Submission No 44

COGENERATION AND TRIGENERATION IN NEW SOUTH WALES

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NSW GOVERNMENT | Trade & Investment

Office of the Director General

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Mr Jonathan O'Dea MP
Chairman
Public Accounts Committee
Parliament House
Macquarie Street
SYDNEY NSW 2000

Dear Mr Chairman

Cogeneration and Trigeneration in NSW

Thank you for the opportunity to inform the Committee on this important issue.

I have attached a paper addressing key areas of the energy supply industry that are of relevance to the Committee. This submission also incorporates information submitted on behalf of the Department of Planning and Infrastructure with respect to project approvals and planning policy, as well as the Office of Environment and Heritage and the Environment Protection Authority with respect to NABERS energy ratings and potential impacts on air quality.

NSW Trade & Investment welcomes this Inquiry as it is concerned that the current regulatory framework does not fully address cogeneration and trigeneration technology or public safety risks and supply security and reliability issues.

NSW Trade & Investment looks forward to the deliberations and findings of this Inquiry.

Yours sincerely

[redacted]

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24.9.13

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NSW GOVERNMENT | Trade & Investment Resources & Energy

Cogeneration and Trigeneration in NSW

Submission to the NSW Legislative Assembly
Public Accounts Committee Inquiry

September 2013

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Executive Summary

In its response to the Commonwealth Government's Draft Energy White Paper, the NSW Government expressed its desire to ensure the appropriate arrangements for integrating embedded generation, including trigeneration systems and the supply of thermal energy, are addressed by the Australian Energy Market Commission in the National Electricity Market framework.

In the interim while national arrangements are considered, the NSW Department of Trade & Investment, Division of Resources and Energy (the Department) welcomes the NSW Legislative Assembly Public Accounts Committee Inquiry into the issues associated with cogeneration and trigeneration. As the issues arising with cogeneration are duplicated in trigeneration this submission will focus on trigeneration only given it has the potential to be used more often in situations affecting the public and small residential energy customers.

This submission outlines background information on and possible implications of current arrangements for:

- Consumer protection: Although State and Federal legislation governs the sale and supply of electricity and gas, there are currently no specific regulatory arrangements or consumer protections governing the sale of thermal energy in the form of hot or chilled water. This means trigeneration customers only receive general protections under the *Australian Consumer Law* (ACL) set out in Schedule 2 of the *Competition and Consumer Act 2010(Cth)*.

- Consumer choice: Due to the bundled nature of some trigeneration operations, customers are unlikely to be provided with a choice of electricity and thermal energy retailer; and may not be protected against financial failure by the trigeneration system operator.

- Public safety: Like traditional electricity networks, trigeneration networks operate in public spaces at voltages and currents which can potentially cause fatalities and serious injuries. The specific public safety risks associated with trigeneration systems, and appropriate mechanisms to address these risks, may still need to be evaluated. In addition, trigeneration thermal energy networks, particularly the hot water or steam pipelines in public spaces, are not currently covered by NSW safety and technical regulation.

- Security and reliability of supply: To maintain services the traditional electricity network is required to deliver adequate supply capacity, reliable performance and appropriate voltage levels without excessive fluctuation. For trigeneration systems this means addressing the supply of fuel i.e. gas, reliable operation of the trigeneration units and networks, appropriate back-up arrangements and a plan to deal with financial failure.

- Other issues: including connection rules, network performance, and requirements for design, construction, operation and maintenance and current licensing arrangements for exporting electricity.

This submission also incorporates information submitted on behalf of the Department of Planning and Infrastructure with respect to project approvals and planning policy, as well as the Office of Environment and Heritage and the Environment Protection Authority (NSW EPA) with respect to the National Australian Built Environment Rating System (NABERS) energy ratings and potential impacts on air quality.

Introduction

This is a time of significant change in the national energy framework, with the ongoing policy development associated with reducing cost of living pressures driving innovative approaches to the provision of efficient energy to consumers. In its response to the Australian Government's Draft Energy White Paper, the NSW Government expressed its desire to ensure the appropriate arrangements for integrating embedded generation, including trigeneration solutions and the supply of thermal energy, are addressed by the Australian Energy Market Commission (AEMC) in the National Electricity Market (NEM) framework.

The NSW Department of Trade and Investment, Division of Resources and Energy (the Department) welcomes the NSW Legislative Assembly Public Accounts Committee Inquiry (the Inquiry) into the issues associated with cogeneration and trigeneration.

While national arrangements are developed, the Department has prepared this submission to the Inquiry covering public safety, consumer protection and supply issues associated with trigeneration systems in public spaces and development precincts. This submission highlights a range of issues relating to trigeneration systems considered to be of likely importance to the community and stakeholders.

The Department notes that a number of stand-alone trigeneration installations, contained wholly within one premises, already exist. This submission does not address these types of infrastructure as the Department considers them to be adequately covered by existing arrangements. This submission also considers how trigeneration system arrangements in NSW can best align with broad energy market objectives and whether current legislative and market mechanisms support the development of trigeneration and cogeneration.

The Department considers more safety and consumer protection issues arise with trigeneration given it has the potential to be used more often in situations affecting public spaces and residential energy customers. Also as the issues arising with cogeneration are duplicated in trigeneration this submission will focus on trigeneration only.

This submission is intended to inform the Inquiry on public safety, consumer protection and supply issues related to trigeneration systems in NSW. The submission discusses these issues as they relate to trigeneration and through this submission seeks to provide the Inquiry with information on the relevance and importance of these issues.

Specifically, this submission is intended to assist the Inquiry as it:

- Considers issues arising from trigeneration systems including consumer protection and choice, public safety and security of supply;
- Seeks community and stakeholder help to identify any regulatory barriers or inconsistencies which may hamper the development of trigeneration systems; and
- Seeks community and stakeholder input on whether specific NSW arrangements should be developed to manage trigeneration systems.

This submission is principally focused on, consumer protection and choice, public safety and security and reliability of supply. This submission also incorporates information submitted on behalf of the Department of Planning and Infrastructure with respect to project approvals and planning policy, as well as the Office of Environment and Heritage and the Environment Protection Authority (EPA) with respect to NABERS energy ratings and potential impacts on air quality.

A Glossary containing definitions used in this submission is included at the end of this document.

Workplace health and safety issues related to trigeneration system employees are not considered in this submission as they are covered by the NSW *Work Health and Safety Act 2011*. It should also be noted that any proposed energy related development will remain subject to planning approval under the NSW *Environmental Planning and Assessment Act 1979*. Matters discussed in this Inquiry should not impact on those requirements, details of which are provided below on behalf of the Department of Planning and Infrastructure.

Project approvals

Under *State Environmental Planning Policy (State and Regional Development) 2011*, the Minister for Planning and Infrastructure is the consent authority for electricity generating works, including cogeneration (using any energy source, including gas, coal, biofuel, distillate, waste, hydro, wave, solar or wind power) that:

- has a capital investment value of more than $30 million, or
- has a capital investment value of more than $10 million and is located in an environmentally sensitive area of State significance.

Projects that meet these criteria would be subject to assessment under Part 4.1 of the *Environmental Planning and Assessment Act 1979* as State Significant Development. Several gas-fired or potentially gas-fired power stations with scope for combined cycle generation (re-use of produced heat for additional electricity generation) have been approved in NSW, including:

- Bamarang Power Station (700 MW)
- Marulan Power Station (1150 MW)
- Tallawarra B Power Station (450 MW)
- Bayswater B Power Station (2000 MW)
- Mount Piper Power Station Extension (2000 MW)

It should be noted that combined cycle generation is generally only one of several options for electricity generation in these proposals.

In addition, several State Significant Development applications for industry have proposed cogeneration, including:

- Shoalhaven Starches Flour Mill, Bomaderry
- Illawarra Cogeneration Plant, Port Kembla Steelworks
- Cargill Abattoir, Bomen

Micro cogeneration and trigeneration have also been proposed as part of State Significant Development proposals for residential development, including Darling Walk, Multiplex Site 3 at Sydney Olympic Park and Blocks 1-4 at the former Carlton United Breweries site in Chippendale. These cogeneration and trigeneration proposals assist the proponents in meeting mandatory energy

efficiency requirements under the Department of Planning and Infrastructure's Building Sustainability Index (BASIX).

The then Minister for Planning's development consent conditions for the TransGrid and Energy Australia MetroGrid project (2002) required the proponents to establish a Demand Management and Planning Project. The Demand Management and Planning Project included demonstration projects for residential cogeneration in Chatswood and Rouse Hill and commercial trigeneration in North Sydney and Sydney CBD. The June 2008 final report on the DMPP is available from TransGrid's website.

Planning Policy

State Environmental Planning Policy (Infrastructure) 2007 specifically encourages heat and biofuel cogeneration through land use permissibility provisions. The SEPP makes industrial development permissible with consent wherever coal or gas-fired electricity generation is permissible with consent. The SEPP also makes electricity generation permissible without consent wherever sewage works are permissible without consent.

Objective 18 of the draft Metropolitan Strategy for Sydney supports decentralised electricity generation and the co-location of land uses that generate and consume waste energy, heat and water. Action 18.1 is to identify opportunity precincts for decentralised energy and water supply schemes and develop guidelines for their implementation in the short-term through Subregional Delivery Plans.

Trigeneration systems

What is trigeneration?

Trigeneration, also known as combined heat, power and cooling, is the simultaneous production of electricity, heat and cooling from a single power plant. It is said to offer energy savings of up to 45 per cent, depending on the type of installation. Both cogeneration and trigeneration systems consist of three components namely:

- a generating unit which outputs electricity and thermal energy (for example heat);
- a distribution network conveying electricity and thermal energy to premises in a defined area or precinct; and
- an installation that conveys the electricity and thermal energy within the premises for use by various appliances or equipment.

In cogeneration only two forms of energy, normally electricity and heat are produced. A trigeneration system adds to this by using part of the heat energy to produce chilled water as a third form of energy.

Trigeneration systems should typically be designed to maximise the thermal usage and plant operating times. In this way, multiple buildings can efficiently utilise the electricity and thermal energy generated and distributed by the tri-generation system.

Connecting a specific building or premises to a trigeneration system normally comprises electrical, heating and cooling installations. This might include the existing electrical wiring and water pipes in a building combined with an on-site trigeneration unit, such as a gas-fired generator located in the building's basement. The installation may, however, use a trigeneration network to source electricity, heating and cooling from a trigeneration unit located off-site.

Trigeneration networks vary significantly from a traditional electricity network because they can interconnect multiple trigeneration units to provide energy to multiple trigeneration installations. Some proposals also incorporate the distribution of gas as a fourth form of energy, however, this is not an essential component of a trigeneration system.

In trigeneration networks, electrical lines and water pipes are often used to transport energy from a trigeneration unit in the public space between buildings and also through a trigeneration precinct.

Trigeneration networks may also have limited or no supply to and from the main electricity network.

How trigeneration differs from historic energy networks

In trigeneration systems generation, distribution and retail operations are often conducted by a single entity whereas conventional energy systems conduct through separate entities. Another key difference between the two systems is that with trigeneration all of the different forms of energy come from the one source. Trigeneration systems are mostly designed to cater to the peak demand for energy of the building or precinct it serves. It is common to limit export of electricity to the excess produced at non-peak times. Export is only possible where a system is connected to the grid, which has associated connection costs which must be borne.

Trigeneration system operators often seek to contractually bind their customers to dedicated supply arrangements. This ensures demand and financial certainty for trigeneration investments in generation and distribution via firm supply contracts. This is different to the current legislative and market mechanisms for the traditional electricity industry and normally comprises three separated sectors:

- *Remote generators* operating in a commercial wholesale market (the NEM) which generate electricity and inject it into the electricity transmission and distribution system for use by consumers some distance away;
- *Electricity transmission and distribution networks* operating as regulated monopolies, which convey electricity at high voltages from multiple remote generating sites to individual households and businesses; and
- *Retailers* operating in fully competitive retail markets, which buy electricity from the generators through the NEM and on sell it to households and businesses. Retailers pay the regulated transmission and distribution "use of system" charges (TUoS & DUoS) to the network operators.

Advantages of trigeneration

The electricity sector is constantly looking for innovative approaches to provide energy efficiently to customers. Trigeneration systems can have some significant advantages over traditional large coal-fired electricity generators, including:

- Lower capital cost of generation is sometimes possible stemming from mass production of small standard trigeneration units resulting in lower marginal cost per kilowatt for installed generation capacity;
- Smaller generation units can be built more quickly meaning new generation capacity can be brought on-line in a shorter timeframe and with a smaller physical footprint;
- Incremental increases in generating capacity can more closely match demand, minimising the under-utilisation of generation assets;
- Smaller increases in generating capacity allow for an incremental investment of capital as opposed to the 'lumpy' nature of large-scale generation capital expenditure;

- Trigeneration units are generally more efficient because a higher percentage of the output energy is utilised by the customer;
- Capital expenditure on the traditional poles and wires network may be reduced.

This final point is often emphasised when making the case for the financial viability of trigeneration. However, many operators of trigeneration units still wish to be connected to the grid to provide back-up supply, or enable exporting of excess energy. This continues to impose network costs, despite the connection only being used infrequently, that reduce any anticipated savings in network costs. Furthermore, if a trigeneration unit or network fails it may result in supply disruptions to outside customers because the existing network has not been upgraded to meet the increased level of demand.

Further, gas fired trigeneration requires the development and maintenance of a gas distribution network and security of gas supply.

Consumer protection

Protection for energy customers is regulated by the *National Energy Retail Law* (NERL) and the *National Energy Retail Rules* (NERR), known collectively as the National Energy Customer Framework (NECF) which commenced in NSW on 1 July 2013. The NECF establishes a strong energy consumer protection framework for gas network and grid based electricity customers. To protect vulnerable customers and prevent anti-competitive behaviour, traditional energy retailers are licensed and small retail customers are provided with a number of safeguards including hardship arrangements and a dedicated Ombudsman to deal with small retail customer disputes.

Many of the same consumer protection issues for small retail electricity customers (i.e. residential and small commercial customers consuming less than 100 MWh/year) would also arise from trigeneration, including the potential for trigeneration customers to be treated differently from, and afforded less protection than, customers using the traditional energy networks.

Currently, protection from unfair disconnection and billing practices do not apply to customers of unlicensed suppliers, however the Australian Energy Regulator's (AER) new Exempt Selling Guideline (part of the NECF package) will have an impact on this policy area. The AER is authorised to exempt persons or classes of persons from the requirement to hold a retailer authorisation. The NERR provide for three different types of exemption:

- deemed exemptions,
- registrable exemptions, and
- individual exemptions.

To manage this process, the AER has published the Exempt Selling Guideline. The Guideline explains how to apply for an individual exemption, and how to obtain a registrable exemption (by registering with the AER as belonging to a class of registrable exemption). It also discusses the factors that the AER will consider in assessing individual exemption applications. The guideline sets out the various classes of deemed and registrable exemptions, and the conditions attached to each class of deemed and registrable exemption. These protections may extend to trigeneration customers who purchase electricity from a trigeneration system operator but do not cover thermal energy.

There are currently no specific regulatory arrangements or consumer protection laws governing the sale of thermal energy in the form of hot or chilled water and the Energy and Water Ombudsman NSW

(EWON) does not have the authority to assist with issues such as billing, disconnection and reconnection. Trigeneration customers receive general protections from the *Australian Consumer Law* (ACL) set out in Schedule 2 of the *Competition and Consumer Act 2010(Cth)*.

Customers of licensed energy retailers have access to the Retailer of Last Resort (RoLR) arrangements which ensure their electricity or gas supply continues even if their retailer ceases operation. This may not be the case for a customer serviced by a trigeneration network and precinct, and RoLR arrangements do not cover thermal energy supply.

Consumer choice and competition

Retail supply

Since 2002 all NSW electricity customers have been free to choose their electricity supplier in a competitive retail market. This policy was given effect by provisions in the *Electricity Supply (General) Regulation 2001*.

The vertically integrated structure of trigeneration system operators raises a number of consumer choice and competition issues. The bundled nature of the trigeneration operations may eliminate the ability of customers to choose their energy supplier. Trigeneration system operators also often contractually bind their customers to dedicated supply arrangements to ensure demand and financial certainty, which may result in little choice for trigeneration customers in how much they are charged for standard energy services. Requiring a trigeneration system operator to separate their retail business from their distribution arm may add unnecessary cost and complexity.

If competition was retained and a customer chose to buy electricity from a licensed retailer rather than the trigeneration operator, and that electricity was supplied via the trigeneration network, the trigeneration network would then be conveying the electricity on behalf of a retail supplier.

Customers may not appreciate the different risks associated with trigeneration compared with conventional electricity supply and the long-term nature of trigeneration projects may also present difficulties for customers seeking to disconnect from trigeneration system or transfer their electricity supply contract to different suppliers. Similarly, the communal nature of the obligations means the disconnection of one customer from the trigeneration network may unfairly burden the remaining participants.

Some trigeneration proponents have stated to the Department that current retail competition policies increase the risk to trigeneration projects as trigeneration systems match the size of the generator to customers' energy needs. If the amount of electricity that will be bought can vary, the risks to the proponent may become too high. Some consider that minimum consumer protection standards may be required for the contractual allocation of risk between consumers and commercial operators, and to ensure fair pricing.

Network connection

Currently, all owners or occupiers of premises within a supply district that have the right to be connected to the main electricity network can obtain a standard customer supply contract or may apply to any licensed retailer for a negotiated supply contract. These rights may not be applicable to

customers (small retail or other) in a trigeneration system if the system operator has not established a connection to the main electricity grid.

In a scenario where a connection to the traditional electricity network exists, it may be possible to give trigeneration network customers a choice of retailer and access to all of the protections available to customers of the traditional electricity network. In this instance, it is unlikely for electricity and thermal energy supplies to be sold as separate services as the trigeneration unit is normally designed to deliver the full energy needs of the precinct it serves. To split the service would make the project unviable.

If the customer has the right to be connected to the traditional electricity network independently of the trigeneration network, it could be argued that competition exists and therefore the price for delivering electricity via the trigeneration network should be left to negotiation. However, in these circumstances a connection to the traditional electricity network may have to be independent of the trigeneration network and paid for by the retail customer. Customers and trigeneration operators do not always have equal power in negotiations. In addition, retailers may not wish to be involved in supply negotiations where a trigeneration system is involved.

Some trigeneration proponents believe current retail competition policy threatens and undermines the business model of trigeneration projects. Trigeneration systems are developed to match the size of the generator in order to meet predicted energy needs. If the amount of electricity that will be bought is variable, the risks to the trigeneration developer may become so high the project will no longer be viable.

The lack of certainty for trigeneration proponents, plus the potential public benefits from trigeneration systems, suggests these issues may need to be managed. Retailers, Distribution Network Service Providers (DNSP) and customers may also benefit from increased certainty.

Public safety

A key part of the Department's role is the technical and safety regulation of energy infrastructure in NSW. Several aspects of trigeneration networks raise issues in this area and these are discussed below.

Trigeneration electricity networks

Electricity networks are inherently dangerous because of the voltages at which they operate. The Department currently regulates DNSPs to ensure the safety and integrity of the traditional electricity network. The primary instrument for this is the *Electricity Supply (Safety and Network Management) Regulation 2008*, which deals with a number of key issues including public safety, system integrity, bushfire risk management and customer installation safety.

Decades of experience has shown that a regulatory framework is needed to ensure public safety and the technical integrity of the traditional electricity network. Network operators are required to use risk-management when designing, installing, operating and maintaining their systems.

Operators must have a safety management strategy in place that includes an analysis of hazardous events, emergency procedures and standards of practice for working on or near the network.

There appears to be little difference between the design, construction and operation of a trigeneration electricity network and the traditional electricity network. Both operate at voltages and currents which can potentially cause fatalities and serious injuries.

Regulatory arrangements similar to traditional electricity networks (e.g. business authorisation, performance reporting and risk management plans) could be quite onerous on a small trigeneration operator. However, the specific public safety risks associated with trigeneration systems require some form of management

Safety of heating and cooling networks

Trigeneration networks include two energy distribution networks not currently covered by NSW safety and technical regulations: the hot and chilled water networks. None of the Acts or regulations relating to water covers its use as an alternative form of energy. While the pressurised closed loop networks that provide hot and chilled water do not pose the same risks to the public as electricity or gas distribution networks, the issue of public safety remains worthy of consideration.

One key problem in this area is the lack of historical knowledge of thermal energy network safety issues. These are rare in Australia and the Inquiry may wish to consider overseas experience principally in Europe and the Unites States of America where such systems have been in operation for some time.

Bushfire risks

Electricity networks have the potential to trigger bushfires, particularly under extreme weather conditions. As a result traditional network operators are required to design and operate their network in such a way as to minimise the possibility of starting fires. The classification of the areas which are bushfire prone (as defined in the *Rural Fires Act 1997*) within a network area is central to this process. Most trigeneration networks are expected to occur in high population and low bushfire risk areas.

Dangerous electrical installations

Fire and electrocution are both risks for customer electrical installations. DNSPs have the responsibility of ensuring dangerous installations are not connected to the network and that any installations which pose a serious problem are identified and disconnected. DNSPs are also required to provide essential safety information to customers and to refuse connections or disconnect where appropriate. The same issues of consumer safety and fire prevention apply to trigeneration installations and appropriate risk management will be required.

Security of supply

The ability of the supply chain to deliver energy continuously to end use customers is a critical component of energy systems in NSW. Avoiding power supply interruptions (i.e. blackouts and brownouts) is a key concern of the NSW Government and the community especially given the essential nature of electricity in a modern society.

To maintain services the traditional electricity network is required to deliver adequate supply capacity, reliable performance and appropriate voltage levels without excessive fluctuation. For trigeneration

systems this means addressing the supply of fuel i.e. gas, reliable operation of the trigeneration units and networks, appropriate back-up arrangements and a plan to deal with financial failure.

One of the main perceived benefits of trigeneration systems is that there is no need to be connected to the main electricity network and therefore not pay the associated network charges. In some cases, the trigeneration system may deliberately exclude the possibility of electricity supply from the main grid, effectively making the trigeneration system operator a monopoly supplier. If the trigeneration system (generating unit or network) fails, connecting customers to the main network will not be immediately possible and could potentially be expensive, requiring significant investment in new connection infrastructure. In addition, the main electricity network cannot supply the thermal energy needed by customers to the "islanded" trigeneration system, meaning prolonged interruptions for electricity, hot water and air conditioning.

The Department considers the following issues are worth detailed consideration by the Inquiry.

Security of fuel supply

If gas stops flowing to a gas-fired trigeneration unit it will be unable to continue supplying energy to customers. The reliability of gas supply will sometimes be beyond the control of the gas transmission and distribution network operators. There have been a number of gas supply disruptions in recent years resulting from infrastructure and market failures which can last for some months, including the 1998 Longford Gas Plant and 2004 Moomba Gas Plant incidents.

Gas fired power stations have traditionally been regarded as 'interruptible' consumers of gas; they are often asked to 'throttle back' or shut down to preserve available gas supplies for the general community and essential services. Where a trigeneration system is supplying small retail customers, a request for a full shutdown may be inappropriate. In such cases alternative fuel supplies or limited generation may be required.

During supply disruptions, gas is allocated through commercial contracts and load shedding. The NSW Government has response plans in place to deal with longer term shortages. The Short Term Trading Market is also in operation, wholesaling gas to Greater Sydney, Newcastle and Wollongong.

It is not currently clear how supply arrangements for trigeneration systems will interact with existing gas market arrangements, and the Department recognises management may be needed to deal with gas supply shortages to a trigeneration precinct. This would be particularly important when residential or priority consumers such as hospitals and nursing homes are affected.

However, it is important to note neither the NSW Government nor the Department has any role in the establishment or ongoing operation of gas supply contracts which exist between private companies.

Reliability of supply to customers

Electricity is considered an essential service by many and the unplanned loss of supply can result in serious impacts to the community including damage to electrical equipment, the loss of critical health services and disruptions to road and public transport.

Mandatory network design, planning and reliability standards for DNSPs were introduced in August 2005 and are implemented through licence conditions.

While these licence conditions are under review and a national framework is being developed there is a general acceptance that traditional electricity network operators should be subject to some reliability

obligations which specify performance standards and reporting requirements. No such standards apply to trigeneration networks and it is unclear if all customers will expect the same levels of technical reliability.

Reliability outcomes for small retail customers may therefore be considered as an area warranting consideration by the Inquiry.

The reliability issue does not just apply to trigeneration system customers. Trigeneration systems have the potential to impact on the main electricity distribution system causing reliability issues for all electricity consumers. The loss of a trigeneration system that supplies electricity to local customers via the main electricity distribution network (the grid) may result in a "black hole" in the network which surrounding parts of the grid are not designed to overcome. Normal retail customers beyond the area covered by the trigeneration system may then experience power outages.

This risk is likely to grow as an increasing number of trigeneration systems come online over the coming decades. The risk is raised further if the trigeneration system does not pay for the grid to be its back up supply. This is discussed in more detail below.

Reliability of thermal energy supplies

Trigeneration hot and chilled water supplies may be the only source of heating and cooling for consumers in a trigeneration precinct, so a system failure would have a high personal impact. This is particularly the case for the reliability of the hot water supply which could be considered as essential to public health as the source of washing and cleaning for residential customers.

As a result, some developers of trigeneration precincts have indicated that they intend to install a conventional hot water system as back-up (noting that this imposes network connection costs). However, no such option exists for air conditioning systems as these run off a chilled water closed loop system.

Continuity

In the context of this submission the term continuity is used in relation to the long term reliable and secure delivery of all forms of energy to a trigeneration system customer. Consideration should be given to circumstances where a trigeneration operator fails financially when the customer is bound to them either technically or commercially.

A trigeneration operator would likely be privately-owned and regulated by the *Corporations Act 2001 (Cth)*. A financial failure of an operator would theoretically see the trigeneration system cease supplying all forms of energy or even transporting electricity from the main electricity network to its customers and the customer may not be able to respond. In particular, the financial failure of an islanded trigeneration system needs to be considered in a way that removes financial barriers to trigeneration installation while ensuring customers' expectations are met.

Back-up supply

One of the main benefits for trigeneration operators and customers is avoiding traditional network charges. However, trigeneration system operators often rely on the traditional electricity network as a back-up. Exactly how that back-up supply should be paid for is a key issue for trigeneration system operators and the general public.

If a trigeneration operator requires back-up supply capacity from the traditional electricity network, this imposes substantial network costs, even if the connection is only used infrequently. There is often

pressure from owners of trigeneration systems to avoid paying network costs, even where back-up supply is sought. Such proposals can create a risk that these costs are borne by the DNSP, which would flow on to higher charges for all of its customers. This would be a cross-subsidy from the traditional electricity network to the trigeneration network. The economic principles which underpin energy markets tend not to support this scenario.

Generally, back-up supply is expected to be part of the negotiations for connecting to the traditional electricity network. Any contract for back-up electricity should conform to normal electricity retail market rules and include a payment for connection capability and capacity.

This, of course, is dependent on the two systems being interconnected. In some cases, trigeneration systems have been designed as either stand alone (islanded) systems or with the capability to only export to the grid.

An islanded trigeneration network cannot be supported by the main electricity network. Even if a temporary connection was established, the main network would not be able to supply electricity to the trigeneration network as it had not been designed to deliver that supply. In the event of a major problem with the trigeneration system, significant and expensive upgrades to the main network might be needed before supplies could be made available to the islanded trigeneration customers.

Similarly, the failure of a grid-connected trigeneration system to export to the grid might also impact on the reliability of the main electricity network in that area by reducing the amount of electricity available. The main electricity network could require upgrading to meet the demand created by importing electricity from other sources.

Other issues

Currently, some trigeneration system proponents see the technical constraints of connecting to the grid put forward by DNSPs as unnecessary barriers to their projects.

Theoretically, trigeneration systems should not interfere with any parts of the main network and the grid should be able to accept appropriately designed trigeneration systems. In practice, networks will interact in different ways depending on the configurations of each at their connection point.

Connection rules

The Service and Installation Rules of NSW[1] that set out the technical rules for connecting to the grid only deal with stand-by and small-scale generation (via inverters). There are no uniform rules defining how a trigeneration system with significant capacity might be connected. This means the technical requirements for each new proposal are negotiated individually with the relevant DNSP.

The National Connections Framework defined in Chapter 5A of the NER has established a connection process for retail customers with micro-embedded generation such as photo-voltaic generation, via solar panels, using the type dictated by Australian Standard AS4777[2].

While Chapter 5A contains a negotiating framework it does not specify the technical or commercial terms for connecting a larger embedded generation unit, such as a trigeneration unit to the grid or to another trigeneration network.

[1] NSW Government Department of Trade, Investment, Regional Infrastructure and Services, *Service and Installation Rules of New South Wales*, [http://www.dwe.nsw.gov.au/energy/electricity_service.shtml]
[2] *AS 4777: Grid connection of energy systems via inverter*

As the operators of these systems are likely to be commercial entities that can negotiate on an even footing with a DNSP, there should be no need for further action in this area.

Changes to the NER are under consideration that will, at least partially, address this issue. The independent rule making body, the AEMC, has published its draft rule determination and draft rule on the connecting embedded generators rule change request submitted by ClimateWorks, Seed Advisory and the Property Council. Public submission on the draft rule closed on 8 August 2013 and the AEMC is expected to make its final determination shortly. It is important to note that under the national electricity framework any party may propose a change to the NER which will be consulted and assessed by the AEMC.

Network performance

The traditional electricity network is required to deliver electricity at appropriate voltage levels without excessive fluctuation. The required standards for DNSPs are contained in their licence conditions, the *Electricity Supply (Safety and Network Management) Regulation 2008*, and nominated codes and standards.

The performance issues for a trigeneration distribution system are essentially the same as for the main electricity distribution systems. While trigeneration systems are unlikely to support major health services or public transport, an aged care facility is a distinct possibility, highlighting the importance of technical integrity.

Trigeneration system customers use the same appliances as other main grid electricity customers and should have the same right to expect that their trigeneration system supply will not damage their electrical or electronic equipment.

Design, construction, operation and maintenance

Technical design, construction, operation and maintenance requirements for trigeneration systems have not yet been determined, particularly whether these systems are compliant with any relevant Australian or International standards. Hence, there is a level of uncertainty on what should be applied under Australian conditions.

Overseas experience with thermal energy systems may be relevant to this issue.

Environmental sustainability

As trigeneration systems are lower carbon producers, the development of trigeneration precincts may provide further opportunities for less polluting energy systems.

NABERS

The National Australian Built Environment Rating System (NABERS) is a national rating system that measures the environmental performance of Australian buildings, tenancies and homes. NABERS measures the energy efficiency, water usage, waste management and indoor environment quality of a building or tenancy and its impact on the environment.

It does this by using measured and verified performance information, such as utility bills, and converting them into an easy to understand star rating scale from one to six stars.

For example, a 6 star rating demonstrates market-leading performance, while a 1 star rating means the building or tenancy has considerable scope for improvement.

There are a number of recognised regulatory and market barriers to the installation of co/trigeneration systems that have impacted on the development of this industry. These include the rising cost of natural gas, the complexity and cost of connecting to the power distribution grid, and difficulties in selling surplus electricity production in the electricity market. Commercial office buildings also face specific technical and financial barriers such as the relatively low hours of operation of office buildings, which directly affects the payback period of investments.

Proponents of co/trigeneration have sought to overcome these barriers and improve the financial viability of their projects. One strategy has been to use the significant market value of a high NABERS Energy rating to attract clients in the commercial property industry to install or connect to co/trigeneration systems.

Since July 2010 NABERS has had specific rules in place to recognise the environmental benefits of onsite co/trigeneration systems in commercial buildings in NABERS Energy ratings. As a result, the number of co/trigeneration projects being developed in the commercial building sector has grown significantly.

The current rules and the two types of NABERS Energy ratings ensure that information is provided about the actual energy efficiency of buildings while being transparent about the additional greenhouse benefits from purchased renewable and low emissions energy.

NABERS and GreenPower

Improving the energy efficiency of buildings and supplying low or zero emissions electricity to the grid are different, yet complementary approaches to reducing the overall environmental impact of the built environment.

The primary objective of NABERS Energy ratings is to make building environmental performance highly visible in order to drive investments in improving the energy efficiency of buildings.

NABERS Energy rating provides rated buildings with two different star rating results: one measures the energy efficiency of a building, and the other measures its greenhouse gas emissions, including the purchase of low or zero emissions electricity. Both star ratings results are provided when a building undertakes a NABERS Energy rating.

The energy efficiency star rating allows a building to compare how much energy it uses with other buildings. This rating is required by law to be disclosed at the point of sale or lease for office buildings over 2000m^2.

The greenhouse gas performance star rating allows buildings to compare the emissions from their energy use with other buildings.

The purchase of GreenPower (certified 100% renewable energy) has no impact on how much energy the building actually uses so does not improve the energy efficiency rating. It is simply a commercial arrangement between the current building owner and the electricity retailer and if the building is sold the new owner may not wish to continue to purchase GreenPower. To be transparent about the true energy requirements of a building, the energy efficiency rating is the only rating that is required to be disclosed at the point of sale or lease under the *Commonwealth Building Energy Efficiency Disclosure Act 2010*. Property owners are also free to disclose and/or promote their greenhouse gas performance rating.

NABERS and cogeneration and trigeneration

Co/trigeneration plants can be installed onsite to directly supply a building and/or adjacent buildings or offsite to supply this energy to the electricity grid and a thermal energy distribution network. As NABERS rates the environmental performance of buildings, the location of a co/trigeneration plant is central to the way the energy from these plants is treated.

- Onsite: Systems that are located onsite and directly supply the building with electricity and thermal energy reduce that building's use of grid electricity and gas. As this makes a building more energy efficient and reduces its emissions, the installation and efficient use of onsite co/trigeneration systems will improve a building's energy efficiency star rating and greenhouse gas performance star rating.

- Grid transfers: The purchase of low emissions electricity from offsite systems helps a building to offset its greenhouse gas emissions. As is the case with GreenPower, this has no impact on how much energy a building actually uses. Purchase of co/trigeneration electricity through the grid will help a building to improve its greenhouse performance star rating, but will have no impact in its energy efficiency star rating.

NABERS has agreed to recognise the greenhouse benefit of low emissions electricity from co/trigeneration systems purchased through the electricity grid in the NABERS greenhouse gas performance rating. This decision was made in October 2012 following a period of extensive industry consultation and was predominantly supported by industry.

Unlike GreenPower, which is a nationally-recognised certified scheme, there is currently no third-party certification scheme that measures the emissions attributable to co/trigeneration electricity through the grid. An industry-led steering committee has now been established to develop a robust measure that will standardise, validate and audit the greenhouse gas emissions attributable to these energy transfers. NABERS has publicly committed to recognising the greenhouse benefit of offsite co/trigeneration systems in the NABERS Energy greenhouse gas performance rating once this industry standard is agreed and introduced.

Air quality

Many proposed trigeneration system operators have indicated their preferred fuel is gas because gas produces lower carbon emissions than coal and its ease of transport and use in smaller generating units. As many trigeneration systems are likely to be located in urban areas, some by products, such as emissions of oxides of nitrogen (NOx), have the potential to adversely affect local and regional air quality that need to be appropriately managed or regulated.

The NSW EPA developed air emission requirements for all new cogeneration plant (including precinct developments) in consultation with industry. These requirements can be found on the NSW EPA website (www.epa.nsw.gov.au/air/cogentrigen.htm).

All new cogeneration in Sydney and the Illawarra should either be NOx neutral or achieve Best Available Techniques emission performance. The NSW EPA considers a NOx emission standard of 250 mg/m^3 is at a Best Available Techniques emission performance for natural gas fired reciprocating internal combustion engines with a capacity to burn less than 7 megajoules per second of fuel in the Sydney and Wollongong Metropolitan Area and Wollondilly Local Government Area. This is more stringent than the current *Protection of the Environment Operations (Clean Air) Regulation 2010* limit of 450 mg/m^3.

Controlling NOx emissions to 250 mg/m^3 has been found to have a minor impact on project financial performance and is unlikely to impact on project viability. The marginal reduction in financial performance is due to the slightly higher fuel consumption[3].

A tighter NOx emission standard may be appropriate for larger installations and those in dense and complex urban environments.

Activities that require an Environment Protection Licence are defined in Schedule 1 of the *Protection of the Environment Operations Act 1997*. Electricity generation is a scheduled activity and a co/trigeneration plant located in the metropolitan area is required to hold an Environment Protection Licence if the internal combustion engines have a capacity to burn more than 3 megajoules of fuel per second. Otherwise, local council is the appropriate regulatory authority for the co/trigeneration plant.

Brisbane City Council requires cogeneration plant to meet a NOx emission standard of 50mg/m^3. Meeting a NOx emission standard of 50mg/m^3 requires the installation of Selective Catalytic Reduction, a post combustion control technology. A trigeneration plant is proposed to be installed as part of Global Switch's Sydney East data centre in Ultimo. Selective Catalytic Reduction will be installed on the trigeneration plant to achieve a NOx emission standard of 50mg/m^3.

Use of the traditional distribution network

Some trigeneration proponents have suggested selling electricity to customers not directly connected to their trigeneration system. Typically these proposals envisage utilising an export connection to the grid and selling to a nearby consumer. Consideration should therefore be given to what charges (such as Distribution Use of System (DUoS) charges) may be appropriate to apply in this case.

[3] SKM 2009, Department of Environment and Climate Change (NSW) Financial Analysis of NOX Controls on Gas Fired Reciprocating Engines, Sinclair Knight Merz, June 2009

The AER is likely to categorise the trigeneration network as a private network which is captured by the AER's Electricity Network Service Provider Registration Exemption Guideline (effective 1 January 2012). This guideline provides some conditions regarding regulation of private networks, including pricing.

Under the NEL and the NER, services provided by the operator of the main distribution system are regulated economically by the AER. Chapter 5 of the NER details how "registered participants" establish their connection to the primary network. This section of the NER is primarily used by generators seeking access to the grid so they can sell their electricity in the NEM.

This is not the primary goal of a trigeneration system operator, who is more likely to establish discrete commercial arrangements with selected customers to provide financial stability for the project. In fact, depending on the size of the trigeneration unit(s), the operator may not even be a "registered participant" within the meaning of the NER. A similar issue to technical connection requirements would then arise: each new proposal would have to negotiate the requirements individually with the relevant DNSP.

The trigeneration system operator and the DNSP can enter into commercial negotiations for access to the traditional electricity network.

Export retail supply

Where a trigeneration operator wants to sell electricity only to a retail customer[4], the trigeneration operator is required to hold a licence in accordance with current energy retailing arrangements. The alternative is for trigeneration operators to sell energy to a licensed retailer or as an exempt electricity seller. Selling electricity to a customer not directly connected to the trigeneration system has implications for the customer. In many cases the retail customer may see advantages in having a direct relationship with the trigeneration system operator.

The regulatory framework allows a customer to choose their retailer but, as discussed previously, the retailer must be authorised to sell electricity.

Recent energy reforms in NSW have resulted in the retail arms of the former EnergyAustralia, Integral Energy and Country Energy being sold meaning the retail and distribution functions of these businesses are now separately owned, and removing any need for ring fencing of retail operations from distribution operations.

Requiring a trigeneration system operator to ring fence its retail business from its network arm would add cost and complexity to the business. Whether such arrangements are required for retail customers buying electricity from a trigeneration system is unclear. It is possible that the trigeneration operator could install an oversized generating capacity with the primary aim of selling electricity to retail rather than trigeneration customers. If this was the case it would be reasonable for the trigeneration operator to be subject to the same rules as any other generator, network operator or retailer.

[4] For the sake of clarity, customers not directly connected to a tri-generation system are called retail customers, while those directly connected to a tri-generation system are called tri-generation customers.

It should be noted that such an arrangement is unlikely to align with the definition of a trigeneration system precinct; namely a distinct geographic area to be supplied with combined heat and power. It could also be argued that, if the trigeneration operator only wants to sell a small amount of residual electricity left over after its own customers' needs are met; application of costly ring fencing measures is an inappropriate regulatory barrier for trigeneration.

Conclusion

The issues described above highlight the complexity of the energy market and the difficulties that exist in developing new arrangements for emerging technologies.

The Department would be pleased to provide further assistance to the Inquiry and provide additional information on specific issues as requested.

Glossary

AEMC	Australian Energy Market Commission
AER	Australian Energy Regulator
BASIX	Building Sustainability Index
Department	NSW Department of Trade & Investment, Division of Resources and Energy
DNSP	Distribution Network Service Provider. Includes operators of the main electricity distribution system.
DUoS	Distribution Use of System charge
Electrical installation	The electrical wiring and associated equipment that are used to convey and control the conveyance of electricity within premises to which electricity is supplied from a distribution system, but does not include anything connected to and extending or situated beyond an electrical outlet socket.[5]
EWON	Energy & Water Ombudsman of NSW
Generating plant	In relation to a *connection point*, includes all equipment involved in generating electrical *energy*.[6]
Generating unit	The actual generator of electricity and all the related equipment essential to its functioning as a single entity.[7]
Islanded trigeneration system	A trigeneration system not connected to the traditional electricity network.
NABERS	National Australian Built Environment Rating System
NECF	National Energy Customer Framework, including the NERL and NERR.
NEL	National Electricity Law
NEM	National Electricity Market
NER	National Electricity Rules
NERL	National Energy Retail Law
NERR	National Energy Retail Rules
mg/m^3	Milligrams per cubic metre
SEPP	State Environmental Planning Policy

[5] *Electricity Supply Act 1995*, definitions.
[6] National Electricity Rules, Chapter 10.
[7] National Electricity Rules, Chapter 10.

Retail Customer	A customer not directly connected to a trigeneration distribution system.
RoLR	Retailer of Last Resort
Traditional Electricity Network	The electricity power lines and associated equipment and electricity structures that are used to convey and control the conveyance of electricity: (a) to the premises of wholesale and retail customers, up to the point of supply in relation to the premises (which may or may not be situated on the building or land comprising the premises), or (a1) from the premises of small retail customers that have a complying generator installed and connected from the point of supply to the premises, or (b) to, from and along the rail network electricity system, This does not include a transmission system or any lines, equipment and structures prescribed by the regulations.[8]
TUoS	Transmission Use of System charge
Trigeneration	The output from a trigeneration unit
Thermal energy supply	Energy supplied in the form of hot and cold water from a trigeneration unit.
Trigeneration Customer	A customer directly connected to a trigeneration system.
Trigeneration Network	An electricity distribution system and water distribution system, and associated equipment, which is capable of conveying electricity and heating and cooling to and from individual premises.
Trigeneration Installation	An electrical installation, a heating installation and a cooling installation within premises capable of conveying energy inside individual premises from a tri-generation unit.
Trigeneration Precinct	A geographic area served by a trigeneration system.
Trigeneration System	A system which includes a combination of a trigeneration unit, a trigeneration installation and a trigeneration network.
Trigeneration System Operator	A person who controls a trigeneration system.
Trigeneration Unit	An energy generation unit with captured electricity output and captured heating output and captured cooling output

[8] *Electricity Supply Act 1995*, definitions.