Australian National University

Battery Storage and Grid Integration Program
An initiative of The Australian National University

30th September 2019

To Whom It May Concern,

RE: Response to the Energy Security Board Post 2025 Market Design - Issues Paper September 2019

On behalf of the Battery Storage and Grid Integration Program at The Australian National University, we welcome the opportunity to respond to the Energy Security Board Post 2025 Market Design - Issues Paper September 2019.

We commend the Energy Security Board (ESB) for establishing the post-2025 market design project (The Project) and support the broad scope of this enquiry. This project is vital at a time when Australia is transitioning from an electricity system primarily powered by large-scale, centralised and fossil-fuel fired generation towards an electricity system primarily powered by renewable and distributed energy generation and energy storage.

Please find below our response to several aspects raised within the Issues Paper as well as other relevant aspects that we believe the ESB should consider as The Project progresses.

The Assessment Framework

The Issues Paper emphasises that the *"the post-2025 project must satisfy the NEO"* which is clearly an important requirement for The Project. We believe an important objective not explicitly stated in the NEO, but that must be considered in The Project, are questions about how to ensure equity is achieved in the design and operation of the electricity system and electricity markets. Ensuring that we deal with questions of equity explicitly, rather than implicitly, or not at all, is vitally important to all consumers of energy and thus a vital area of consideration for The Project.

That equity should be explicitly dealt with is evidenced by noting that the electricity system has been created on behalf of all energy consumers, to provide an essential service for all energy consumers, and whose costs are socialised amongst all energy consumers. Considerations related to equity become increasingly important as we incorporate growing amounts of distributed energy resources (DER) whose allocation, for various reasons, will not be evenly or equitably distributed nor accessible to all.

We are broadly supportive of the assessment criteria outlined within the Issues paper and note the emphasis of the ESB to ensure that the assessment criteria encompasses and recognises the complex social, technical and economic considerations necessary to ensure a successful outcome for The Project.

In progressing The Project we believe there are several aspects of the future electricity system and market operation that must be considered jointly and simultaneously. These include the:

1. technical considerations (Figure 1) of jointly and simultaneously managing energy reliability, energy security, and access to network capacity (both transmission and distribution) and the,
2. social considerations (Figure 2) of jointly ensuring affordability, equity and choice for consumers of energy. These social considerations require a recognition that there is no one

type of energy consumer and any assessment framework must be able to assess the benefits and impacts to diverse residential and commercial energy consumers.

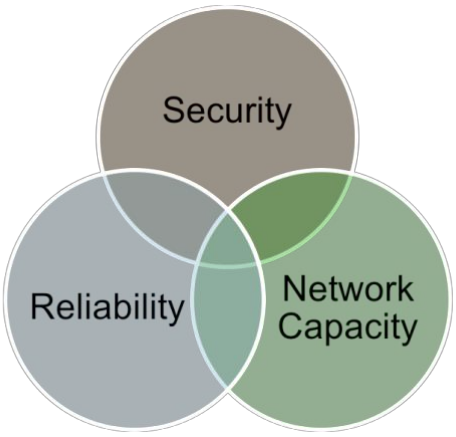


Figure 1. There is an increasing requirement to simultaneously manage energy security, energy reliability and network capacity, particularly when considering the market participation of distribution connected assets.

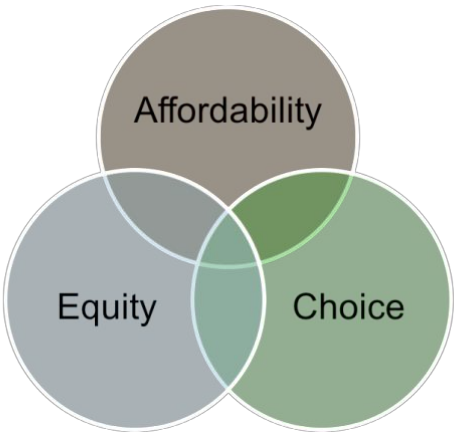


Figure 2. There is an increasing requirement to simultaneously ensure affordability, equity and choice for all consumers of energy. It is vital that we recognise that there are many different types of energy consumers.

It is widely acknowledged (see Figure 3 for example) that the percentage of distributed energy resources and distribution connected assets is expected to increase dramatically in Australia such that Australia will lead the world in levels of decentralisation over the decades ahead. In this future system, two way dynamic flows of energy will be commonplace, and traditional consumers of energy will increasingly become energy generators capable of participating in markets for energy, ancillary and network services. As this decentralisation occurs, there will be no such thing as the 'demand' side of the grid, rather there will simply be consumers and producers of energy interconnected through both the transmission and distribution networks.

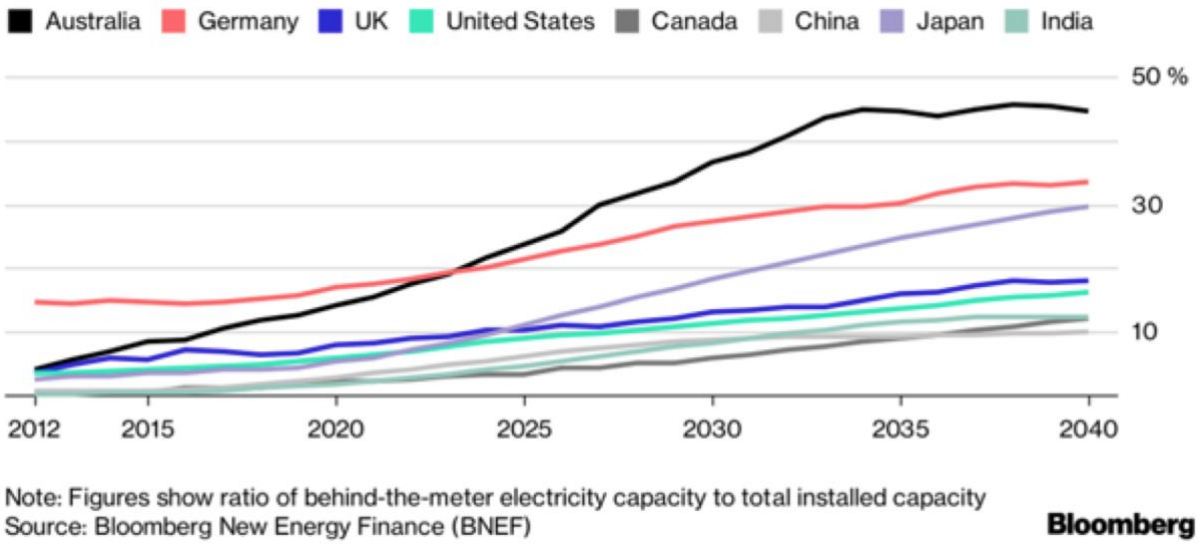


Figure 3. Australia will lead the world in levels of decentralisation over the decades ahead (Bloomberg New Energy Finance, 2017).

At the same time, Australia's energy mix is changing (Figure 4), including significant uptake of renewable and non-synchronous generation.

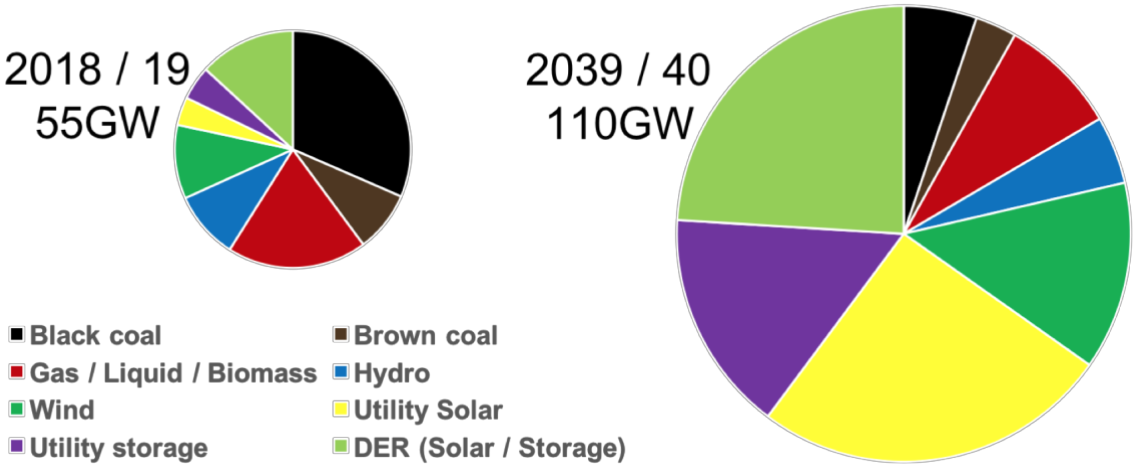


Figure 4. Australia's changing energy mix to 2040. https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/Integrated-System-Plan

In recognising the transition underway, we would advocate for any future market design to be assessed on the principle that *all electrons are to be considered equal,* irrespective of source. Such an assessment criteria requires that generation sources (and potentially loads) are only assessed on their ability to deliver capacity, with a defined performance and firmness, at a given time, and for a given duration. We believe such an approach is important to prevent the emergence of separate rules for centralised, distributed or renewable generation or storage assets or separate rules for the participation of generation or loads depending on whether they are transmission or distribution connected.

In support of this principle, we would encourage the choice of assessment criteria that include a precise articulation of power system requirements, for example as defined in the AEMO Power system requirements - Reference paper[1]. *It is vital that poorly-defined and ambiguous terms like baseload generation are not inadvertently incorporated into the assessment criteria, threatening the articulated principle of technology neutrality.*

In the same context, any future market must be assessed on its ability to fairly assess and reward the delivery of energy, ancillary and network services from all system connected generators and loads. Future market designs must explicitly acknowledge the delivery of services for energy reliability and energy security provided by consumer assets including solar PV, battery storage and electric vehicles. These services, where they are provided to the required specification, should then be rewarded consistently with the reward structures for services provided from traditional, centralised generation sources. This may include the requirement for explicit valuation and reward of services currently provided as a consequence of standards mandated volt-var, volt-watt and freq-watt inverter settings.

Social, Technical and Economic Modelling

We are pleased to see the broad scope of modelling proposed to underpin The Project and believe such modelling will be very important to achieving a successful outcome. We would suggest that The Project include a strong program of social research, particularly as it relates to residential consumers of energy. This will be important to ensuring that the perspectives, benefits and impacts of any proposed changes will be appropriately considered across all categories of energy consumers.

We believe that the modelling undertaken through The Project must also appropriately consider the implications of distribution connected assets (including DER) participating in markets for energy, ancillary and network services.

[1] https://www.aemo.com.au/-/media/Files/Electricity/NEM/Security_and_Reliability/Power-system-requirements.pdf

It is well understood that in the transmission network it is possible to decouple the management of voltage and frequency due to the low resistance to reactance ratio of the conducting equipment. Consequently, in the transmission network, real power is typically used to maintain frequency, and reactive power is used to manage voltage. In the distribution network, resistance and reactance can be of similar values so real and reactive power both have an impact on system frequency and voltage. It will, therefore, be particularly important to understand the implications of these technical considerations on the value, performance and operation of services delivered from distribution connected assets into markets for energy, ancillary and network services.

It is also important to note that as distribution network services will require the consumption or supply of real power they will also be subject to valuation at the pool price for energy in the NEM. For this reason, there will be a strong correlation between the future costs for network services and the cost of energy as determined by the market.

From this perspective, changes to market operation, and the inclusion of sub-regional or local marginal pricing (as proposed in the COGATI[2] reforms), may have implications for the cost of operating different distribution networks based on their utilisation of different network services. In particular, differentiated sub-regional or local marginal pricing, has the potential to vary the cost of operations for different distribution networks, potentially creating differentiated pricing (i.e. pricing islands) for different energy consumers. Ensuring that differentiated sub-regional or local marginal pricing does not result in inequality for energy consumers is thus a vital area of consideration in The Project.

It will be important to consider how fungibility is achieved in any future market design. Currently, fungibility in existing NEM markets is provided by Marginal Loss Factors (MLF) and Distribution Loss Factors (DLF) which account for the effective losses from a given generation source through to the demand they supply. Future markets, particularly markets for network services may be complicated by the non-linear relationship between network services and voltage and thermal constraints, potentially creating challenges for the provision of fungible service delivery from different locations in the distribution network. For these reasons, it may be necessary to consider alternative price setting mechanisms for the future market provision of network services.

Beyond the modelling activities undertaken in The Project we would also encourage the ESB to leverage the lessons learned through the very many ARENA and government funded trials and projects already underway in this space, including projects related to the design and operation of future Distribution System Operator (DSO) and Distribution Market Operator (DMO) capabilities. Noting the timeline for The Project, we believe it will be vital to consider how lessons learned from these projects over the coming years can be effectively incorporated into the post-2025 market design and operation.

Other Considerations for The Project

Driving retail innovation to benefit the consumer through unlocking community and local energy models

In considering the opportunity for new (retail) service offerings that may emerge as a result of The Project, we encourage the ESB to consider complementary regulatory changes that may be required to unlock new energy models for energy consumers. These may include support for new network tariffs and regulations that provide a broad and equitable range of incentives to optimise the utilisation and management of the distribution network for the benefit of all energy consumers, the market operator and networks.

In particular, such tariff and regulatory reform may allow energy consumers to benefit from access to grid-connected (but not behind-the-meter) generation and storage assets installed in distribution

2 https://www.aemc.gov.au/market-reviews-advice/coordination-generation-and-transmission-investment-implementation-access-and

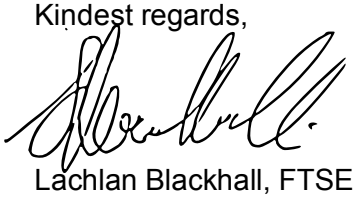
networks. These are often referred to as local or community energy models and are the subject of significant current investigation through several ARENA funded projects that include distribution network service providers (DNSPs) as active partners.

Integrating DER

As articulated in the Issues Paper there are important considerations in The Project to support the integration and participation of distributed energy resources (DER) into markets for energy, ancillary and network services. The authors recently provided a submission[3] into the Open Energy Networks consultation and believe that many aspects of that submission are relevant to The Project. In this context, a copy of that earlier submission is attached to this response.

We appreciate the opportunity to provide a response to the Energy Security Board Post 2025 Market Design - Issues Paper September 2019 and would be happy to provide further details about any aspect of our submission should it be of interest.

Kindest regards,



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[3] On the integration and coordination of distributed energy resources and assets as they participate in, and contribute to, the secure and reliable operation of the electricity system - A submission in response to the Open Energy Networks Consultation Paper.