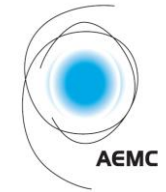




Centre for Energy and
Environmental Markets



We welcome the opportunity to contribute to this discussion regarding the proposed Distributed Energy Resources register.

The UNSW Centre for Energy and Environmental Markets (CEEM) undertakes interdisciplinary research in the design, analysis and performance monitoring of energy and environmental markets and their associated policy frameworks. CEEM brings together UNSW researchers from the Australian School of Business, the Faculty of Engineering, the Institute of Environmental Studies, the Faculty of Arts and Social Sciences and the Faculty of Law, working alongside a number of Australian and International partners.

CEEM's research focuses on the challenges and opportunities of clean energy transition within market oriented electricity industries. Key aspects of this transition are the integration of large-scale renewable technologies yet also, critically, distributed energy technologies – generation, storage and 'smart' loads – into the electricity industry. Facilitating this integration requires appropriate spot, ancillary and forward wholesale electricity markets, retail markets, monopoly network regulation frameworks and broader energy and climate policies.

CEEM has been undertaking research into these challenges for more than a decade, with a focus on the design of markets and regulatory frameworks within the Australian National Electricity Market, and State and Federal energy and climate policy. More details of this work can be found at the Centre website – www.ceem.unsw.edu.au. We welcome comments, suggestions and corrections on this submission, and all our work in the area. Please contact Associate Professor Iain MacGill, Joint Director of the Centre at i.macgill@unsw.edu.au.

Through our work, we utilise a wide range of data sets and aim to contribute to public policy development and debate. As such, we appreciate the value of accurate and complete data sets for developing evidence based policy. Current and recent work has focused on a number of specific topics relevant to this review, including embedded network regulation, wholesale market impacts of high penetration, Distributed Energy Resources (DERs), the impact of solar PV on network peak demand, and system security challenges relating to rooftop PV.

For Australia to make its fair contribution to global efforts to avoid dangerous global warming, the Australian electricity sector must transition to almost entirely emission free generation sources within a matter of decades. Distributed energy resources seem almost certain to have a key role to play in such transition both in generation, notably distributed PV, yet also through a range of technologies to facilitate integration of both distributed as well as centralised utility renewables. These technologies include not only energy storage, but also demand response and new types of electrical loads such as electric vehicles. The key challenge for the Australian NEM looking forward is to effectively and efficiently facilitate these, and other appropriate technologies, at sufficient speed to meet this transition challenge. The proposed rule change under consideration here would seem to be a necessary first step, however just the first step in the development of a more formal set of market, regulatory and policy arrangements that appropriately integrate the wide and growing range of distributed energy resources into NEM operation and investment processes, both centrally and market driven.

We would of course be happy to discuss the ideas put forward in this submission further with the AEMC. Note also that we do make reference to some ongoing but as yet unpublished work, which we could further explain in any meetings with the AEMC.

Attachment 1 Stakeholder feedback template

The template below has been developed to enable stakeholders to provide their feedback on the questions posed in this paper and any other issues that they would like to provide feedback on. The AEMC encourages stakeholders to use this template to assist it to consider the views expressed by stakeholders on each issue. Stakeholders should not feel obliged to answer each question, but rather address those issues of particular interest or concern. Further context for the questions can be found in the consultation paper.

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Questions		Feedback
Chapter 4 – Assessment framework		
1.	Is the assessment framework appropriate for considering the proposed rule changes?	<p>The proposed assessment framework could be improved in some key regards. Firstly, it would be useful to frame this assessment in terms of the scale and required speed of electricity industry transformation required to appropriately contribute to global efforts to avoid dangerous global warming.</p> <p>More specifically, we recommend either including an additional criteria, or adapting the first criteria ('Improve operation of the power system') to reflect the changing nature of the electricity supply chain under such transition. Specifically, as decentralisation and decarbonisation continue, a number of new challenges are emerging and as result this register is not necessary only to <i>improve</i> operation of the power system, but also to <i>maintain</i> operation. That is, if seeking to assess the benefits of the proposed register, it's important to not only consider improvements to operation which could occur with a DER register, but also to consider the 'avoided costs'. 'Costs' is used broadly here and includes, for instance, reduced reliability which could occur as DER penetration increases in the context of a rapidly changing power system.</p> <p>Similarly, the second proposed criteria 'Promote better investment decisions' aims to improve outcomes, where it is also worth considering the important role a DER register could play in maintaining the ability for market participants to make sound investment decisions.</p> <p>Regarding the proposed criteria 'Balance information transparency and confidentiality' we recommend that the following information need is included (in addition to those already listed): 'advocacy groups, researchers and policy makers to have access to an appropriate level of data for development of modelling and analysis to inform policy development and generate public good through increased transparency and understanding in the industry'.</p> <p>We have also had the benefit of reading Dr Penelope Crossley's response on this point and agree with her submission on the importance of consumer access to their own data.</p>
2.	Are there other relevant considerations that should be included in the assessing the proposed rule changes?	<p>As noted in question 1) an emphasis on maintaining – in addition to improving – operation and investment decision making is recommended.</p> <p>Secondly, whilst noting that this is likely captured within the first criteria (and acknowledged elsewhere in the consultation paper), we could recommend that the contribution to</p>

Questions		Feedback
		<p>maintaining system security is specifically flagged in the assessment criteria.</p> <p>At present, the proposed considerations do not appear to take into account the likely development of distributed energy markets, of the forms outlined in the AEMC DMM paper, or currently being trialled in the ARENA deX project. Ideally, the assessment framework would also consider what information would be necessary to facilitate optimal operation of distribution level markets and how to manage the participation of households.</p>
Chapter 5 – Section 5.1.1 – Benefits of a register		
3.	What are the likely uses of a distributed energy resources register?	<p>The likely uses flagged in the consultation paper are all relevant. In particular we would emphasise the value of a DER register for maintaining system security due to improved understanding of the location of DERs within the power system (identified by NMIs) and record of inverter frequency / voltage set points.</p> <p>The information captured in a DER register could also be used to inform public policy development through improved modelling and granularity of information. For instance, through being able to assess the costs associated with high penetration of DERs in a specific region, compared with the value of emissions reductions delivered by often renewable forms of generation, or the reduction in necessary network augmentation delivered by DERs.</p> <p>In addition to this, the DER register – if suitable information is made available – could help develop similar information and communication tools such as those provided by APVI¹, based on the CER data, and AREMI², also based on publicly available data. The APVI tools are combined with additional data which also makes the NEMWatch³ widget possible, assisting in better industry forecasting. Provision of DER data would allow for further development of tools similar to these, which could be used by all participants to inform decision-making.</p>

¹ <http://pv-map.apvi.org.au/analyses>

² <http://nationalmap.gov.au/renewables/>

³ <http://www.nem-watch.info/widgets/reneweconomy/>

Questions		Feedback
4.	How, and to what extent, could the static information provided by a DER register meet the objectives outlined by the COAG Energy Council, namely:	
	a) more accurate load forecasting?	<p>It is expected that improved locational information (i.e. NMIs rather than postcodes) could better inform load forecasting on specific connection points. This would be particularly beneficial in the development of localised energy markets, such as those postulated in the AEMC DMM.</p> <p>Although most helpful when paired with operational data (particularly in the case of 'smart' DERs such as batteries) it is possible to model the operational behaviour of 'passive' DERs such as solar PV using solar irradiance data. Therefore, static data can still be highly valuable to load forecasting. Work in progress at CEEM is examining several different operational strategies for batteries which could assist in future load forecasting.</p>
	b) improving AEMO's ability to manage power system security during credible contingency, protected and non-credible contingency events?	<p>Information regarding inverter set points, inverter response settings and location within the network (ideally NMIs which can be aggregated to the connection point level) could directly assist in the ability to manage power system events.</p> <p>Work soon to be published by CEEM assessing rooftop PV operational data following non-credible contingency events suggests that the response of PV inverters varies widely under extreme event conditions on the network. Further, it indicates that even inverters of the same make and model, located in the same region and likely experiencing similar conditions, can respond in different ways. This highlights the need for data collection beyond the manufacturer and model. In particular, the collection of frequency and voltage response set points, as well as response settings is key.</p> <p>We would recommend that the Commission also considers the following two points in its assessment:</p> <ol style="list-style-type: none"> 1. Even static data is 'live' – firmware updates to an inverter or changes to the response settings can dramatically alter its response during a system event. It is therefore important that this static information is considered to be 'live' and is updated frequently (acknowledging that this is addressed in part later in the consultation paper). 2.

Questions		Feedback
		<p>3. DER register not the final solution but is an important piece in the puzzle – we note that whilst the proposed DER register does not enable the required level of visibility to entirely address the system security challenge associated with DERs, it could be a critical source of information to be used in combination with other data sets.</p> <p>For example, coupled with information about how voltage and frequency conditions vary across the network (requiring fine grain monitoring equipment) a DER register could potentially enable AEMO (or DNSPs) to develop models of how demand might change across the network following contingency events.</p>
	c) improving AEMO's ability to set the bounds of the technical envelope at an efficient level?	Improved visibility is likely to assist AEMO in setting the bounds of the technical envelope at an efficient level. Recent preliminary work conducted by CEEM has shown that rooftop PV inverters, when considered in aggregate, have demonstrated up to 50% curtailment of generation following non-credible contingencies. The 'efficient' technical envelope of power system operation is clearly changing with DER uptake.
	d) improving efficient market and network investment?	By providing localised DER information, it will be possible to better establish existing trends and hence make more accurate forecasts for network and market investment. Given that initial investment in DER will be consumer-led, not industry driven, the accurate and timely tracking of these investments will be necessary for maximising the efficiency of wider market and network investment.
5.	Are there any other ways that a distributed energy resources register could benefit the National Electricity Market?	We agree with Dr Penelope Crossley's submission on this point.
6.	What features does a register need to have in order to meet the objectives outlined by the COAG Energy Council?	<p>At a high level, standardisation of the information gathered (i.e. consistent naming of inverters) and ensuring sufficient detail are key.</p> <p>As flagged above, it is important that the register is 'live' despite containing static data. Further, a suitable emphasis on inverter firmware updates and changes to response settings is necessary to support system security outcomes. At a minimum, the following information on inverter settings should be recorded:</p> <ul style="list-style-type: none"> - Frequency and voltage set points (multiple set points are expected) - Time to disconnect following a disturbance

Questions		Feedback
		<ul style="list-style-type: none"> - Time to reconnection - Any conditions for reconnection (i.e. voltage within bounds for a certain period of time) - Disconnection and reconnection ramp rates
Chapter 5 – Section 5.1.2 – Expected costs		
7.	What costs do you believe would likely be involved in the collection of useful data about DER?	We agree with Dr Penelope Crossley's submission on this point.
8.	Do you agree with the costs identified by Jacobs for different stakeholders? If not, why?	We agree with Dr Penelope Crossley's submission on this point.
9.	Are stakeholders able to provide data or case studies that would support further quantification (in monetary terms) of any of costs likely to manifest?	No response provided.
10.	How might the nature and magnitude of these potential costs change over time?	We agree with Dr Penelope Crossley's submission on this point.
Chapter 5 – Section 5.2 – Governance		
11.	Please comment on the suitability of the following:	
	a) Should 'small scale' systems be limited to generation systems below 5 MW? Should any further limitations be imposed (e.g. a minimum capacity or a threshold in MWh for energy storage)?	We agree with Dr Penelope Crossley's submission on this point.
	b) Is the NER definition of 'connection point' an appropriate spatial demarcation for 'behind the meter' DER? If not, what is an appropriate spatial demarcation for 'behind the meter' DER?	No response provided.
	c) Is a 'distributed energy resource' " <i>an integrated</i>	It is recommended that a list of examples is provided along with the definition. More generally, there is a wide and growing range of DERs that may, with greater deployment,

Questions		Feedback
	<i>system of energy equipment co-located with consumer load</i> "? If not, what else could it be characterised as?	need to be better integrated into NEM arrangements. As just one example, residential and commercial air-conditioners can exhibit unexpected, and at present largely unregulated, behaviours under some types of extreme power system events. These air-conditioners are offer highly promising opportunities for significant demand-side response capabilities. There are other commercial and industrial loads that might also participate in such DSR, while other potentially relevant technologies include electric vehicles.
12.	Regarding the management of a DER register:	
	a) To what extent should the types and capacity of DER eligible for inclusion in the register be defined in the NER or in an AEMO guideline?	It is recommended that the definition of DER eligible for inclusion in the register clearly includes existing technologies, but is flexible enough to allow for the inclusion of new technologies as they become available, given the rapidly changing nature of energy technology at present.
	b) Should the nature of the information being collected and recorded in the register and any other requirements, such as how often parties need to report the data, be determined in an AEMO guideline?	Yes, as above.
	c) What types of principles, factors or other criteria should AEMO be required to consider when developing guidelines on the collection and recording of information on DER?	We recommend that the following principles are considered when developing the guideline: <ul style="list-style-type: none"> - Consistency of units (i.e. kW compared with W) - Consistency of recorded information - Consistency across jurisdictions – ideally nationally consistent, despite that some information may only be relevant in some states or distribution regions. - Accessibility of data (stored format) - Standardised format for inverter manufacturer and model details (potentially require inverter manufacturers to register new products so that there is consistent naming) - Incentives for quality control are considered - A mechanism for keeping the information current is devised. For instance through requiring a contact person from the inverter manufacturers or requiring firmware updates to be recorded.

Questions		Feedback
Chapter 5 – Section 5.3 – Data collection and compliance		
13.	How often does the data need to be collected and updated to achieve the objectives of a DER register?	At a minimum, we recommend monthly collection and reporting of information, as per the current CER approach. This may need to be updated if it is found to be insufficient once implemented.
14.	Do you agree that there is a need for consistency across network regions in what data should be collected?	Yes, this is good practice and reduces complexity / confusion for installers and manufacturers. In addition to this, consistency across networks should reduce operational costs for the operator of the register, and maximises the utility of the data gathered.
15.	If DNSPs' connection application processes are considered a good method of collecting data, what changes are needed to existing processes?	It is noted in the consultation paper that the DNSP connection application processes collects inconsistent information between distribution regions, with low levels of compliance and with inconsistent database approaches. It is uncertain, therefore, how DNSP connection application processes can be regarded as a good method of data collection, without requiring both a consistent process between all network locations and a high level of compliance, such as that achieved in the CER process. In addition, we have also had the benefit of reading PIAC's response to the consultation paper and agree with PIAC on this point.
16.	Should obligations on parties other than DNSPs be considered to support data collection? If yes, which parties are best placed to collect and report this data?	Obligations should also be placed on inverter manufacturers, installers and aggregators as these parties are most likely to know when upgrades or changes are made to a system, affecting its operation. However, it is noted that these parties are currently not incentivised to do so, beyond the SREC scheme. In addition, we agree with PIAC's submission on this point.
17.	How would an obligation on the parties identified above best be applied and enforced? Please provide details.	The SREC enjoyed a high level of compliance due to the financial reward available. A similar incentive could improve participation in the DER register, while also supporting the greater deployment of distributed energy resources. However it is clear that enforcement mechanisms without financial rewards of this type will also be required. An alternative option would be to require participation in the DER register as a pre-requisite to participating in any future distribution markets (as set out in the Distribution Market Model final report). That is, to only allow consumers and their agents to be rewarded for the provision of

Questions		Feedback
		network services, or other possible values if the DER is registered. It is noted that these markets do not currently exist and therefore it would likely provide a weak incentive. Further, that this could create a barrier to entry to these developing markets.
18.	Will a register be beneficial if the levels of compliance in relation to providing information are similar to the low levels of compliance with the DNSP connection application processes? What levels of compliance are needed?	<p>The extent of non-compliance experienced by DNSPs is not clear, particularly the proportion of systems captured, and the details included (or omitted).</p> <p>We note that the DER register will be most beneficial if it is accurate and current, and that it will be of greatest benefit in some respects (particularly with regards to assessment of response following system events) in regions with high penetration and/or a weaker grid.</p> <p>We suggest setting a compliance target and reviewing this annually, for instance aiming for 90% of systems or more, as in the manner of the CER, to be recorded and with updates (either additional infrastructure or firmware) being recorded. An annual audit could ascertain the level of compliance present.</p>
19.	How else can compliance levels be improved?	<p>As suggested above, compliance levels could potentially be improved through:</p> <ul style="list-style-type: none"> - An auditing process (which could involve fines for installers / aggregators in the case of additional equipment being installed, or for manufacturers in the case of unreported firmware updates although we note that this latter issue may be very difficult to audit) - Providing a financial incentive similar to the SREC. - Participation in future distribution markets contingent on registration <p>In addition, we agree with Dr Penelope Crossley's submission and PIAC's submission on this point.</p>
20.	How can compliance best be maintained over time as technology changes?	<p>We recommend the following actions are taken to support compliance over time as technology changes:</p> <ul style="list-style-type: none"> - Consistency of format and units (reduced barrier to participation by wide range of stakeholders) - Frequent review of compliance mechanism(s), and DER definition to be stated in the AEMO guideline, as well as the frequency of audits required <p>In addition, we agree with Dr Penelope Crossley's submission and PIAC's submission on this point.</p>

Questions		Feedback
Chapter 5 – Section 5.4 – Transparency and confidentiality		
21.	Given the nature of information that may be required to be provided by registered participants under the proposed rule change, are existing regulatory arrangements (such as the protected information provisions under the NEL and Privacy Act 1988) regarding the collection and disclosure of information adequate to protect market participants and consumers whose DER systems are included in the register?	No response provided.
22.	If not:	
	a) What are the likely nature, and magnitude, of potential consequences of insufficient protection of such information?	We agree with Dr Penelope Crossley's submission on this point.
	b) Should the NER limit, on the basis of confidentiality concerns, the information that registered participants or others would be required to provide to AEMO under the DER Register Guidelines? If yes, how?	Of necessity, detailed data including NMI, and system component information will need to be gathered through this scheme. The question is less about what data is gathered, and more about how that data is managed and protected.
	c) Should the NER limit, on the basis of confidentiality concerns, how AEMO may use or disclose information provided to it under the DER Register Guidelines? If yes, how?	Yes, the NER should limit how the information in the DER register is disclosed. The information has the potential to be quite useful to the industry for reasons discussed elsewhere, and also as an excellent research tool for informing future decision-making. However, any information disclosed should be anonymised, in a similar manner to the CER small system data or provided under non-disclosure agreements. Given the competition concerns outlined below, it is recommended that information not be disclosed.
23.	Are there any competition concerns raised by the establishment of the register?	Yes, as flagged by Dr Penny Crossley and summarised in the consultation paper, access to this data set by retailers or insurance companies could potentially lead to market abuse (page 33). Further, the consultation paper suggests that Participants not registered with AEMO might be required to pay a fee in order to access DER register data (page 32). We note that this could lead to information asymmetry between existing market participants and new entrants, which is not recommended. The free movement of information is essential to

Questions		Feedback
		efficient market operation – asymmetry of information will lead to market distortions, creating an inefficient outcome.
Chapter 5 – Section 5.5 – Safety issues and emergency response		
24.	Would the sharing of data collected under a DER register be useful to emergency services, and if so, how?	No response provided.
25.	Are there existing mechanisms currently in place (e.g. requisite IT systems) that could facilitate the practical sharing of data with emergency responders on a real time basis?	No response provided.
26.	Is the proposed DER register the most practical mechanism to provide emergency services with the required information?	No response provided.
27.	What important features does a register need to have in order to meet the needs of emergency services?	No response provided.
28.	To what extent is energy related information already shared between relevant bodies (e.g. AEMO/CER) to emergency services for safety reasons?	No response provided.
Other comments on the rule change request or consultation paper		
29.	Do you have any other comments on the rule change request or the consultation paper?	<p>We note that the Finkel Review recommendation stated that this register (along with a ‘data collection framework’ to provide ‘real-time data’) should be in place by mid-2018.</p> <p>We recommend that the DER register project is implemented as soon as possible and that in developing the guidelines AEMO refers to the numerous consultation processes undertaken to date on this topic. Ultimately, the register is most likely to provide value if it is accurate and up to date, and accessible for the parties wishing to utilise it; whether this is achieved will be a direct product of implementation.</p> <p>Critically, we flag again (refer to question 4b) that a DER register is merely the first step towards appropriate DER integration. In order to facilitate transition to a more decentralised electricity system, it is critical that the recommendation put forward in the Finkel Review is</p>

Questions		Feedback
		addressed in full. Specifically, that a 'data collection framework to provide real-time data' is also developed as a matter of priority. Coupled with the static data considered in the DER register, this will provide a critical tool for AEMO and other key decision makers to manage the power system as it transitions.