Submission No 32

COGENERATION AND TRIGENERATION IN NEW SOUTH WALES

Organisation: NSW Distribution Network Service Providers, Ausgrid, Endeavour Energy and Essential Energy

Name: Mr Vince Graham

Position: Chief Executive

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Mr Jonathan O'Dea MP
The Chair
Public Accounts Committee
Parliament House
Macquarie Street
Sydney NSW 2000

Dear Mr O'Dea

The NSW DNSP's submission to the *Inquiry into cogeneration and trigeneration in New South Wales*.

The NSW Distribution Network Service Providers, Ausgrid, Endeavour Energy and Essential Energy (the NSW DNSPs) welcome the opportunity to provide this joint submission to the *Inquiry into cogeneration and trigeneration in New South Wales*.

The NSW DNSPs note that cogeneration and trigeneration are forms of embedded generation. Embedded generators are a privately owned generation source connected within a distribution network that does not have direct access to the transmission network. They are 'embedded' with or near loads supplied by the electricity system allowing embedded generator customers to receive the benefit of their own generation through minimising consumption from the public pool and network.

Cogeneration and trigeneration embedded generation allow the simultaneous production of electricity, heat and cooling from a single fuel input to maximise the efficiency of its utilisation as an energy source. From a network perspective, the connection and utilisation of the electrical energy produced by a cogeneration/trigeneration plant is no different from other forms of embedded generation. Accordingly, issues associated with embedded generation are the main focus of this submission with some references to other considerations which are relevant to the specific characteristics of cogeneration/trigeneration.

Electricity networks have been traditionally designed and built according to a paradigm which assumes that electricity flows in one direction, from a large generation source to the end consumers via transmission and distribution networks. Embedded generation introduces potential and time variant two way flows of electricity into networks, which they are not traditionally built or designed to accommodate. As networks are not traditionally built to handle two way flows of electricity, the connection of embedded generation can cause potential system protection, fault level, and voltage regulation issues, which in turn may adversely affect a DNSP's ability to safely deliver power supply and affect the reliability and quality of other customers supplied to the network.

In order to facilitate the connection of an embedded generator, a DNSP may need to undertake significant additional studies to determine the impact of the embedded generator on its network. These studies include consideration of whether additional system augmentation and/or protection requirements are necessary to ensure that the embedded generator can be integrated into the network without compromising the safety, reliability or quality of other customers' power supply.

Undertaking these studies and developing technical solutions to enable embedded generators to safely connect to networks (by meeting the necessary technical requirements) may take time and can often be quite costly to the applicant.

However, it is important to emphasise the necessity of these precautions in order for DNSPs to maintain:

- Safety - to customers, people working on or near the electricity network and the general public.
- Protection of equipment from damage - DNSP infrastructure, customer installations and appliances.
- Reliability and quality of power supply to all customers.

Whilst noting the technical issues that need to be addressed, it should be stressed that these issues can be overcome, and that there are numerous cases where cogeneration and trigeneration have been connected to distribution networks and are operating successfully.

In this respect, we are supportive of the direction of the recent AEMC Draft Rule Determination – Connecting Embedded Generators which is aimed at developing streamlined connection processes, documentation and technical requirements for embedded generator connections. In addition, we note that there have been a number of recent reforms and policy initiatives that complement and underpin the regulatory framework. Further detail on recent reforms and policy initiatives is found at attachment B.

If you would like to discuss this submission further, please contact Mr John Hardwick, Group Executive Network Strategy at Networks NSW on [redacted] [redacted] or via email at [redacted]

Yours sincerely,

[redacted]

Matthew Webb for
Vince Graham
Chief Executive Officer
Ausgrid, Endeavour Energy and Essential Energy

Attachment A - Responses to the Terms of Reference

i) Whether the current regulatory framework can adequately support the utilisation of cogeneration/trigeneration precinct developments.

We note there have been a number of market reviews and inquiries undertaken in recent years aimed at testing the appropriateness of the framework for accommodating generator connections. These reviews have generally concluded that the framework is appropriate and robust[1]. We also note the opportunities provided by recent industry reforms and policy initiatives such as:

- The establishment of the National Energy Customer Framework (including the addition of the new Chapter 5A to the existing National Electricity Rules (NER)).
- The establishment of a National Framework for Distribution Planning and Expansion.
- Reforms that are being considered and developed as a result of the AEMC Power of Choice Review.

In addition, the AEMC is currently consulting on a connecting embedded generators rule change which is aimed at developing streamlined connection processes and documentation for embedded generator connections. Accordingly, we believe that time needs to be allowed in order for the reform changes to be implemented and the impacts to be realised, before further fundamental changes to the regulatory framework are considered. Further detail on recent reforms and policy initiatives is found at Attachment B.

ii) The operation of cogeneration/trigeneration technology in other jurisdictions and the applicability of the technology to New South Wales.

The viability of potential cogeneration/trigeneration projects may be affected by jurisdiction specific planning, installation and operating approval requirements, and energy efficiency incentive schemes.

iii) The economic viability of cogeneration/trigeneration technology in New South Wales including the impact of future gas prices on the running costs of cogeneration/trigeneration systems.

Commercial outcomes for embedded generators can vary widely depending on the nature of the host customer installation energy requirements and the input fuel. For example, as natural (mains) gas is the most commonly used input fuel, its relative cost will have a significant influence on the commercial viability of a potential cogeneration/trigeneration installation.

The metering arrangements used in any given customer installation can also have a significant effect on the commercial prospects of a potential cogeneration/trigeneration site. This is particularly evident for a 'precinct' based system where a local embedded generator source supplies nearby ("local") customers. A typical example for demonstrating this point is a commercial building with a cogeneration system. If the building is owner occupied and has a single metered entity, it can locate a cogeneration unit behind the meter, and avoid both retail and network charges fully.

If it is tenanted, with many individually metered customers, the cogeneration unit could be located behind the base services meter and fully offset costs for that account. However energy to the tenant accounts would at best, avoid the retail portion of the bill and full network charges would be paid by all tenants.

[1] See for example, AEMC 2011, Transmission Frameworks Review, First Interim Report, 17 November 2011, Sydney.

This demonstrates that an identical physical and electrical performance arrangement can have very different commercial outcomes which should not be the case. This represents a cross-subsidy to those customers who locate their generators behind the metering, which is likely to drive sub-optimal investment.

The above issue relates to the inequities and inefficiencies resulting from the poor price signals conveyed to customers in relation to their network usage decisions. This is a broader issue that results in a distortion of customer decisions regarding investment and operation of embedded generation units. For example shoulder and energy charges in network tariffs also distort network usage decisions by encouraging an inefficient level of energy conservation during periods when the network is not likely to be constrained.

The longer term solution to the above issues is to convey cost reflective network pricing solutions to these customers. It is only in this situation that investment in embedded generation will be based on efficient incentives and that efficient generation behaviour will occur once the investment has been made. However, cost reflective pricing can only be achieved where interval metering has been installed. Even where interval metering is present, it will take time to achieve a cost reflective pricing solution.

Grid support and Investment Deferral

Whilst it is possible for greater levels of embedded generation connections to lead to network investment deferral, it is important to qualify this as currently being a generally limited benefit because:

- embedded generators of this nature cannot, for technical reasons, be generally relied on for network support[2];
- embedded generation proponents generally seek a network supply as a standby or backup anyway;
- they have no contractual obligation to operate at the times they are needed; and
- upgrading of the shared network is often required to accommodate embedded generation (both to manage fault level requirements and voltage regulation in order to accommodate the embedded generator's export[3], as well as additional capacity and connection points to convey the generated energy).

In our experience, connection applicants who have connected embedded generators to supply their own load have generally sought to retain access to network supply for standby/backup to cover maintenance and failures of their generation systems. This means the network assets (and associated capacity availability) need to be maintained as though the customer was using them. Currently, due to a lack of cost reflectivity in current tariff structures, embedded generators are not paying for grid support/stand by capacity.

Consequently, as there is currently inefficient price signalling and connection applicants are not paying the true cost for supplying their connection and required services (that is, they are not paying for the standby capacity that they receive) they are being cross subsidised by other load customers.

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[2] We commissioned a study in 2012 that modelled the stability of typical 'tri-generation' units based on typical fault clearance times for our network. The results suggested that these units would be unstable for local upstream faults, and could not be relied on for network support for these scenarios. The study also indicated that for transmission and sub-transmission faults, that the generator system was likely stable, and so able to ride through these faults. Further modelling and empirical studies are needed to determine the extent to which generators can be relied on for network support.

[3] Pragmatically, the higher the desired level of embedded generator export, the more network capacity is required to "absorb" the exported energy and transport it to a point within the network hierarchy where it can be distributed to a sufficiently large customer base.

This results in load customers paying higher prices than necessary, without any off setting benefit.[4]

Another consequence of this inefficient price signalling is that it has the potential to make significant portions of the network appear to be under-utilised for potentially long periods of time (as the capacity has been reserved by the embedded generator and may be infrequently used). Further, as penetration levels of embedded generators increases, DNSPs will also encounter difficulties in how any such reserve capacity should be allocated.

This issue could be addressed by reforming tariffs so that they were more cost reflective, consisting of higher fixed charges and a move to more capacity based pricing. However, as noted above, the ability of DNSPs to provide more cost reflective price signalling is limited to the availability of enabling technology. In the absence of enabling technology, a mechanism would need to be developed in the NER to correct the current cross subsidisation of grid support.

Once this issue is addressed, the NSW DNSPs envisage that over time, as more embedded generators connect and DNSPs become more familiar with how the technology impacts on their network, network support contracts may become more common place and workable. This would result in more efficient outcomes to consumers through network deferrals and better utilisation of existing electricity assets.

iv) Any financial, public safety and/or other risks to prospective cogeneration/trigeneration customers.

The NSW DNSPs note that embedded generators can provide benefits to both customers and networks. However, the proliferation of embedded generators connected within distribution networks needs to be considered in the broader context of a DSNP's obligation to provide a safe and reliable electricity supply for all customers that meets licence conditions and regulatory requirements.

As a general principle (although subject to security and technical considerations discussed in this submission), NSW DNSPs seek to treat embedded generators in the same manner as any load customer seeking to connect to its network. In order to facilitate the connection of embedded generators, we have developed a set of standards which set out the technical requirements and processes required to safely connect embedded generators to the network[5]. These are designed to address risks to our customers, and prospective cogeneration/trigeneration customers and the community in general.

In terms of financial risks to prospective cogeneration/trigeneration customers, we note that should the vendor go into receivership, there may be the potential for a loss of supply to these customers until such time as alternative supply arrangements are made.

v) Any supply security and reliability issues associated with cogeneration/trigeneration, especially for residential customers of these systems.

In respect of supply security and reliability and as noted earlier, networks have traditionally not been designed or built to handle the two way flow of electricity (i.e. they are built primarily to distribute electricity not receive). Hence, when generators connect to the network they expose DNSPs to a range of risks and introduce added complexity in managing and operating the network.

[4] A DNSP must incur investment expenditure to provide capacity to enable customer and embedded generator connections. If the embedded generator is load supplying and drawing, the DNSP cannot recover use of system charges from the embedded generator despite them still relying on the DNSPs network for support. The DNSP still needs to recover the cost of its investment; however, it has a smaller customer base to recover these costs from which results in higher use of system charges.

[5] Details provided in Attachment B.

All embedded generators (except for micro and some small embedded generator connections) can impose the need for DNSPs to investigate the impact of the proposed connection on the safety and performance of the network. Consequently, the connection process varies in terms of time, parties involved (in terms of the contestable works), information requirements, technical studies, technical requirements and costs depending on the following important factors:

- the capacity of the generator seeking to connect;
- whether the generator is seeking to export electricity; and
- whether existing assets need to be altered or additional connection assets installed in order to enable the embedded generator to safely connect to the network.

Moreover, in order to connect to the network, a generator must satisfy technical requirements to maintain:

- Safety to customers, people working on or near the electricity network and the general public;
- Protection of equipment, including our network and other customer installations; and
- Reliability and quality of supply to all customers.

These principles are applicable to all customer connections; however, it is more technically complicated to connect a generator that can export electricity to the network than it is to connect a load or a generator that will not export.

Typically the size, complexity and duration of system studies increases with increasing connection capacity and voltage. Also, as the generator connection voltage increases, the equipment specifications for connection to the network may become more onerous due to the impacts the generator can have on system performance.

Consequently, the information requirements, technical studies and costs for connecting larger embedded generators can be significantly more than for micro and smaller generators. In addition, the time required to connect large embedded generators to the sub-transmission network is also substantially longer than the time taken to connect embedded generators to the distribution network. This is largely a reflection of the complexity involved in connecting these types of embedded generators to the network.

vi) The ability of existing regulatory arrangements at the New South Wales and national level to address issues which may be identified.

Please refer to our response to i) above.

vii) Any other relevant matters.

The most recent regulatory development that impacts on the uptake of cogeneration and trigeneration in NSW is the AEMC Draft Rule Determination – Connecting Embedded Generators. This Rule change is aimed at developing streamlined connection processes and documentation for embedded generator connections and as such, will be of assistance to both the DNSPs and connection applicants.

The NSW DNSPs note that a current challenge faced by DNSPs in facilitating embedded generator connections (which include both cogeneration and trigeneration) is that connection applicants can be uncertain or overly optimistic regarding what type of connection they require (whether the connection is to allow export, grid support, or where the connection capacity may change over time) or do not have a firm view of the type of generating unit and its technical characteristics that they are seeking to have connected.

This uncertainty has subsequently resulted in an iterative and time consuming process at the inquiry stage of the connection process. In our experience, we have often needed to work with the connection applicant to better define/refine their requirements so that we have been able to undertake the necessary analysis to facilitate the connection applicant's connection.

Consequently, the NSW DNSPs strongly support the new requirements (set out in the draft Rule) for connection applicants to provide more information when lodging their inquiries. Providing this information will enable DNSPs to gain a better understanding of the connection applicant's connection requirements/objectives; and would assist in the early identification of technical issues which may necessitate further time or impact on the feasibility of the connection. Further, this should also reduce the level of iteration that occurs in the initial inquiry stage of connections, as DNSPs would have the necessary information to provide the connection applicant with a timely response.

Whilst the NSW DNSPs already provide guidance to connection applicants to help facilitate their connection,[6] we consider that the draft Rule requirement to publish an 'information pack' would assist in:

- Providing further guidance to potential applicants;
- Helping the connection applicant in defining their connection requirements; and
- Would provide an indication of the possible costs for connections which would help the connection applicant to determine the feasibility of their proposed connection (prior to them lodging an inquiry), thus reducing the number of connection inquiries for DNSPs to process.

[6] *Ibid*

Attachment B – Developments in the current regulatory framework

As detailed in our submission, a number of policy initiatives and reviews have taken place to facilitate embedded generation in the NEM. It is important to note that some of the market reforms and reviews aimed at addressing embedded generation issues are still being finalised. Consequently, the changes and recommendations from these reforms are yet to be implemented. We maintain that further time is required in order to allow for these changes to be implemented and for processes to be bedded down before further changes to the regulatory framework are proposed.

This section is aimed at providing a brief summary of these initiatives by industry body.

Ministerial Council on Energy (now Standing Council on Energy and Resources)

- *Economic regulatory incentives for demand side response and embedded generation* (released in 2007) – the NERA Consulting papers released as part of the MCE's economic regulatory package focused on efficient pricing through interval meters to incentivise demand side response (DSR) and embedded generation, but recommended introduction (or continuation) of some specific mechanisms until efficient pricing is achieved. The NERA papers included 28 recommendations, some of which sought immediate changes, while the majority recommended further work be undertaken to develop appropriate approaches.
- *National Energy Customer Framework* (Finalised in 2012) - Resulted in the development of a national connection framework (Chapter 5A), which streamlines the connection process for customer and generator connections.
- *Draft Energy White Paper* – notes that the current framework is generally robust, however, notes that the increasing proliferation of intermitted generation may pose challenges for DNSP and that this may require further assessment of the structure and operation of networks.

Australian Energy Market Commission (AEMC)

- *Demand Side Participation (DSP) Review – Stage 2* (Final Report 2008) - recommended that the AEMC undertake a review of technical standards for embedded generators
- *Reliability Panel Review of Technical Standards (2009)* – a comprehensive review of technical standards for embedded generators was deferred until there had been sufficient connections under technical standards to assess the appropriateness of the standards.
- *Scale Efficient Network Extensions(SENE) – rule change proposal* (Final Rule 2011) – AEMC determined that the scope for efficiency gains at a distribution level for SENE was less than transmission networks and noted that SENE could result in inefficient investment and duplication of assets for distribution networks.
- *Inclusion of embedded generation in demand management schemes – rule change proposal* – (Final Rule 2011) the Demand Management Incentive Scheme objectives were amended to include embedded generation and the title was amended to recognise demand management schemes encompassed embedded generation.
- *Network Support Payments and Avoided TUoS for Embedded Generators – rule change proposal* (Final Rule 2011) – rule determined that the level of compensation for embedded generators should be reflective of the benefits they provide to the transmission network. In other words, payments to embedded generators should reflect the extent to which they defer investment.
- *Power of Choice: DSP 3 Review* – (current) draft advice will consider whether arrangements provide the right incentives for DNSPs to connect and engage with embedded generators in an efficient and timely manner, as well as efficient options to enhance the ability of embedded generation installation.

- *Small aggregator generator framework rule change proposal* – (current) aims to establish a new category of Registered Participant to streamline current registration and meter data processes for small generating units.
- *Connecting Embedded Generators, Draft Rule Determination (AEMC)* - aimed at developing streamlined connection processes and documentation for embedded generator connections.

Energy Networks Association (ENA)

- *Embedded Generation – ENA Policy Framework Discussion Paper (November 2008)* – outlines key issues from a network perspective that have arisen under the current framework and also outlines key industry positions in relation to these issues.
- *Impacts and Benefits of Embedded Generation in Australian Electricity Distribution Networks* (March 2011) – outlines embedded generation scenarios and analysis methodologies featuring in Australian distribution network segments and outlines key considerations for customers, networks and regulation.
- *ENA Guideline for the preparation of documentation for connection of Embedded Generators within Distribution Networks* (May 2011) – provides a national reference framework for the preparation of documents for connection of embedded generation within distribution networks. It is aimed at providing general information to assist the DNSP in developing and or reviewing documentation for customers in relation to embedded generators.
- *Demand Management Embedded Generation Committee (DMEG)* – formed by ENA members in order to facilitate the connection or embedded generations and the removal of technical barriers to embedded generation connection.

NSW DNSPs

- *Electricity Supply Standard ES11* – outlines the requirements for the connection of embedded generators.
- *Network Standards NS194* – outlines technical requirements for the connection of embedded generators.
- *Generator connection agreement* – sets out the general conditions for connection as well as the operating and maintenance protocol to be followed by the embedded generator.
- *Member of the ENA Demand Management Embedded Generation (DMEG) Taskforce* – which is aimed at facilitating the connection of embedded generation, by identifying technical solutions to allow their safe integration into the network and identifying strategies for the removal of other perceived barriers to connection.
- *Connection of a Power Generator System* – document has been developed to inform people wishing to connect a power generator system (including solar generators) to Endeavour Energy's distribution network.
- *Technical Review Request* – request for technical assistance to determine preliminary connection requirements prior to lodging a formal application for large or complex developments. This includes master planning for major projects or subdivisions, embedded networks, asset relocations and embedded generator connections.

Attachment C: Summary of typical cogeneration/trigeneration plant installations

The following list provides an indication of the typical situations where cogeneration/trigeneration installations may improve energy efficiency and/or utilise otherwise wasted fuel sources:

- Commercial buildings and complexes – provision of air conditioning and hot water services via exhaust heat recovery from gas engine driven electricity generation plant (with absorption chillers for cooling).

- Industries requiring high volumes of sterilising and/or clean down hot water (such as abattoirs and food processing plants) – exhaust heat recovery from gas engine driven generation plant to supply the full or part electricity load demand.

- Industries which create potential fuel sources from waste products including:

    - saw mills and timber processing plants which burn bark, saw dust and wood shavings to generate electricity and provide heat for kiln drying, product curing and hot water services; and

    - abattoirs and other biomass waste producing industries which allow methane production to fuel gas engine driven electricity generation.

- Greenhouse dependent horticulture industries (requiring UV light with temperature controlled and CO_2 enriched atmospheres) – gas engine driven electricity generation with exhaust heat and CO_2 recovery.

- Future gas powered fuel-cell (and micro generator) CHP (Combined Heat & Power) plants.