Appendix A Format for submissions

Submitter	Dr Allan Miller

Question		Comment
Q1.	What is your view of the potential competition, reliability and efficiency benefits of more participation?	Mass participation may involve many consumers participating in the market without any clear link to the operation of the electricity grid. Peer-to-peer may be an example, with one advantage being increased renewable energy generation. Another advantage is greater competition through more choice of supply. Mass participation may also involve many consumers taking part in the operation of the electricity network while also taking part in an aspect of the electricity market. This is closely aligned with the concept of a smart-grid (according to the European Technology Platform's definition of a smart grid). An example is demand responsiveness, through home energy management systems - be they dedicated systems, apps, or controlled by a third party. There are benefits from this through increased efficiencies in more sources of demand response to manage energy, transmission, distribution, and ancillary service costs. Most important is the potential for mass participation, through demand response, to help ensure security of supply with consumers benefiting from a more secure supply and gaining financial benefit from offering this as a service. GREEN Grid research shows that the need for certain ancillary services is likely to increase as more variable renewable generation increases (such as wind and solar). More variable renewable generation is likely to be developed in order for New Zealand to reach its 90% target by 2025. A further theoretical benefit of greater demand responsiveness is more elastic demand in response to price, in theory giving consumers direct ability to participate in setting the price. Although a nice idea in principle, this has a number of significant complications, such as how to derive a price to the consumer, and the need for real-time response when the market currently has a gate closure period. While strictly not participation in the electricity market itself, there are other forms of mass participation in the operation of the grid, such as control of voltage on local distribution networks using advanced solar PV inverters. Such means of voltage control may be more economic than other forms of voltage control, such as upgrading the network or installing specialist equipment.

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Q2.	What is your view of the opportunities to promote competition and more participation in the electricity industry?	It is possible that more innovation will arise through more competition. For example, better options for control of load may arise as more innovation in retail occurs. I believe there is an opening for innovation in control equipment for homes / businesses and prices, or some other signal, that reflects a bundle of benefits so as to maximise benefit to the customer. The bundle of benefits would include energy price, transmission constraints, distribution networks constraints, and a range of ancillary services.
Q3.	What other issues might inhibit efficient mass participation? Please provide your reasons.	Lack of standardisation of prices or control mechanisms across retailers and distribution networks could inhibit mass participation. Furthermore, lack of 'ease of use' home energy management products, in terms of ease of set up and communication, could inhibit mass participation. Lack of standardisation across retailers and distribution networks may also inhibit peer-to-peer mechanisms. For mass participation through demand response to be economically viable, or to maximise its value to the consumer, the consumer needs to be able to access the multiple uses of demand response (energy, transmission, distribution, ancillary services). Furthermore, markets need to be developed to allow demand response to participate in some of these. For example, frequency keeping and droop response ancillary services – to allow demand response to continuously adjust for variable renewable generation output rather than just hydro governors alone. There may not be a large demand for such an ancillary service at present, but as GREEN Grid research shows, the need for droop response will increase as wind generation increases. (Wind generation will need to increase as New Zealand needs more renewable electricity generation.) In addition to distribution, transmission and ancillary service uses, demand response needs to be able to participate in the energy market to increase the price elasticity of demand from the industry as a whole, not just to individual firms as created by competition. This may become increasingly important to the New Zealand electricity industry as variable renewable generation increases, in order to meet New Zealand's 90% renewable energy by 2025 target and beyond.

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		An issue that may inhibit the effectiveness of mass participation, specifically through demand response, is that of *over response* of loads 'en masse'. Furthermore, *poor coordination* of demand response could inhibit effectiveness of mass participation. Poor coordination might occur through different needs of demand response, and result in an ineffective response, if any. Other issues relating to demand response mass participation include how to control load, understand the potential response available at any time, and measure and reward response. Control of load in response to price is an attractive idea, but the complexities of providing a real-time price to each consumer that bundles energy, marginal losses, transmission, distribution and ancillary services are enormous – so much so that the cost of implementing a real-time bundled price may outweigh any benefit. While price might provide a vision for the future, a roadmap to price as a means of control might be appropriate, with intermediate steps, such as time-of-use tariffs. Engagement with manufacturers of technology able to implement demand response may help align their technology development roadmaps with the market development. Conversely, the market development may benefit from understanding the capability of technology.
Q4.	What is your view of the opportunities for network businesses to obtain external help to provide aspects of the network service using competition or market mechanisms?	There are opportunities through demand response to limit the size of the networks required to service customers. This is already being practiced to varying extents depending on the network. The may be opportunities to avoid network investment altogether in the future using solar PV and battery technology, for remote locations for example, although research shows that this is currently an expensive option (Mason, I.G. and Miller A.J.V. 2016. Energetic and economic optimisation of islanded household-scale photovoltaic-plus-battery systems, Renewable Energy 96 (2016) pp:559-573). It is also important to encompass in any 'rule book' changes a vision for the electricity industry, and importance of the network, in the future. The primary purpose of electricity networks is to reliably deliver energy, when required. As climate change mitigation, through the Paris Agreement, takes on more importance, so too will renewable electricity supply and therefore the electricity infrastructure, including networks. New technology, such as solar PV and

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		batteries, will continue to have some role as an alternative supply, but new ways of using electricity will lead to greater electricity consumption – for example, electric vehicles and heat pumps for space heating and water heating (Mason, I.G., Gates, H., Chua, H. and Miller A.J.V. 2016. Transitioning New Zealand to Renewable Energy, EEA Conference & Exhibition 2017, 21 – 23 June, Wellington). The controllability of loads will contribute to limiting the maximum size of the network assets required.
Q5.	What do you think are the main challenges to be dealt with to increase the use of competition in supplying network services? What are your reasons?	See Q3 Comment as well as Q2 Comment. In addition an issue may be retailers not passing through the appropriate price signals from difference parts of the supply chain (e.g. transmission, distribution and ancillary services). However retailers should be free to bundle these as they see fit, within the constraints imposed by competition. Further, in order to manage their supply cost from these various parts of the supply chain, provide their own signals to consumers to control load.
Q6.	What is your view on whether open access is required and what would be the elements for an effective open access framework?	Open access is required. The most important element to ensure effectiveness is standardisation of distribution and transmission offerings throughout the market.
Q7.	How effective are the existing arrangements for open access? What are the problems?	No response.
Q8.	What type of distributor behaviours and outcomes should the Authority focus on to understand whether changes are required to support open access?	No response.

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Q9.	What changes to existing arrangements might be required to enable peer-to-peer electricity exchange?	No response.
Q10.	What are the costs and the benefits of enabling peer-to-peer electricity exchange?	There are potential benefits to solar power producers through opportunities to sell their exported power at higher prices, thereby making their system more economic. This can be assessed to an extent using the EECA energywise™ solar calculator. Ultimately this may contribute more renewable energy to New Zealand. Added benefits to New Zealand are more sources of renewable generation. The costs are: (1) 'rule book' changes to facilitate this, which are levied across all consumers (including those not participating in peer-to-peer trading); (2) potential network cost increases to all consumers in a network to enable greater export onto the network by PV solar producers; and (3) the cost to a distribution business from the connection of PV solar and 'use of network' while revenue from solar producers to the distribution business reduces. Other potential costs include the need to upgrade the network to cope with greater export volumes. This can be avoided by following the draft EEA Guideline for Connection of Small-Scale Inverter Based Distributed Generation (to be finalised later in 2017 / early 2018).
Q11.	What is your view of the possibility for, and impact of, any current or future blurring of participant type? What are your reasons?	There may be advantages to consumers becoming active 'participants' (through direct load control or home energy management systems including apps). In this respect blurring aids this, but they may act through a retailer as the participant. In this case the retailer needs clear incentives, and needs to provide clear incentives, to have the consumer participate, which can be hidden at present. More retail competition might deal with this.
Q12.	What types of participation are or might be prevented because the party is not recognised as a participant? What are the potential impacts?	No response.

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Q13.	What challenges might new forms of generation, such as virtual power plants, or small and dispersed generators, face in entering the market?	Challenges will be network connection and pricing, including non-standard terms for network connection across all distribution businesses. Network congestion may also become an issue. Incorporating the EEA Guide for Connection of Small-Scale Inverter Based Distributed Generation (currently the draft EEA Guideline for Connection of Small-Scale Inverter Based Distributed Generation) into each distribution businesses Connection and Operating Standards will provide a standard method of connection and deal with potential congestion.
Q14.	What changes might be required to the rule book to facilitate the emergence of virtual power plants or demand response?	Changes to the Electricity Industry Participation Code are required, as currently requested by the EEA, identified in finalising the Guide referred to in Q13. An holistic vision for the electricity industry in New Zealand, its vital role in the operation of the economy, and its role in reducing New Zealand's greenhouse gas emissions in the future should provide the overarching context to the 'rule book'.
Q15.	Would the functioning of the market for hedges and PPAs and the availability of finance be improved if there were greater transparency of long-term prices and greater standardisation of terms and conditions for long-term contracts?	Yes – at the very least, transparency of prices and standardisation may assist liquidity.