Centre for Energy and Environmental Markets

CEEM Submission to the AEMC Consultation Paper:

National Electricity Amendment (Local Generation Network Credits) Rule 2015

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About CEEM

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, and the Faculty of Arts and Social Sciences and the Faculty of Law, working alongside a number of international partners. Its research areas include the design of spot, ancillary and forward electricity markets, market-based environmental regulation, the integration of stochastic renewable energy technologies into the electricity network, and the broader policy context in which all these markets operate.

One of CEEM's three primary research programs is on distributed energy options, challenges and opportunities for the electricity industry, with a focus on the Australian National Electricity Market. More information on our work in this area can be found on the Centre website – www.ceem.unsw.edu.au.

We welcome comments and suggestions on all of our work including this submission. Please contact the Centre's Joint Director (Engineering), Associate Professor Iain MacGill – i.macgill@unsw.edu.au.

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Contents

1 Introduction

CEEM welcomes the opportunity to comment on the rule change request regarding Local Generation Network Credits, submitted by the City of Sydney, Property Council of Australia and Total Environment Centre.

We feel this rule change request, beyond its specific merits and limitations as discussed later in this submission, provides a valuable opportunity for the AEMC and its stakeholders to continue the work of facilitating distributed energy options to contribute towards the long-term interests of consumers in the NEM.

Recent progress with distributed energy options including, notably, residential and commercial photovoltaics as well as trigeneration systems, and the promise of emerging technologies such as battery storage, has highlighted the potential for distributed energy to contribute towards a more economically, environmentally and socially sustainable Australian electricity industry.

However, current NEM arrangements, and those of almost all electricity industries around the world, don't provide an economically efficient basis for choices between centralised and distributed generation. Or more generally, the role that a wide range of distributed energy options – generation, storage and demand response – might play in delivering network services.

AS the AEMC consultation paper highlights, there is a range of work already underway by the AEMC and others looking to address aspects of this transformational challenge. However, much still needs to be done and this rule change proposal needs to be seen in the light of the challenges for distributed energy that remain, and possible options to address them. The proponents are to be commended for their efforts to identify some key issues and propose arrangements to address them.

The consultation paper highlights some potential limitations with the proposed rule change. It is hardly surprising that the proposed Local Generation Network Credit (LGNC) has limitations – the complexities, uncertainties and longer-term transformational potential of distributed energy within an existing market context not designed for them means that all options to facilitate improved distributed energy outcomes will face challenges. However, if not LGNC, then what?

This proposed rule change presents an opportunity for the AEMC to develop a framework that can, over time, provide the coherent and comprehensive reassessment of NEM arrangements that seems almost certainly to be required to appropriately facilitate distributed energy options. **The AEMC Options paper flagged as a possible next step would certainly be appropriate in this context.**

More broadly, longer-term interests require longer-term perspectives. Whilst the efficiency of market arrangements in the longer term is more a question of dynamic efficiency including facilitating investment in technology and business model

innovation, the focus of NEM governance still seems to be primarily on allocative and productive efficiency. We recommend that the AEMC ensure that the LGNC rule change is assessed taking into account the need for low-carbon innovation and transformation to serve the long-term interests of energy consumers.

2 Consultation paper background

Embedded generation

The consultation paper highlights the broad definition of embedded generation within the current NEM rules (connected to the distribution network), which includes generation from household PV systems to a 160MW OCGT plant. Given the very different commercial context of these two extremes, this would seem to highlight the need for the AEMC to revisit the most appropriate terminology for distributed generation, and distributed energy options more generally. Although developing more accurate terminology is not the focus of this particular rule change, it is worth considering whether improved terminology would support more efficient outcomes across a range of future scenarios, including LGNC arrangements,, and further, ensuring that the potential for more appropriate terminology is considered throughout the rule change assessment process.

How embedded generation can affect networks

As the consultation paper notes, the spectrum of distributed generation options is also broad. It should be noted that none of these options, nor network elements themselves, offer absolutely assured availability and predictability, although the characteristics of these technologies can certainly vary greatly (PV being a notable example of limited availability). The network economics of these various options are certainly complex – in part because the economics of distribution networks are highly complex given the typically large, lumpy, long-lived, highly specific, irreversible capital investments involved.

Distributed energy options have a range of potential values including energy and environmental benefits, as well as in providing network equivalent services in some circumstances. By contrast to network investments, they also offer potentially far less lumpy (although significant in aggregate), shorter lived and less specific investment options. As such, comparisons between network and distributed generation options will invariably be challenging, and will need to use:

1) probabilistic techniques – towards which network investment is currently being directed within the NEM, but which doesn't receive sufficient attention in the consultation paper, and
2) a comparison framework that acknowledges the broader values which drive distributed generation when considering different investment options.

3 Details of the rule change request

The rule change request proponents have identified a gap in the NER relating to the network support services provided by small scale embedded generation. As noted in

the consultation paper, this perceived issue is understood to result in inefficient investment and operation of small scale embedded generation and ultimately, increased prices for consumers.

Accordingly, the proposed LGNC payment is intended to ensure efficient investment and operation of small scale embedded generation. It is intended to help reward existing and new embedded generators, where they provide support services to the distribution network.

One concern with the consultation paper is whether it has adequately captured the broader intent of LGNC arrangements, which is to acknowledge and financially reward benefits which are already being delivered, and which are currently not appropriately recognised. In particular, the phrase network "credit" might be seen to imply that the proposed LGNC is intended to incentivise a greater degree of embedded generation. The intent is rather to ensure the market arrangements more accurately reflect the physical reality within the network, thereby ensuring more efficient decision-making by stakeholders. Such an approach supports the payment of LGNCs to both new as well as existing distributed generators – the fact that the investment has already been made doesn't mean that it shouldn't receive payment for any network benefits that it provides.

4 Consultation questions

4.1 Consultation question 1.

Question 1 Assessment framework

1. **Would the proposed framework allow the Commission to appropriately assess whether the rule change request can meet the NEO?**
2. **What is the relevance, if any, of reliability and security for the purposes of assessing the proposed rule (or a more preferable rule)?**
3. **What changes, if any, to the proposed assessment framework do you consider appropriate?**

The proposed assessment framework focuses on cost to consumers, reliability and security as follows:

- demand is met at the lowest total system cost (given reliability standards);
- prices reflect those costs – customers should face tariffs that reflect the underlying costs of supply;
- there is efficient investment in new assets over time; the NER should provide DNSP with incentives to make the right investments in network and non-network solutions at the right times and in the right places.

We see some potential limitations here:

- The first condition should more appropriately be to maximise net system benefits rather than just lowest system cost, given that this generally requires setting some fixed reliability and power quality standards which may well not be economically efficient. As best as possible, the AEMC should seek to better link reliability and security within the economic analysis of LGNC – particularly important given the acknowledged role that fixed, politically established, reliability standards played in rapidly increasingly network expenditure over the past decade.

  Also, the NEO refers to electricity services, which are a better reflection of consumer interests than just their demand (consumption). A greater services orientation would assist the AEMC in assessing the impact of rule changes on the long-term interests of consumers by better reflecting the growing interest and options for more active consumer engagement in meeting their service needs.

  The second condition also risks confusing 'prices' arising from and responding dynamically to changing market supply and demand, with 'tariffs' that are generally fixed by a single party for periods of time. Furthermore, economically efficient investment decisions require 'future' prices over the intended payback period of the investment. For example, future pricing within the NEM wholesale market is established through derivatives such as PPAs which play a vital role in supporting investment. There is very little discussion in the consultation paper about how such long-term prices or tariffs will be established to appropriately facilitate distributed energy investment.

- With regard to the question of investment, also, maximising system net benefits requires efficient investment by both consumers and DNSPS, and accordingly, the NER should seek to appropriately incentivise both parties.

4.2 Consultation question 2.

Question 2 Perceived issue with current NER

1. **Are the current NER provisions (including changes that have been made but not yet come into effect) likely to provide appropriate price signals for efficient embedded generation? That is, do the NER provide incentives to individually or collectively (including through small generation aggregators) invest in and operate embedded generation assets in a way that will reduce total long-run costs of the electricity system?**

2. **Do the current NER provisions (including changes that have been made but not yet come into effect) appropriately incentivise network businesses to adopt both network and non-network solutions to achieve efficient investment in, and operation of, the electricity system that minimises long-term costs?**

3. **If your answer to questions 1 or 2 is 'no', what is the specific area in which the current NER provisions do not achieve these outcomes – for example, is the issue with the current provisions only related to embedded generators of a certain type or below a certain size, or is there an issue for all embedded generators?**

Mechanisms in the NER

The Consultation paper provides a valuable summary of NER mechanisms intended to incentivise efficient use of non-network solutions. The key question is, of course, how effective these are proving in driving economically efficient non-network solutions. And further, to the extent they have not contributed to widespread deployment to date, the reasons for this. A number of these mechanisms are only recent – the requirement for more cost-reflective distribution network tariffs being one such case. It would be valuable for the AEMC to provide more details on these measures including timelines for their roll out, appropriate assessment frameworks (perhaps an expansion of the proposed assessment framework put forward in the consultation paper) and, most importantly, outcomes to date.

It is certainly well established that distributed energy (DE) sources such as solar PV, co-generation, tri-generation, energy storage and demand management can potentially provide significant network support. This is acknowledged in the recent CSIRO and Energy Network Association Network Transformation Roadmap, interim report:

"Accenture noted that the integration of distributed energy resources showed considerable value to traditional network businesses by providing greater network

capacity and energy diversity to optimise grid performance for both supply and demand." [1]

It is critical that the benefits provided by DE sources are recognised under the National Electricity Rules, in order to ensure efficient investment and operational decisions. Under the current rules, the benefits provided by DE **are not rewarded**. Specific details are provided below.

4.2.1 Cost Reflective Tariffs

The Cost Reflective Tariffs (CRT) developed by DNSPs in response to the Distribution Network Pricing Arrangements rule change[2], have some key limitations, as discussed below. Also, as noted in the rule change proposal, they do not currently reward DE export. Ideally an LGNC arrangement, or similar, would be an integrated payment to DE sources under CRT, in recognition of the services provided.

Certainly, CEEM and other stakeholder' work on CRT has highlighted the limitations of current proposals being put forward by a number of the distribution network service providers in terms of providing efficient investment signals through demand charges. They are generally applied as a c/kW charge based on the customer's monthly peak demand over a fairly broad time period (eg. from 2pm to 8pm). Higher charges will often apply in summer months (if it is a summer peaking network) and there may be a minimum monthly capacity assumed – which would act as a default service availability charge if the customer's demand does not exceed this minimum capacity. There are a number of problems with this approach:

1. The demand charge should likely not be based on the monthly peak but on the annual peak (seasonally adjusted as required) because this best correlates with the network determination process and resultant costs. In addition, the demand charge should not be based on the customer's peak but on the customer's demand at the time (and day) of the annual peak on the sections of the network that service them.

2. It is not only the demand at the precise time of the network peak that is important, but also the demand immediately prior to that (ie. the preceding three or so hours) because this demand leads to heating of components such as transformers, that in turn, often sets the limit on network capacity.

3. The methods used by DNSPs to calculate LRMC have generally been fairly opaque to date, and based on relatively short timeframes.

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[1] CSIRO, Energy Networks Association, 2015. *Electricity Network Transformation Roadmap, Interim program report*

[2] AEMC, *Distribution Network Pricing Arrangements.* [Accessed 4 Feb 2016] Available at: http://www.aemc.gov.au/Rule-Changes/Distribution-Network-Pricing-Arrangements

4. CRTs proposed to date have generally had very limited geographical diversity despite the reality, as noted in the consultation paper, that LRMC varies very considerably across the network. While there are a range of reasons for such reticence in more regional tariff variation, it does highlight a key limitation of CRT as currently implemented in terms of economical efficiency.

5. Finally, tariffs need to be designed so that customers will not only respond to the price signals provided, but so that customers also *want* the tariff structures to be put in place, and maintained. Work undertaken by the CSIRO indicates that the current demand charges have the characteristics that customers least prefer i.e. customers prefer the charge to be applied over a broader time period (which is different to a charge based on a single peak that can occur at any time over a broad period), they prefer the charge to occur occasionally and with notification, rather than every day, and they prefer a rebate rather than a penalty.

Thus, serious questions remain about the best way to design cost-reflective tariffs to reduce cross-subsidies, maximise fairness and customer responsiveness; in particular, how to structure the tariffs, how to define and calculate the long run marginal cost, and how to allocate the residual component.

It is arguable that this LGNC rule request highlights the fact that the DNSP's 'cost-reflective' tariffs are *not* cost-reflective. An economically efficient CRT should provide equal and opposite price signals to the DNSP and consumers/prosumers regarding the cost of provision of network services (when electricity is being either imported or exported). In this case, a consumer would automatically be rewarded for providing network support at any particular time - and so LGNCs would likely not be necessary. There is an evident path forward to try and better harmonise export and consumption.

4.2.2 Other relevant rules

The **Regulatory Investment Test for Distribution (RIT-D)** requires DNSPs to consider and assess all credible options before they make an investment decision to address an identified network need. However, there would seem to be some key limitations with current RIT-D arrangements:

- only identifies large opportunities to avoid large (>$5 million) network investments, so would exclude a significant proportion of distribution network investment
- the initial decision regarding whether a non-network option should be considered lies with the DNSP
- effectiveness is very much reliant on non-network stakeholders being actively engaged,
- does not need to be applied where the project is related only to the refurbishment or replacement of existing assets,

- despite the better regulation reforms and recent downgrades in DNSPs Weighted Average Cost of Capital (WACCs), strong incentives remain for DNSPs to prefer CAPEX over OPEX
- network support payments can be negotiated directly with DNSPs but this is likely only feasible for large projects
- there is no process for non-network solutions to be tested in advance, and
- includes only economic impacts.

The 2014 Distribution Annual Planning Reports (DAPRs) for distributors operating in the Australian National Electricity Market list some 330 committed or proposed network augmentation projects, and only some 35 proposed RIT-D projects. Of these projects where either RIT-D or the previous Regulator Test were applied, only 1 resulted in a non-network option, and this was a diesel generator.

Despite the **Capital Expenditure Sharing Scheme (CESS)** and **Efficiency Benefit Sharing Scheme (EBSS)**, a small excess in the WACC can still outweigh the value of the cost savings retained, and provide a significant incentive to overinvest in network solutions. The Demand Management Incentive Scheme (DMIS) and Demand Management Innovation Allowance (DMIA) have thus far not proved effective at overcoming these barriers.

The improved transparency and engagement under the **distribution network planning and expansion framework**, specifically via the DAPRs is welcome, but there is still no load data available below the Zone Substation level, and there remains significant opacity in the calculation of LRMC at different parts of the network.

The **small generator aggregator framework** would require DNSPs to be willing to negotiate with aggregators to purchase network support payments, and for aggregators to have sufficient customers to be able to offer network support in a particular area.

In conclusion, a key AEMC contribution towards appropriate assessment of the LNGC rule change proposal would be an assessment of the outcomes of all of the above mechanisms in delivering economically efficient distributed energy investment – focussing on, but not exclusively considering, distributed generation.

4.3 Consultation question 3.

Question 3 Determining avoided costs

1. **What are the factors that influence the long-run network costs that can be avoided through embedded generation? For example, do these cost savings depend on the location, voltage and type of generation?**

2. **Can embedded generation materially reduce DNSPs' ongoing operating and maintenance expenditure? If so, to what extent do these cost savings depend on the location, voltage and type of generation?**

The value of long run network costs that can be avoided through embedded generation and other distributed technologies certainly varies considerably depending on the time and location (including voltage level) at which the energy is available. The underlying generation technology itself does not affect the energy value, and any energy injected into the grid at the relevant time and location should be eligible to be rewarded.

An appropriate price signal would overcome any uncertainty associated with forecasting the availability of variable generators. If the price was sufficiently high, technologies that could deliver network support at peak times would be incentivised to ensure availability. A price signal that delivered network support via distributed energy, would also reduce the long timeframes required to commit network investments, and improve the flexibility and efficiency of the network.

As previously noted, DE can provide a range of benefits, including network benefits. In particular, in the ENA and CSIRO roadmap interim report, Accenture notes that "…integration of distributed energy resources showed considerable value to traditional network businesses by providing greater network capacity and energy diversity to optimise grid performance for both supply and demand."[3]

[3] CSIRO, Energy Networks Association, 2015. Electricity Network Transformation Roadmap, Interim program report

4.4 Consultation question 4.

Question 4 Specificity of calculations

If LGNCs of some form were to be introduced:

1. **What is the appropriate degree of specificity in the calculation of avoided network costs and, if relevant, operating and maintenance costs? For example, should different calculations be made for different voltage levels and/or geographic locations and, if so, what would be the criteria for distinguishing between levels/locations?**

2. **How often should this calculation be updated, recognising that the potential network cost savings can increase and decrease significantly over time as demand patterns change and network investments are made?**

Whilst it is important to maintain clarity and therefore simplicity, there is a growing capability for more complex, data-based solutions, which are likely to be a necessary aspect of decentralised energy uptake.

Whilst it is critical to analyse the costs and benefits of instigating LGNC arrangements, it is also critical to consider the rule change from a forward looking perspective. In particular, the growth in DE sources is expected to accelerate into the future, and the ENA has acknowledged that network business models need to change and move towards operation as a platform for energy services[4].

Therefore, whilst establishing a LGNC system will present a significant increase in complexity for stakeholders within the NEM, this increased complexity could support more efficient outcomes for consumers overall. The LGNC rule change provides a valuable opportunity to investigate how to build a more integrated, data-based electricity distribution system and to make a tangible step towards achieving effective complexity.

[4] CSIRO, Energy Networks Association, 2015. *Electricity Network Transformation Roadmap, Interim program report*

4.5 Consultation question 5.

Question 5 Potential benefits of the proposal

1. Compared with the current NER provisions, would the proposal:
   - (a) Provide superior or inferior price signals to embedded generators (including small-scale embedded generators) to incentivise them to invest in and operate those assets efficiently, thereby reducing long-term total system costs?
   - (b) Provide superior or inferior incentives to DNSPs to adopt efficient network and non-network solutions (including small-scale embedded generation) so as to reduce long-run total system costs?
   - (c) Have any potential beneficial or detrimental effects on any non-price attributes of the service, such as network reliability and/or security of supply?
   - (d) Reduce or increase the prices consumers pay for electricity?
2. To what extent do your answers to 1(a) to (d) depend on:
   - (a) To whom LGNCs are applied (eg whether it is applied to all embedded generators or whether there are criteria based on a generator's capacity, availability and/or location)?
   - (b) The degree of specificity in the calculation of avoided network costs (ie whether separate calculations are made for different voltage levels and/or locations) and how often it is updated?
   - (c) The proportion of the estimated avoided network costs that are reflected in the LGNCs paid to embedded generators?
3. If you do not consider that the proposed rule would enhance the NEO, are there potential alternative approaches that may do so?

Compared to current NER provisions

As discussed, the current NER provisions do not appear to appropriately incentivise investment and operational decisions around small scale DE. Although the proposed LGNC has limitations, we believe it could send superior price signals to consumers with respect to investment in, and operation of, distributed energy resources, than are currently realised under the NER.

Note that if 100% of the LGNC is paid to consumers, as proposed, then DNSPs will not have a direct incentive to support DE uptake where appropriate, through the LGNC mechanism. However, the LGNC could support an alternative way to use the network which is more platform based. This could prove beneficial to DNSPs as it decreases the risk of grid defection. However it is very important to examine the incentives created under LGNC arrangements for both consumers and DNSPs.

Potential alternative approaches

As noted, a key consideration is that an ideal solution would provide a level playing field for all options that can deliver energy services, including network and non-network solutions. If the AEMC is not supportive of the submitted rule change, what would the AEMC propose as an alternative approach to ensure distributed energy (including generation, but also storage and demand response), is appropriately facilitated and rewarded for the benefits it can provide?

There are certainly a range of other approaches that the AEMC could consider including appropriate network tariffs for peer-to-peer electricity trading, or Local Electricity Trading (LET); through which embedded generators are able to sell generation to other embedded customers within their local network area without being liable for the full DUOS and TUOS. It is worth noting that initiating LGNC payments could act to support peer-to-peer trading arrangements.

Such innovative arrangements enable a transaction between generators and loads, which is advantageous for the following reasons:

- Potential to enable a greater degree of co-ordination between local loads and generation;
- Potential to enable a higher degree of engagement and understanding in the temporal and locational aspects of electricity could set the foundation for more efficient consumer behaviours into the future;
- Requiring the presence of a load in order to successfully sell exported generation could provide a natural 'cap' to DE investment, rather than necessitating network service providers determine an appropriate point at which to cease making LGNC payments.

This final point is particularly relevant when comparing LGNC to potential peer-to-peer network tariff arrangements. Under the proposed LGNC arrangements, networks are required to regulate the amount of DE allowed within network regions. However the proposed LGNC does not provide suitable incentive for networks to do so efficiently since 100% of the credit is proposed to be paid to the generator.

4.6 Consultation question 6.

Question 6 Potential costs of design, implementation and administration

1. What changes would DNSPs and other parties need to make to their existing systems and processes to enable the design, implementation and administration of LGNCs? To what extent does this depend on:
   - (a) To whom LGNCs are applied (ie whether it is applied to all embedded generators or whether there are criteria based on a generator's capacity, availability and/or location)?
   - (b) The degree of specificity in the calculation of avoided network costs (and, in turn, LGNCs) – ie whether separate calculations are made for different voltage levels and/or locations?
   - (c) How often the calculation is updated?
   - (d) How often the LGNCs need to be paid?
2. What are the likely costs associated with undertaking the changes described above and how are these likely to vary depending on the factors set out in 1(a) to (d)?
3. How do these costs compare to the expected benefits of the proposed rule change?

As noted in response to consultation question 4, the increase of DE sources is likely to necessitate a more complex, data-based electricity industry going forward. This rule change presents an excellent opportunity for the AEMC to consider the long term integration of DE sources and how new technical solutions can be utilised to improve the efficiency of the electricity industry, and ultimately deliver greater benefits to consumers.

Consideration of appropriate temporal and locational specificity in relation to a potential LGNC, should be conducted within a broader review of the framework for cost-reflective tariff design. Indeed, efficient, appropriately specific prices for network services could be used to calculate both a cost-reflective tariff and an LGNC for network services. Such an approach would result in more efficient pricing, and reduce the administrative costs of calculating avoided network costs.