry was hoping for a solution for winter 2023, now the industry is hoping for a solution for 2024. Will we be in the same situation in 2025? The Authority needs to hurry up and development the off-market mechanism for this winter.

Response to questions

Q1: Do you agree with the principle that the winter capacity margin should be based on the trade-off between the cost of the hours of reserve or energy shortfall and the cost of the peaking generation needed to mitigate it? Do you have any other suggestions on factors the Authority should consider and why?

The events on 9th August 2021 clearly showed that the public and politician's tolerance of outages is very limited. A target needs to be set, based on the tolerance of politicians, representing society's views, to accept outages. If the target is not set with a political perspective, there will be endless enquiries etc every time there is a shortage. The enquiries, court challenges and the like, which occurred following 9th August, create uncertainty for market, potentially reducing innovation and investment. We suggest the Authority sets some standards with the politicians and industry, and then develops the mechanisms to deliver to these standards. That way there will be more certainty.

Q2: Do you agree with our assessment of the incentives for demand response? If not, what is your view? Are there other criteria that the Authority should consider?

Paragraph 3.25 states: *The full benefit to the participants and ultimately consumers, will come from exposing that flexibility to the wholesale market.* The caveat, which is assumed but needs to be clearly state by the Authority, is that the full benefits will occur only if there is a perfect rule set for the benefits to be realised, particularly to get the market to operate perfectly 100% of the time.

² The former Transpower-run demand response programme identified hundreds of megawatts of capacity or demand response that could be called in extreme situations.

SolarZero discovered during the process of entering the reserves market and the winter peak pilot that the New Zealand electricity market is a long way from a perfect rule set.

The time taken to change the rules to better enable distributed energy resources in our experience will be lengthy – years. The winter peak situation is urgent. SolarZero supports work by the Authority to better enable distributed energy resources, but this work is unlikely to come to fruition in the next few years and then the sector will need to understand and respond to the rule changes, which will also take time.

In short, a much more timely response is needed to address winter peak, but we support more work on rules regarding distributed energy resources. As stated elsewhere in this submission, an off-market mechanism enables innovation in advance of rules being changed that are needed to enable the innovative technology to participate in the market.

Paragraph 3.33 states: *With the implementation of dispatchable demand and dispatch notification in the New Zealand market in May 2023, there are no such technical barriers [to demand participation].* As the only organisation to trial DNL we would suggest this statement (*no technical barriers*) is heroic. We would be happy to share our experience of DNL with staff at the Authority.

Q3: Other than financial incentives, what are the other barriers to entry for demand response participation in the wholesale market that you have identified?

As mentioned above, the Electricity Code was not written with distributed energy resources in mind. Our two experiences – reserves and a winter peak pilot – have involved hacks (technical/software and in relation to the Code) and the goodwill of all parties. We note that goodwill has been forthcoming and we are appreciative of that. But hacks and goodwill are not a solid foundation for keeping the lights on.

As SolarZero learnt over winter 2023 it makes time to develop the systems for new innovative products. The time includes working with the system operator to be dispatched and working with the Authority, if needed, to work through Electricity Code issues if they arise. The technical, regulatory (Code), dispatch and financial issues all need to be worked through. That all takes time and means costs. Ideally some form of innovation funding should be available to more rapidly bring new products and services to fruition than would otherwise be the case. An off-market mechanism could double as a means for assisting innovation by making it much easier for new technology to be stood up in a market-like setting.

Q4: Do you agree that the Authority should focus its resources on identifying and lowering barriers for BESS and demand side flexibility to participate in the wholesale and ancillary services markets? If so, where do you think the Authority should focus first?

The answer is incredibly simple. Develop an off-market winter peak product. And do so quickly, i.e. for this winter. There has been debate ever since 9th August 2021 – nearly 3 years. It is well beyond time for the EA to actually do something beyond a bit of “coordination”. The Electricity CE’s Forum made suggestions as did others. Three years is long enough. It is time for the EA to act.

The EA should rapidly, i.e. for this winter develop an off-market product to ensure that lights stay on. The off-market product will help enable operators of resources (such as BESS and demand side flexibility) to learn how to participate in the electricity system at a technical level, which is important. Over time the Authority can develop the appropriate rules and Code changes, which does take years.

Under this approach the off-market part is essentially the place where innovation/learning is done so that the market can be effectively, transparently and confidently evolved.

Q5: Do you agree that any solutions should satisfy these principles? If not, what is your view and why? Are there other principles that the Authority should consider?

We note that a key change in the proposed principles is to change that it can be implemented in 2024 rather than 2023. Hopefully we will not be asked to comment further on principles this time next year that include a change along the lines of implementing something in 2025. We suggest that the industry has had enough of commenting on principles etc to do with winter peak. It is time for the EA to step up and rapidly develop a product for winter 2024 and beyond.

Q6: Do you agree that a standard product for financial 'super peak' hedges is required?

This solution may take some considerable time to develop and bed in. As outlined above the market may work well for 99% of the time but needs perfect rules to work 100% of the time. A "super peak" hedge may not be the solution because:

- It does not address the fact that the rules are not enabling of new technology.
- It may only get the market to the 22 hours (as per the 2012/17 document), not the much smaller percentage of time that politicians, who are in practice representing consumers' views, see as acceptable.

Q7: What factors do you think we should consider in the design of such a [hedge] product?

We have no response to this question.

Q8: Do you agree with our assessment of the risk for the medium to long term

The document suggests that over time risks of shortage during a winter peak will decline. Why that will happen is not clear from the document, for example, as more thermal plant retires the unit commitment issue reduces but so does firm capacity. As stated in the introductory sections of this submission, New Zealand had a legacy of firm generation that has now gone. The market in its current form has not delivered firm capacity for winter peak. It is a leap of faith, unsupported by evidence, that the Authority considers that winter peak issues will go away of their own accord.

Q9: Do you think it would be beneficial to create a new integrated standby ancillary service? What is your view and why?

Paragraph 7.44 states: *Standby reserve would primarily come from flexible sources that are already being offered to the market under the current regulatory regime.* As demonstrated in the pilot SolarZero undertook with Ara Ake, Transpower and the Authority, SolarZero has resources (distributed batteries) for winter peak that cannot:

- Elegantly be made visible to the market and dispatched– they can only do so via a "hack" to the system, e.g. using DNL which was not designed for distributed energy resources.
- Receive payment for services provided.

In short, SolarZero developed a product that was not already being offered into the market. Therefore, paragraph 7.44 is wrong in its assumption that flexible resources are being offered into the market *already*.

We think it would be tremendously beneficial to rapidly develop a scheme that enables flexible resources to be brought into the market. Through the Ara Ake-funded pilot we have proved it is technically possible to bring tens of megawatts of distributed energy resources into the market. But there is no real and effective mechanism for doing so on a routine basis in a way that fits with the market.

What is needed is an off-market mechanism comprising:

- An availability payment for *new* resources that are guaranteed to be available during a winter peak, i.e. the resources need to be proven to perform.
- A fee paid when called, even when called to be on “stand by” but not dispatched.
- The requirement that the amount available needs to be visible to the system operator and able to be dispatched through as close to normal dispatch systems as possible.

The mechanism would be a combination of out of market and within the dispatch system. It would be an insurance-type product with consumers meeting the need for bridging the gap between what the market would provide with the current rule set (which is imperfect) and what is politically acceptable.

It will also have an innovation dimension, i.e. support the innovation of both technology and the electricity market rules. Over time as the rule set is improved resources could be shifted to participate in the market directly rather than through this off-market mechanism. In this way the mechanism becomes a staging environment that enables resources to help keep the lights on while the market rules innovate and evolve, which as mentioned in this submission, can be a lengthy and drawn-out process.

Q10: How should the costs for a standby ancillary service be allocated?

The most appropriate analogy is an insurance product that the whole country purchases to ensure the lights stay on. The sums involved are not huge. The benefits are large in terms of avoiding political interference and endless enquiries should the lights go out not to mention further consultation documents and associated submissions etc, as the industry continues to experience since August 9 2021.

Q11: How should the residual requirement be set? Should it be an operational setting or dynamically calculated? If it is dynamically calculated, what factors should be considered in the calculation?

These are technical questions best addressed by a technical working group.

Q12: How should deficit (scarcity) standby residual be priced in relation to scarcity energy and scarcity reserve price?

This question can only be answered as part of a detailed design process.

Q13: Do you agree with our preliminary assessment of the issues associated with procuring additional resource out of market? If not, what is your view and why?

Given that the CEO Forum proposal has been out for over a year, it is disappointing that the EA has only done a “preliminary assessment” of an off-market mechanism. It would seem to be the best option to pursue. It is mystifying as to why the Authority is not choosing to rapidly do more work on this option.

The document misses some key points about an off-market mechanism. Such a mechanism, if well designed, has the potential to enable innovation, test new technologies and enable new market rules to be explored and designed. Over time resources could be moved out of the off-market mechanism and into the market as the rules and systems are developed in the market.

As SolarZero has learnt, bringing new technology into the market is hard has only been achieved via hacks of rules/systems and good will. We strongly encourage the Authority to rapidly develop an off-market mechanism that can be used to drive innovation in the market itself.

An off-market mechanism should not be seen as being separate to the market. Instead it should be seen as a useful adjunct, for example, as a staging ground where new approaches and technologies can be tested and explored, enabling market rules to be developed on the basis of real evidence and practical experience. In other words, an off-market mechanism should be seen as a key part of market innovation.

Q14: Do you think it would be beneficial to create an out-of-market tender for emergency demand response? If not what is your view and why?

Yes, absolutely. An energy only market will only work 100% of the time if the rules are 100% perfect. When the market is under pressure, i.e. operating at the 0.1% level an imperfect rule set will create significant issues. Our experience with reserves and DNL is that the rule set is no where near perfect. Therefore, an off-market mechanism is needed to provide the space and time for the rule set to be improved and updated.

The off-market solution could be a staging environment for understanding how new technologies can work in practice, i.e. in part the off-market mechanism performs an innovation support function. The Authority would benefit immensely from this approach because it could understand how the rules might be structured to enable the new kinds of resources and innovative approaches to come to market. Currently the Authority is attempting to develop new rules in something of a vacuum, attempting to second guess how new technology and innovative approaches may work in practice.

The Electricity Code has only ever been backwards looking. The Authority is now trying to adjust the Code to anticipate new technologies, such as distributed energy resources. As we have learned with DNL and changes to the rules to enable batteries into reserves, it would be much better to have a staging area where the processes and procedures could be developed to the point that they are well understood and then, and only then, codified, i.e. the Electricity Code developed on the basis of some learning by doing.

Some points in the consultation document concern us. For example, paragraph 8.23 states that “Dispatch notification participants would not be able to participate in the scheme due to the lower dispatch-compliance requirements associated with dispatch notification”. What we take this to mean is that distributed energy resources would be excluded from participating in helping to meet winter peak. That makes no sense given SolarZero has proven that it can provide resources to help meet winter peak. Why would the Authority go to the expense and trouble of developing a mechanism and then say it can’t be used when needed? Again, this makes no sense.

As with Option 1, the Transpower pilot demand response programme proved that there are significant resources - over 200MW – that are not part of the market and have no real interest in being part of the market. But the resources can help meet a peak and owners/operators are prepared to do this if adequately compensated.

Q15: Do you think it would be beneficial to provide payments to resource providers for any uncleared generation and/or dispatchable demand? If not what is your view and why?

The thinking for this option appears to be that some kind of market mechanism, possibly priced at 50% of reserves, could bring additional resources to help meet winter peak. The fundamental problem is that the market may well work for 99% of the time but it unlikely to work for 100% of the time unless the entire rule set is 100% perfect.

As has been proved the market is under-provisioning for winter peak. The peak legacy that was bequeathed when the market was established has declined and the “market” has not delivered new peak capacity of the scale needed.

We would need to understand more about this option to provide further comment on it.

Q16: What do you consider to be an appropriate scaling factor to determine the price for residual and why?

As above, we would need to understand more about this option to provide comment on it.

Q17: What is your view on the factors the Authority should consider when valuing the costs associated with a standby ancillary service?

Paragraph 8.92 states that “New Zealand’s market settings are designed to allow for scarcity prices to emerge when appropriate, as this incentivises investment and innovation in the long term”. This may work for most of the time, but may not work for the 0.1% of the time that matters – during a cold, still winter peak. The reason being is that the rule set is not perfect. If so, the Authority needs to develop a mechanism that recognises that the market works well for most of the time, but not all of the time because, for example, the rule set does not well support new technology, i.e. the rule set is imperfect.

We would like to point out that the market rules are critical for innovation. Currently SolarZero is participating in the reserves market and has demonstrated that it can deliver a peak product. But it has only been able to come into the market via hacks to the existing Electricity Code. Without a significant update to the Code innovation will be challenging. This point is important if the Authority wishes to see new resources come into the market – existing rules may not enable the new resources.

An off-market mechanism provides an ideal way to test and develop new technologies and the associated rules needed to enable that technology in the market.

Paragraph 8.93 essentially says that 22 hours without power is acceptable, based on the 2012 and 17 reports referenced earlier. Politically, even a few hours of 1.5% of consumers not having power on a cold winter night is not acceptable.

Paragraph 8.96 states “A more efficient, and potentially lower cost solution would be to ensure that the resources that are currently available in the wholesale market are providing the right price signals early enough to maintain security of supply”. This sentence appears to assume that sufficient resources are currently available. That needs testing. The document provides no evidence to support this statement.

A solution that brings in resources that are not normally available would seem the best solution for keeping the lights on at a level that is political acceptable. Transpower proved it can be done via the pilot demand response programme. It is time the Authority got on with the job and ensured that the lights stay on, using resources that are not in the market normally if that is what has to be done.

The process should be:

- Develop an off-market mechanism.
- Use the mechanism to test technology.
- Use the mechanism to understand how the market systems and rules need to be adapted to enable the technology.

- Develop the appropriate part of the market, e.g. the ancillary services part, to enable the technology to participate in the market.

Q18: Do you have any information on any other international standby ancillary services and their positive impacts? If yes, please share your information.

As discussed above, the Transpower pilot demand response programme demonstrated that resources could be brought into the electricity system that were not part of the market and possibly have no intention of being part of the market. The learnings from the programme need to be analysed in terms of providing understanding of how a mechanism could work that could harness resources that are not part of the market under normal circumstances.

Appendix: Table from the report “Security Standards Assessment Document” (2012 and reviewed 2017)

Provision of peaking services to keep the lights on for a lesser period . That is based on the estimate of a gas peaker plant. That is the market response to winter peak.

Table 2: Figures for explaining WCM

WCM (MW)	Expected hours p.a. of energy or reserve shortfall (as a result of capacity shortage)	National benefit-cost ratio of additional investment in peaking generation (considering only benefits in terms of reducing capacity shortage)
500	61	3.03
550	47	2.33
600	36	1.74
650	28	1.25
690	22	1
700	21	0.94
750	16	0.66
800	11	0.48
850	8	0.34
900	6	0.27
950	4	0.17
1,000	3	0.12

Events on 9th August 2021 suggest the 22 hours is not acceptable. For a few hours 30,000+ households were without power. The political ramifications were significant. A number of inquiries were held, Transpower was fined, all of the process involved presumably costing millions of dollars not to mention the opportunity cost of electricity sector staff spending time on analysing the event.

The fact that the optimal market solution is 22 hours and three hours was deemed unacceptable indicates that the market cannot and will not provide a solution for winter peak. Relying on high market prices won't work.

A different approach is needed for the extreme peak times. What is needed is some kind of insurance policy and a system for dealing with extreme peak. The analogy is fires where households have both insurance and there is a fire service. In other words, there is a *system* for dealing with extreme events.

Until the last couple of years, New Zealand has not had to worry about meeting peak. We have lived off a legacy developed over many decades. We are now exceeding that legacy. The evidence points to the rules in New Zealand's energy-only market not enabling a level of security that the New Zealanders expect.