Submission No 17

COGENERATION AND TRIGENERATION IN NEW SOUTH WALES

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4th September, 2013

Jonathon O'Dea MP
Chair, Public Accounts Committee
Parliament of NSW
Macquarie Street
Sydney NSW 2000

Inquiry into Cogeneration and Trigeneration in NSW

Dear Mr O'Dea,

Kinesis would like to thank you for your invitation to provide this submission to the Public Accounts Committee's inquiry into cogeneration and trigeneration in NSW.

Established in 2007, Kinesis provides pragmatic and evidence based solutions to the climate problem. Working locally, nationally and internationally, we are a small and agile firm that can leverage enormous capacity. Our approach, combined with our world class expertise, ensures our clients have access to outstanding advice, analysis, tools and services for achieving measurable, verifiable and reportable outcomes.

Our response is based on our extensive project experience advising public and private sector clients from across Australia and internationally on the technical, environmental and commercial viability of supply and demand side solutions, including cogeneration and trigeneration, for building, precinct and city scale developments. Our cogeneration and trigeneration experience includes (but is not limited to) the following projects which showcase the broad potential application of cogeneration and trigeneration technologies:

1. Developing and delivering the City of Sydney's *Decentralised Energy Master Plan - Trigeneration* which set out the design and technical specifications for a decentralised energy network (supplying thermal and electrical energy) powered by 360 MW of trigeneration capacity. This Master Plan formed the basis of a $150 million Heads of Agreement signed between the City of Sydney and Origin Energy (Australia's largest energy company).

2. Developing and delivering the City of Perth's *Carbon Reduction Plan for the City*. The centrepiece of this plan is a series of trigeneration powered "low carbon hubs" that have the potential to provide 35% of the multi-unit dwellings, 70% of the commercial floor space and 65% of the retail floor space within the central core of the city with low carbon thermal energy and electricity, reducing total greenhouse gas emissions by approximately 9% below current levels.

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3. Undertaking an *Energy Feasibility Study* of Wagga Wagga City Council's Oasis Aquatic Centre. This study assessed the financial and technical viability of a range of alternative energy and energy efficiency measures that could be deployed at the aquatic centre to reduce greenhouse gas emissions and save Council money. Our final report recommended the implementation of a cogeneration system to supply energy for pool heating and electricity. The report formed the basis of Council's successful application for funding from the Commonwealth Government's Community Energy Efficiency Program. Kinesis also assisted Council with its tendering and procurement process.

4. Advising the Canterbury Earthquake Recovery Authority (CERA) on distributed energy infrastructure options (including supply and demand side solutions) that could be implemented as part of Christchurch's post earthquake redevelopment. As part of this analysis we assessed the technical, environmental and commercial feasibility of local and district trigeneration solutions.

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

Cogeneration is a process whereby natural (or renewable) gas is burned in an engine to generate electricity. Because the engine is powered by gas rather than coal (the traditional form of electricity generation in NSW), it can produce 40% fewer greenhouse gas emissions than traditional coal-fired electricity (or if renewable gas is utilised, the electricity produced can be carbon neutral). Further, the waste heat from this process can be captured to supply space heating and hot water. Trigeneration refers to the process where the waste heat is also used to drive a heat driven cooler in order to provide space cooling. This waste heat is carbon neutral and can displace the energy traditionally needed for heating and cooling.

Typically, cogeneration and trigeneration systems are deployed in individual buildings, supplying that building with electricity and meeting some or all of its thermal energy demands. Precinct and city scale (district) trigeneration is also being deployed to provide city solutions in areas with a high concentration of cooling, heating and hot water demand. Here, centralised trigeneration systems distribute thermal energy to multiple buildings through a thermal pipe network and distribute low carbon electricity through the grid.

Cogeneration and trigeneration are proven technologies that have been successfully deployed in commercial, residential and industrial settings across Australia. Cogeneration and trigeneration systems have already been installed within dozens of individual buildings across NSW. This is a proven application of the technology which can achieve significant financial and environmental outcomes as the following examples show:

Aquatic Centres

Kinesis recently assisted the City of Wagga Wagga install a cogeneration system for its Oasis Aquatic Centre. This system has been designed to meet most of the centre's electrical needs while also producing thermal energy which will supplement the existing gas boilers used to heat the Centre's numerous swimming pools. The City budgeted $780,000 for the installation;

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however, the system (which was switched on in early August, 2013) was installed and commissioned for a total cost of less than $500,000.

By producing electricity needed to run the Centre onsite, and reducing the gas needed to heat the swimming pools (by using some of that gas to generate electricity and relying on waste heat to help heat the pools) the cogeneration system is expected to reduce annual energy bills for the site from $400,000 - $450,000 per year to around $80,000 per year, while also reducing total greenhouse gas emissions by approximately 1,000 tonnes per year.

Multi-Unit Residential Buildings

Utilising cogeneration to heat and power an aquatic centre is a proven and common application of the technology as the large and constant heating demand required makes cogeneration a financially attractive alternative.

However, Kinesis has identified other uses of the technology that can achieve significant emissions reductions and financial returns. In 2011, Kinesis prepared a report examining the viability of installing Mini-CHP (cogeneration systems of between 10KWe to 200KWe) technology to service the hot water demands of multi-unit residential hot water customers.

This application of cogeneration technology has already proven to be commercially viable in NSW. In 2006, key members of the Kinesis team (who were working for the NSW Department of Planning at the time) commissioned the installation of a 25 KWe cogeneration system in a 132 unit residential apartment block being developed in Chatswood as part of the NSW government's Building Sustainability Index (BASIX) implementation strategy. This was the first application of cogeneration technology for a residential development in Australia.

Drawing on this practical example, Kinesis modelled a series of potential mini-CHP installations across different residential building types showing that a cogeneration system installed in a multi-unit residential building and sized to supply domestic hot water while also powering common are amenities (such as lighting, lifts, car park ventilation, etc) could reduce greenhouse gas emissions by between 5% and 35% below business as usual are possible while internal rates of return of between 20% and 40%.

Urban Precinct Developments

District infrastructure systems while proven commercially outside of Australia, are less common in NSW than individual building systems. However, many developers and city managers have begun exploring district cogeneration and trigeneration opportunities and initial project are beginning to appear.

The Central Park Development in Sydney will feature a centralised trigeneration plant servicing a network of connected buildings. In the first stage of its development, a two-megawatt (MW) tri-generation energy plant, run on natural gas, will produce low-carbon thermal energy, providing heating and cooling for 3,000 residences and 65,000sqm of retail and commercial space in 14 buildings at Central Park. There developers have allocated space

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for expansion of the trigeneration plant up to 6 MW to connect further buildings to the network. The developer claims that the plant will reduce greenhouse gas emissions by approximately 190,000 tonnes over 25 years.

These examples highlight a small selection of the diverse range of cogeneration and trigeneration applications that are possible and already being explored. It also illustrates the flexibility cogeneration and trigeneration have to meet a variety of different demands and to be applied to a variety of different contexts.

However, it also emphasises the need to ensure the particular application of a technology is the correct application for a given context.

Distributed energy technology, renewable energy and energy efficiency are often discussed as if they are mutually exclusive, where one technology type must be preferred over another. The reality is that a suite of technologies are required to deliver the optimal emissions reduction and cost savings. Kinesis has worked with city authorities in Sydney, Perth, Christchurch and Auckland to identify and assess distributed energy systems at a city wide scale and for specific development sites.

While there have been common results that can be applied to each city, the main finding from our work has been the need to remain technology neutral and outcome focused. Technology that will work in one city may not be as cost effective or greenhouse efficient when applied in another city. This variance can be due to a city's climate, urban form, energy pricing structure and/or the existing energy grid's capacity/configuration.

Our work has shown that cookie cutter approaches are ineffective. Careful analytics, using sophisticated financial and technical modelling is needed to ensure that a particular technology, particularly cogeneration and trigeneration will be effective in a particular context.

It should be noted that there have been cases where Kinesis have advised clients against the implementation of cogeneration or trigeneration technology, in some cases against the desires of the client, where its application would represent a low impact, high cost outcome compared to other technologies.

Care must be taken not to over incentivise a particular technology (such as cogeneration or trigeneration) because the end result can see inefficient infrastructure being deployed at scale and locking in long term costs while locking out future alternative opportunities.

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

The *Decentralised Energy Master Plan – Trigeneration*, which Kinesis prepared on behalf of the City of Sydney found that a large scale district trigeneration scheme could be implemented and be commercially viable under the current regulatory framework in NSW.

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To achieve this regulatory compliance, the Master Plan recommended the City partner with an energy services company that was authorised to engage in the retail sale of energy.

In NSW, a person must hold a retailer authorisation prior to engaging in the retail sale of energy (electricity or gas). The Australian Energy Regulator (AER) administers retailer authorisations. A building owner who on-sell electricity to tenants within their building is exempt from this requirement, which enables building only cogeneration and trigeneration schemes to operate without retailer authorisation.

However, if a cogeneration or trigeneration operator wishes to sell electricity beyond their building, they must hold a retailer authorisation. This regulation limits the potential operators of district cogeneration and trigeneration schemes to current authorised energy retailers (unless the potential operator is able to go through the process of receiving authorisation). Even if a building operator wants to sell excess electricity from their building's cogeneration or trigeneration system to a neighbouring building (even a neighbouring building they also own) they must hold a retailer authorisation.

While this regulatory requirement does not prevent the implementation of district schemes (where an energy retailer is involved in the scheme to facilitate the sale of electricity) it may prevent smaller scale schemes from being implemented where none of the parties are likely to be able (due to time, cost or qualifying constraints) to receive energy retailing authorisation.

The issue of exported electricity

Cogeneration or trigeneration operators that do not hold an energy retailer authorisation can still export electricity from their plant, to the distribution network. However, there is no guarantee they will receive any payment for this exported electricity (payment is determined by the network utility).

In most cases, even if the building operator can receive payment for this electricity, it is likely to be far less than the retail cost of electricity. Further the payment is often lower than the cost of producing the electricity.

This restriction means it is in the financial interest of a building operator to ensure they size the cogeneration or trigeneration system so that the electricity it produces is used entirely in their building and that no electricity is exported to the grid.

There are many examples of cogeneration and trigeneration systems installed in buildings in NSW that have been oversized so that if they run they will export electricity. Often, because they have been oversized, these plants cannot operate for financial reasons.

Lack of requirement to connect

The biggest risk for any developer of a district cogeneration or trigeneration scale project is ensuring that adjacent properties connect to district scheme so the scheme operator achieves a return on their capital investment.

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Consideration could be given to ways in which district scheme operators who can demonstrate greenhouse gas emissions reductions, network supply and demand side management and reliability benefits to the state and potential savings for customers can be ensured that customers will connect to their network, whether through financial incentivisation or through obligations to connect.

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

The economic viability of cogeneration/trigeneration technology in NSW relies on the particular application of the technology.

As the City of Wagga Wagga examples illustrates, even with recent rises in gas prices, cogeneration and trigeneration remains a commercially and environmentally viable technology in many contexts and is likely to remain so even with further gas prices rises.

However, there are likely to be more marginal applications of the technology that will become unviable if gas prices continue to rise.

One issue currently affective the ongoing viability of cogeneration and trigeneration is the lack of recognition or value ascribed to the low carbon electricity and zero carbon thermal energy cogeneration and trigeneration systems produce.

Currently, retailers sell two forms of electricity: black electricity and GreenPower. Black electricity is regular electricity sourced over the distribution network. GreenPower is electricity that has been certified by the NSW Office of Environment and Heritage as being renewable and producing no greenhouse gas emissions.

Cogeneration and trigeneration systems produce electricity that has lower carbon emissions than black electricity. However, if this electricity is sold by an energy retailer, they will receive no certification or recognition of this lower carbon intensity and therefore it is difficult to receive any additional monetary value for the electricity from a potential customer.

This is particularly an issue for building operators who want to connect to a district cogeneration or trigeneration scheme as a means of improving their building's NABERS rating. Under a recent ruling, the building operator will not be able to attribute the lower carbon intensity of the electricity or thermal energy they purchase to their building's NABERS rating, thus removing a potential incentive for them to connect.

Cogeneration and trigeneration systems produce energy that has lower greenhouse gas emissions intensity than is currently available from traditional energy networks in NSW. They should be able to receive financial recognition for the delivery of this energy.

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Any other relevant matters

Traditionally, the use of cogeneration and trigeneration technologies in NSW has been driven by the greenhouse benefits it offers.

However, at its best cogeneration/trigeneration can play a crucial role in both supply and demand side energy management. These benefits include:

1. Reduced TUOS charges for households and businesses that purchase electricity supplied by the proposed trigeneration systems.
2. Reduced electricity peak supply issues (from the electricity produced by the trigeneration systems).
3. Reduced electricity demand peak issues (by displacing electric chiller demand with thermal energy).
4. Reduced network demand charges for customers that connect to the thermal network (and therefore reduce their total peak electricity demand).

Cogeneration and trigeneration systems can provide supplemental generation capacity which can assist in managing energy supply. There is potential for this additional capacity to be monetised, for example the operations of the Independent Market Operator in Western Australia.

It can also provide demand management assistance by lowering peak demands and increasing network reliability and can has the potential to provide a valuable contribution to any CBD's N-2 delivery strategy. Benefits which could be passed onto network customers. The benefits can be maximised when coupled with thermal storage, a potential network management solution which is currently underutilised in NSW.

In summary, optimising the joined up benefits of greenhouse gas emissions reductions, supply and demand side network management solutions and customer savings requires a more coordinated and collaborative approach to the design and implementation of distributed energy infrastructure than has currently been achieved for any cogeneration and trigeneration project in NSW.

I would be pleased to discuss this submission further.

Please do not hesitate to contact me on [redacted] or via e-mail at:
[redacted]

Yours Truly,
Bruce Taper
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Director
Kinesis