Response to Moving to a Two-Sided Market Consultation Paper

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We would like to thank the authors of the "Moving to a Two-Sided Market" consultation paper for the opportunity to provide some feedback, and to congratulate them on what is already a very comprehensive report and ambitious project. We represent a group of power systems and DER researchers from the ANU and UTAS. Some of our more relevant experience in relation to the discussion is the series of ARENA-funded projects in the area of DER network and market integration we either led or contributed to including: CONSORT, Evolve, Optimal DER Scheduling for Frequency Stability and Community Models for Deploying and Operating DER.

Please find below our responses to a selection of the questions raised throughout the paper. Apologies if parts of it are reiterating things the paper already covers --- some aspects we thought were particularly important we restated.

2.1 Do stakeholders agree with our characterisation of the benefits of moving to a two-sided market? Are there other areas the ESB should be considering?

We agree with the benefits as highlighted in the document. We'd like to further emphasise that in order to realise these benefits, and to give consumers appropriate representation, it will be critical to foster a healthy level of competition between demand-side traders.

As mentioned in the paper, a two-sided market will facilitate the provision of congestion management, voltage control, and frequency regulation services from both demand and supply sides, which will help to lower ancillary service prices. However, it will be necessary to increase the coordination between the market operator, transmission system operators, and distribution system operators, to avoid synchronized activation of services. For instance, a distribution system operator may use demand flexibility to solve a congestion problem, but this activation may produce a frequency deviation, and consequently the activation of a frequency service. This is a problem observed in Europe, where the coordination between different system operators has been fostered to mitigate these problems.

A two-side market will enable the participation of DER on both sides of the market. However, it also brings technical challenges. For instance, the optimization of DER is characterised by the synchronized actions produced by the current market signals. These synchronized actions may generate voltage and congestion problems in the distribution networks.

Therefore, it will be necessary to increase the coordination between distribution system operators, aggregators/retailers, and the market operator. It is worth noting that the impact of these synchronized actions in the distribution networks is being studied in the *Optimal DER Scheduling for Frequency Stability project.*

3.1 What considerations should be taken into account in determining the rights and obligations that attach to a connection point in a two-sided market (in relation to end users, traders and the market operator)? How should these differ from the current arrangements?

We don't have specific feedback on how much the end user and trader obligations would need to change compared to the existing arrangements (e.g., between consumers and retailers). However, we'd like to emphasise the point that the metering on the connection point is the only source of truth about how services are delivered for most end users. As such, the market should not be overly trusting of or reliant on information about what is going on behind the meter if it comes via the trader, lest it open opportunities for price manipulation or perverse behaviour. Similarly, care should be taken with demand response approaches that rely on self-reported baselines.

The bidding process should reflect the physical opportunity for two-way flows at connection points. Instead of bidding either as a scheduled load or scheduled generator, there should be the opportunity for each connection point to bid either positive (load) or negative (generation) in each market interval. This could greatly simplify the market design, and provide traders with more flexibility.

3.2 Under the current market rules, traders of different kinds (eg retailers and small generation aggregators) have different obligations to the market operator, end users and other market participants. To what extent (if any) would it be helpful for a two-sided market design to distinguish between different types of traders, or between traders in different services?

We support the intent to move away from categories of participants to a focus on services offered. A trader would have the opportunity to deliver any service, provided the assets they control are able to meet the necessary performance standards for that service. This approach would remove the generator / consumer separation that is becoming outdated and presents a barrier to traders, particularly aggregators, participating in the market with a combination of load, generation and storage assets.

As such, where there is a difference in the way that the market needs to treat a participant / asset (e.g., scheduled vs non-scheduled), then this should be represented by multiple services that a trader can offer. This might require the development of new services such as inertia and reactive power support, as outlined in the paper.

In summary, whenever possible we would recommend that a two-sided market should not seek to distinguish between different types of traders, or between traders in different

services. We do however recognise that there may be important reasons for limited differentiation in some circumstances. These might include:

- Where there are important legal, financial or other reasons to make a distinction between small traders such as those representing a single customer or end user.
- Where differentiation could be used as a short-term way of fostering the adoption of emerging technologies when existing service definitions do not adequately accommodate an emerging technology or account for some externalities.

3.6. What considerations should be taken into account in designing a two-sided market that allows innovations in technical standards and services?

The ambition to enable the opportunity for individual consumer traders should go a long way in promoting innovation more broadly. The market and clearing process should be designed from the start to enable new services to be added and trialled with minimal effort / disruption, and to make changes to the existing services over time.

4.1 What components of scheduling and dispatch should be expanded in the move to a two-sided market? That is, what processes should we expect more participation in out of MT-PASA, ST-PASA, pre-dispatch and dispatch?

An accurate price forecast is important for the most efficient utilisation of DER that are required to manage state, such as batteries that have to manage the current and future state of charge. While an ahead market may provide traders of such DER with more certainty, it won't by itself guarantee an efficient market utilisation of DER. Whether or not an ahead market is established, it will be critical to have accurate and timely pre-dispatch pricing information in some form. The current approach to doing this, running NEMDE multiple times in sequence, is working from dispatch bids that cannot express the time-coupled dependencies of stateful DER. It is somewhat circular in that current pre-dispatch pricing approaches require traders to already have a good estimate of pre-dispatch pricing prior to submitting their bids.

There are opportunities modify the bidding process so that it can better capture these device and technology specific time-coupled dependencies. Iterative bidding for services is one approach to resolve this problem, where bids are simultaneously cleared over a forward horizon, but where only the next dispatch interval is binding (this mirrors the approaches taken when using model predictive control). However, identifying other approaches that allow these device and technology specific time-coupled dependencies to be captured in the bidding process is an important area of future research and development.

4.2 To what extent can self-submitted forecasts replace the need for centrally determined forecasts?

If the goal is to have a trader accountable for every connection point, then it makes sense for the forecasts of unscheduled / semi-scheduled devices to be incorporated into the trader bids (but perhaps as different services if the market needs to distinguish between levels of reliability). The basis for this suggestion is that behind the meter behaviour can be very

complicated as it is composed of the combined behaviour of load, generation and storage assets. In this context, the trader / end users are likely best placed to accurately forecast connection point behaviour.

High quality short-term central forecasts could still play a role. E.g., AEMO could provide a trusted source for short-term solar insolation forecasts for different regions, that traders would be able to optionally feed into their predictions. This could lower the barrier of entry for smaller traders to enter the market.

4.3 What is an appropriate mechanism for encouraging dispatch targets to be followed and complied with?

We support the following principles (which mostly overlap with the intent in the paper) when it comes to penalising deviation / rewarding compliance to dispatch instructions:

- Only penalise behaviour that has a tangible impact on other participants. I.e., truly unforeseen forecasting errors should not be penalised just for the sake of it, so long as they are cancelled out by other forecasting errors in the system.
- Any penalties (or rewards) should be in proportion to harms (or benefits) they cause.
- For services closely related to system security such as contingency FCAS, there are low likelihood but severe risks. There it may be necessary to penalise with the intent to deter, in order to achieve a higher degree of compliance.
- Finally there should be a path to dispute penalties if there are certain external factors which are deemed reasonably out of the control of the trader.

Overall there needs to be a balance so that AEMO has a system that operates predictably for system security and reliability reasons, but where the penalties don't become a barrier to participation for a diverse set of technologies and traders. As part of this, we hope a solution could be found that doesn't give large incumbents an overt advantage purely due to their scale, rather than due to a tangible benefit to market performance. It seems necessary to make the market as accessible as possible for small players (even end user traders) in order to drive innovation, competition and new targeted services.

We see a number of possible mechanisms that could be employed for this purpose, possibly a combination of them:

- The most straight-forward approach would be to extend / enhance the existing **"causer pays"** approach to penalising deviation, where costs associated with the reserve markets are recovered by the causer(s).
- **Scoring rules** mechanisms require that traders submit the confidence of their ability to meet their bid amount as a form of interval or variance about their estimate. This provides the market operator with extra information about how extreme any deviations are likely to be and can enable more targeted enablement of reserves and forward planning. The key to this approach is to elicit truthful information from traders, which can be done by applying appropriate scoring rules that take into account a trader's stated certainty and the final outcome when calculating a penalty or reward.

- **Statistical tests** can be automatically applied to the bids and outcomes of traders over time, to detect statistical bias, and in addition to flag whether this behaviour is consistent with price manipulation. If there is an honest statistical bias in their bids, this can be corrected either by the traders themselves, or in how the market operator considers their bids.
- More granular **service levels** might go a long way to providing the flexibility of different traders to fully participate, without the risk of strong penalties for not conforming. For example, the existing market distinguishes between scheduled and semi-scheduled generation. These could be turned into different services, and further expanded on to cover connection point services with different levels of reliability and different expectations. This would give AEMO greater oversight, and the ability to selectively choose between bids if there is not enough reserve available to cover the uncertainty.

4.4 What transitional approach should be taken with moving to a two-sided market? How can we increase the level of participation in bidding and dispatch?

Some key steps that would increase participation include simplifying market requirements and rules, such as reducing bid size requirements (and allowing non-integer bids), allowing traders to participate in both sides of the market, and enabling the participation of all types of technologies in all ancillary services. Most of the ancillary services were designed according to the characteristics of synchronous generators.

5.2 The paper suggests that the all three options could be adopted as a transitionary pathway. What are the relative benefits or trade-offs of a longer transition? Are there other options that should be considered in the transition? Are there any parties that should be priorities to transition first?

We propose the following subtly different way to frame / approach the transition, with the ultimate goal of full-participation. The idea would be to turn on full-participation from the start, but in a way where participants have no obligation to actually do anything different initially, and have a gradually increasing incentive to actively participate. The idea is to just have a default bid for every new trader that gets constructed from existing AEMO forecasts (submitted at the market cap). Initially the penalties for not meeting dispatch instructions (effectively the AEMO forecast for those not actively changing the bid from the default) would be zero. Incrementally the penalties could be increased, initially for the largest retailers / traders, and gradually for the smaller traders over time as technology develops.

This is perhaps only a subtle difference from the approach outlined in the paper, but it has the advantage of making active participation voluntary initially, while providing a clear and strong incentive for the participants to develop the trading capability over time, but without directly forcing any one category of participant (i.e. they can choose to just pay any penalties that the AEMO forecasts result in).

6.1 Do you think locational marginal pricing would encourage behaviours to help manage congestion in distribution networks? Are there other options that would be preferable?

Yes, we believe locational marginal pricing presents an effective and efficient means of allocating the use of DER for wholesale market services and network services. This includes managing network congestion and accounting for network losses. However, the details require considerable thought:

- Accurate modelling of LMPs requires modelling complicated power flow equations, which presents a computational challenge for a market dispatch engine. The existing NEMDE approach is to linearly approximate flows on interconnects, and rely on loss factors for transmission lines within regions. Exactly how much these simplifications impact market efficiency is unknown, but it is clear that such approximations would have a greater impact on the distribution system:
    - Voltage is expected to often be the limiting factor in existing distribution systems. Capturing voltage requires more detailed power flow modelling. It could perhaps be converted to a conservative limit on real power, but at a cost to accuracy.
    - Reactive power sunk or sourced from inverter-equipped DER has the potential to play a significant part in managing voltages. To do so most efficiently would require LMPs not just for real power, but also for reactive power.
- Even the simplest form of modelling would present a computational challenge when solved as part of a centralised dispatch engine, due to the sheer increase in the scale of the problem when the distribution system is included. New distributed or hierarchical optimisation techniques will be required to solve the problem on a 5 minute market timeline.
- If DER are enabled to provide reserve capability, it will typically be the extreme contingency events that will need to be checked for network feasibility. This means potentially another set of LMPs for these extreme scenarios.
- There would be winners and losers in the process of moving towards a LMP orientated market, as it adjusts to more efficient operation. Even by just converting the transmission system to a more accurate LMP scheme could affect the revenues of existing incumbents, which would have to be managed. At a smaller distribution-level scale, the expected revenue from DER devices could significantly change over time as other DER is adopted and as the distribution system is upgraded to relieve constraints. This might make it risky to consider network support revenue too heavily in DER investment decisions.
- LMPs could at times expose traders to more extreme prices. E.g., active export limits will drop local prices to zero or even negative and import limits will raise prices beyond the nodal reference point. This might make participation more risky for smaller traders.
- The rights to any revenue generated through price differences on congested lines would need to be carefully considered so that the incentives of networks remain aligned with the NEO. One idea would be to allocate any collected revenue back towards network upgrades, and to use LMPs to help guide where network upgrades

would provide the most benefit to the system, or to help resolve any significant inequities.
- Networks might like to invest in their own network connected DER for providing network support, in situations where private investment is insufficient. LMPs provide a natural means of coordinating these with other DER, but it raises a potential ring-fencing violation as it might not be possible to separate the network support component from the wholesale market signal component of an LMP.

It is worth stating that these challenges are not all unique to LMPs. Other approaches that efficiently reconcile the use of DER in wholesale markets while respecting distribution network constraints will face the same or similar challenges. The ARENA *CONSORT* and *Optimal DER Scheduling for Frequency Stability* projects have / are investigating the use of LMPs for performing this coordination and addressing several of these challenges.

Another mechanism for managing network congestion are the *Operating Envelope* capabilities that are being developed through several projects and initiatives, including open energy networks and the ARENA *evolve* project. Operating envelopes ultimately represent individual units of connection point capacity and could be considered as property rights that could be aggregated, traded or sold. Managing distribution network congestion in this manner could be largely managed locally or in a distributed fashion. Such an approach could eliminate the more complicated task outlined above of calculating local marginal prices in distribution networks.

A simpler approach to managing congestion in distribution networks may also be warranted because such congestion is unlikely to be experienced permanently, nor in all locations within a distribution network. Indeed, in many distribution networks today, congestion issues are only experienced in certain circumstances (i.e. on clear sky days in spring or autumn when load is typically low and solar generation is maximal.)

6.2 What do you think is the most efficient method for recovering network costs to support a level playing field for participants in a two-sided market?

We support the following principles to ensure that DNSPs recover network costs in a manner that's a level playing field for participants in a two-sided market:
- Fixed network costs are socialised equitably amongst all customers and end users.
- ToU or dynamic tariffs are used to eliminate the network impacts due to coincident demand or generation peaks. We do not support tariffs that financially penalise the use of network capacity that does not have financial implications for either the build or operation of network assets.
- Tariffs should not unduly penalise specific technologies or aggregation / retail models that offer benefits to customers and networks. For example, the use of suburb or community scale battery assets is currently disincentivised by the need to incur two network charges when 1) storing energy (perhaps from excess solar generation during the day) and 2) when the battery discharges and the energy is consumed by a customer (perhaps in the evening).

- Tariffs should incentivise the local use of energy, thereby reducing distribution network losses. For example tariffs could differentiate between local flows of energy (i.e. downstream of a network or zone sub transformer) from remote flows of energy between regions in the network.

We also highlight the important ongoing work in this area being undertaken through the DEIP Access and Pricing working group.

7.2 Which form of ahead mechanism would best complement a two-sided market?

Two of the stated benefits of ahead markets are to provide the market operator with greater security and reliability, and to enable participants to plan out their actions over time with more certainty. The latter of these will only be as effective if a trader is able to accurately express their preferences / capabilities (e.g., a battery with a state of charge) in a multi-temporal bid, which would require significant attention in the ahead market design.