

**SUBMISSION TO
PRODUCTIVITY COMMISSION ON
POTENTIAL IMPROVEMENTS TO, REGULATION OF DISTRIBUTION AND
TRANSMISSION NETWORKS IN THE NEM**

BACKGROUND

Sustainable Sydney 2030

In developing its vision for the future, Sustainable Sydney 2030, the City of Sydney spent more than a year consulting its community and a consensus emerged on the way to make Sydney a greener, more global and connected city.

Some 90% of people wanted the City to take urgent action to tackle climate change, so the City made sustainability the overarching theme. A major objective of Sustainable Sydney 2030 is to position Sydney as one of the world's leading green cities in the race to counter climate change. To achieve this, the City has committed to reducing greenhouse gas emissions by 70% by 2030 from 2006 levels.

80% of the city's greenhouse gas emissions come from centralised power generation, primarily burning coal, which is inefficient, unnecessarily polluting, a waste of non-renewable resources and the primary cause of climate change. Key in the City's objective to tackle climate change is to supply 100 per cent of the city's electricity from local generating plants through a combination of energy efficiency and low or zero carbon decentralised energy, principally trigeneration that can be fuelled from natural gas or renewable gases.

The emission reduction targets will be delivered through what Sustainable Sydney 2030 calls "Green Transformers". These are a combination of green infrastructure, primarily trigeneration, but also waste and recycled water infrastructure. When combined with demand reduction, trigeneration will provide 70 per cent of the electricity needs of the city in 2030 and reduce overall greenhouse intensity in the City of Sydney Local Government Area by 33%. This will need at least 477MW_e of trigeneration and cogeneration to be delivered by 2030. The balance of energy needs will come from waste heat from local electricity generation and renewable energy from within and outside the City's Local Government Area. The combination of these actions is the Green Infrastructure Plan.

Green Infrastructure Plan

Developing the Green Infrastructure Plan and putting it into action is happening on two levels – for the city as a whole and by the City of Sydney leading the way and installing local green infrastructure projects in its own operations. The Green Infrastructure Plan comprises:

Decentralised Energy – Trigeneration Master Plan
Decentralised Energy – Renewable Energy Master Plan
Advanced Waste Treatment Master Plan
Decentralised Water Master Plan
Automated Waste Collection Master Plan

The City's integrated approach to a city-wide energy, water and waste infrastructure, for example, enables the trigeneration, recycled water and waste collection to share the same network infrastructure routes and stations. Recycled water could be treated by zero carbon waste heat from trigeneration and renewable gases and non potable water could be recovered from waste and used in the city's green infrastructure network.

Distribution and Transmission Network Charges

The Institute of Sustainable Futures, University of Technology Sydney 'Close to Home: Potential benefits of Decentralised Energy for NSW Electricity Consumers' report¹ established that over 2010-15, electricity network businesses in Australia are spending over \$46 billion, more expenditure than the proposed \$34 billion National Broadband Network.

In NSW, electricity networks are undertaking capital expenditure of \$17.4 billion over the 5 years to 2013/14. This represents \$2,400 per person and an 80% increase on the previous 5 year period. Average electricity prices in the Sydney electricity distribution network area are expected to increase by 83% during this period with the proportion of electricity bills that goes to pay network charges to rise from 40% to 60%.

The Institute of Sustainable Futures estimates that the City's plans to supply 70% of the Local Government Area's electricity needs from a 360MWe trigeneration network by 2030 could achieve savings in deferred electricity network costs and avoided costs of new power station capacity to serve the city's growing demand in the order of \$1.5 billion by 2030.

Interim Decentralised Energy - Trigeneration Master Plan

The interim Trigeneration Master Plan was completed by the Kinesis consortium in December 2010 and placed on public exhibition until 28 January 2011. No negative comments were received. The interim Master Plan covers the four energy dense zones of the city – CBD North, CDB South, Pyrmont/ Broadway and Green Square. Together, these four zones would deliver 360MW_e of trigeneration which would exceed the City's 330MW_e trigeneration target under Green Transformers in Sustainable Sydney 2030.

The 360MW_e of trigeneration systems set out in the interim Master Plan would reduce electricity consumption by 30% and peak power by 60%. A key part of the reductions is the replacement of electrically driven air conditioning by thermally driven air conditioning. Across the four low carbon zones the Master Plan will reduce peak electricity demand by 542MW, down from 912MW to 370MW.

¹ Institute of Sustainable Futures, University of Technology Sydney 'Close to Home: Potential Benefits of Decentralised Energy for NSW Electricity Consumers November 2010'
<http://www.isf.uts.edu.au/publications/dunstanlangham2010closetohome.pdf>
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Trigeneration in the four low carbon zones will also reduce the City of Sydney's greenhouse gas emissions by between 1.1 million and 1.7 million tonnes a year depending on which operational performance is selected. This represents a reduction in greenhouse gas emissions of between 39% and 56% for the building sector and between 18% and 26% of the overall Sustainable Sydney 2030 target. Of key importance is the cumulative emission reduction of 10.6 to 15.3 million tonnes with potentially up to 19 million tonnes emissions reduction by 2030 depending on both the configuration of the decentralised energy network and the rate at which buildings within the four low carbon zones connect to the network.

The commercial performance of the interim Master Plan is commensurate with a sound financial return for the trigeneration systems operator. The estimated cost of the decentralised energy network or trigeneration systems for the four low carbon zones is estimated at \$950 million (\$440 million in 2010 dollars when discounted using 7% nominal rate).

The Trigeneration Master Plan is the leading and the largest of the Master Plans in the Green Infrastructure Plan in which other Master Plans will follow utilising the same infrastructure routes and co-located stations, wherever possible.

Final Decentralised Energy - Trigeneration Master Plan

The interim Trigeneration Master Plan will be replaced by the final Trigeneration Master Plan² approved by Council on 25 June 2012 to go on public exhibition for 28 days. The final Master Plan comprises the original four low carbon zones plus the following that were not included in the interim Master Plan:

1. Air quality assessment confirmation by the CSIRO;
2. Gas network augmentation feasibility study by Jemena, the gas network distribution operator for Sydney;
3. Increase in trigeneration capacity for the Green Square Low Carbon Zone from 20MW_e to 32MW_e;
4. Additional precinct scale trigeneration of 38MW_e in trigeneration 'hotspots';
5. Additional small scale cogeneration and fuel cells outside of the Low Carbon Zones and trigeneration 'hotspots' amounting to 67MW_e;
6. Detailed case studies at the request of the Sydney Better Buildings Partnership on connection to the trigeneration decentralised energy network for particular commercial, residential and university buildings;
7. Case study on domestic fuel cells; and
8. Update of enabling actions.

² Draft Final Decentralised Energy Master Plan – Trigeneration <http://www.sydney2030.com.au/development-in-2030/city-wide-projects/powering-sydney-allan-jones>

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The final Trigeneration Master Plan identifies 477MW_e of trigeneration and cogeneration capacity across the City's LGA. This would reduce greenhouse gas emissions across the LGA by 24% to 33%. This equates to a reduction of 1.4 to 2.05 million tonnes of greenhouse gas emissions a year.

Renewable Energy Master Plan

The Renewable Energy Master Plan will set out the renewable electricity and renewable gases resources and locations both inside and outside the LGA. A proximity principle of 250km from the city has been applied for renewables outside the city to avoid investment in remote renewables and minimise associated increases in network charges to consumers.

The final Arup report shows that 55% of the 30% renewable electricity target can be delivered within the LGA and 45% from outside the LGA. In addition, renewable gases and fuels needed to replace natural gas for the 360MW_e of trigeneration in the interim Trigeneration Master Plan can be sourced from feedstock within 250km of the city, most within 50km of the city.

Together, this would deliver reductions in greenhouse gas emissions of 2.15 million tonnes a year which equates to a 31.5% reduction in overall greenhouse gas emissions from the 2006 base year and potentially up to 100% of the city's local energy target (70% trigeneration plus 30% renewable energy) being met from renewable energy.

The final Renewable Energy Master Plan will be published later in 2012.

City's Trigeneration Project

Following completion of the 2 year long procurement process Cogent Energy (owned by Origin Energy) were appointed by the City as the Energy Services Provider to design, finance, build, operate and maintain the city-wide trigeneration network. Heads of agreement were signed in April 2012 and the development, energy sales and other agreements are expected to be completed in July 2012.

A key feature of the agreement is that the trigeneration energy centres and low carbon electricity and zero carbon thermal energy outputs will be owned and retailed by Cogent Energy and the thermal reticulation network will be owned by the City of Sydney.

Stages 1 and 2 of the project comprise 63.5MWe of trigeneration across four precincts plus supply to all 230 of the City's buildings by 2015. The City's buildings will be first to be supplied with low carbon energy which is expected to be commissioned by July 2014.

Stage 3 represents the balance of the trigeneration network to be rolled out by 2030.

PRODUCTIVITY COMMISSION QUESTIONS

Q1. Will the generators only partially offset demand for electricity of buildings they are installed in, or fully supply those buildings, or export energy into the grid for other users in the CBD?

Some buildings will host trigeneration energy centres which will be designed to generate more energy than the host building needs. Surplus electricity will be distributed across the local public wires distribution network (not the transmission grid) to other buildings within the low carbon zones or precincts, paying a Distribution Use of System charge to Ausgrid. This will be facilitated by trading software (*CogentPower*) to enable electricity to be netted off.

The same system will also be utilised to supply surplus renewable electricity from City owned buildings and operations to other City owned buildings and operations to enable the City to deliver the 30% renewable electricity target on its own buildings and operations. This process will initially be used for the City's large scale photovoltaic projects but will apply to other forms of local renewable energy in the future.

Q2. Is the intention to use trigeneration only at times of high demand and rely on the grid at other times, or to rely on trigeneration to supply baseload power and the grid for peak demand, or to use trigeneration for both baseload and peak demand?

The network will be designed to supply 100% electricity and thermal energy (heating and cooling) 24 hours a day, 365 days a year for connected buildings. The network will be designed not to export or import electricity from the grid transmission network at times of operation, although there may be some minor flows of electricity at the grid supply points. In order to facilitate this, the trigeneration gas engine modules will, in the main, be based on multiples of 4MW_e high electrical efficiency gas engines which can modulate down by 50%.

However, some customers will initially opt for peak and shoulder trigeneration electricity and other customers will opt for 24/7 trigeneration electricity. This will depend on the economics for each customer at the time but all customers are likely to take up 24/7 trigeneration electricity in the future as grid electricity prices continue to increase even for off peak electricity. For peak and shoulder trigeneration electricity customers, off peak electricity will be supplied by Cogent Energy/Origin Energy from the grid when the grid has the lowest demand.

All thermal energy supplies will be available 24 hours a day, 365 days a year. Utilising thermal energy for heating and cooling will fundamentally alter the energy profile in the CBD from being electrically led to be thermal energy led. Thermal energy networks will be backed up by thermal storage and back up boilers providing three levels of thermal energy resilience.

Buildings connecting to the trigeneration network will reduce their emissions by between 40% and 60%, depending on whether buildings take peak and shoulder trigeneration electricity or 24/7 trigeneration electricity. Both will significantly improve NABERS and GreenStar ratings, providing another reason to building owners to

connect in a highly competitive market for anchor tenants seeking to occupy low carbon buildings.

Q3. Will the network be maintained as a backup supply should distributed generation fail? Will it be maintained to transmit energy exported by distributed generators to the rest of the CBD, or to other regions?

See above. Should distributed generation fail the grid would be used as backup. However, it is important to remember that the electricity demand would have been substantially reduced in that electricity would no longer be used for primary heating and cooling. This would come from the thermal energy systems 24 hours a day. It is also important to remember that decentralised energy does not operate as individual distributed generation units, but collectively, so that if individual gas engine modules or even individual energy centres fail supply would first come from other energy centres in the trigeneration network before energy is taken from the grid.

Surplus trigeneration electricity will be exported across the local distribution network to other buildings connected to the trigeneration network, but not to other regions, as set out in the Trigenation Master Plan.

Q4. Given those needs, how much of the electricity network will it be possible to avoid building or replacing?

Other world cities such as New York, Copenhagen and Malmo connect 98% or more of their buildings to decentralised energy networks. New York State has 6,000MW_e alone of decentralised energy. However, the City has taken a more pessimistic approach with its Trigenation Master Plan in that it is based on connecting 65% of all commercial floor space, 50% of all retail floor space and 30% of all residential floor space in the CBD and Green Square to the trigeneration network. In practice, if the City achieved this level of penetration it is likely that most, if not all, of the city's buildings would connect to the trigeneration network.

Trigenation would reduce electricity consumption by 30% and peak electricity demand by 60% across the CBD and Green Square so this would be reflected in the potential to avoid building or replacing network, particularly for those parts of the network designed to supply peak power to electric air conditioning and heating. Ausgrid estimates that \$11 billion of network asset is required to meet demand for just 100 hours a year which could be substantially reduced with trigeneration.

Q5. How will the remaining network be paid for, given that a) distributed generation will shrink the amount of electricity purchased through the grid, raising the 'per MWh' fee required to cover its costs and b) some customers may be reluctant to pay the required charges just for backup supply?

- a) Sustainable Sydney 2030 and the City's Green Infrastructure Plan targets are partly to address the situation on 2006 levels and partly to address growth by 2030. For example, the 70% reduction in greenhouse gas emissions target is to reduce 2030 emissions, taking account of growth on a business as usual basis (including the Government's Renewable Energy Target), below 2006 levels by 2030.

This means that network, particularly for displaced peak power, can be used for other supply, ie, growth and/or large scale renewable energy and/or the emerging electric vehicle market without spending huge amounts of money on increased network assets on a business as usual scenario.

Working with network operators such as Ausgrid means that these increasing demands can be addressed by demand side management more economically than continually building network assets, particularly for peak power, which is making electricity unaffordable.

- b) Customers will not have to pay charges for backup supply. This will form part of their energy supply agreement and the Energy Services Provider will manage the risk with the balance of their energy portfolio.

Q6. Do existing estimates of the possible network savings take into account that the network, including an expansion expected over the remaining four years of the current regulatory period, will already exist and some extent be left 'stranded' by the transition to local generation and b) the costs of network modifications required to accommodate distributed generation supply back into the grid?

- a) No, but network assets would not necessarily be 'stranded' as they can be used to offset further capital investment in future regulatory periods to the benefit of electricity consumers as a whole. See answer to Q5a).
- b) As answered under Q2 the trigeneration network will not be designed to export energy into the grid transmission network. The cost of connection to the electricity distribution network will form part of the project costs of the trigeneration network. Ausgrid formed part of the Trigenation Master Plan project team and advised the best points on their network to connect the trigeneration energy centres, generally at the 11kV and 33kV levels, to minimise network modifications. Trigenation simply replaces remote electrons with local electrons but without the grid losses and the ability to capture and utilise waste heat from local electricity generation. It is not intended to export electricity into the grid transmission network.

Q7. Our understanding is that Cogent will build and own the trigeneration equipment and attached network? If so, how will they make their revenue?

- **In particular, how will the prices of the resulting electricity, heating and cooling be determined? Will trigeneration be competing for customers with electricity available from the grid?**
- **How will the generators be reimbursed for any energy that they export back to the grid?**
- **Will the City, or someone else, pay Cogent a fixed amount to cover their capital costs, or will these be recovered from energy consumers?**

Cogent Energy will build and own the trigeneration energy centres and the electrical and thermal energy outputs which they will retail to customers using the electricity distribution network owned by Ausgrid and the thermal reticulation network owned

by the City. Cogent Energy will also design, build, operate and maintain the Council's thermal reticulation network. Cogent Energy will make their revenue from the sale of electrical and thermal energy.

- Trigeneration electricity will be sold directly to customers in competition with grid electricity. Thermal energy will be sold to customers at agreed rates with customers on a project by project basis, taking account of comparable heat from gas fired boilers and cooling from electric chillers.
- It is not intended that generators will export back to the transmission grid. Generators will be reimbursed for electricity sold to customers who host a trigeneration energy centre and to other customers over the electricity distribution network.
- Capital costs, in the main, are recovered from the sale of energy to customers. However, the City will contribute towards the capital costs of a precinct based project where buildings are connected to the thermal reticulation network and possibly towards the energy centre. Given that thermal reticulation networks need to be built over time to the full capacity of a precinct from stage 1 without having the full thermal energy load connected at stage 1 it is necessary to forward fund this so that future thermal energy loads can be connected. For example, the first stage of a 20MWth precinct may be supplied from a 4MWe/4MWth trigeneration plant in stage 1 without the economics from a 20MWth connected thermal energy load. Forward funding of the first stage of the 20MWth thermal reticulation network will enable further thermal energy loads to be connected in the future up to the capacity of that precinct as set out in the Trigeneration Master Plan.

The City controls the investment of this through a specified maximum cost of carbon abatement and recovers its investment in the thermal reticulation network with a funds reimbursement mechanism in the development agreement as and when future thermal energy loads are connected.

Q8. In order to estimate the net benefits of distributed generation we will also require some figures for the forecast annual per MW cost of trigeneration, taking into account equipment capex, ongoing capex, fuel costs, and depreciation and so on.

The forecast figures for the 360MWe in the CBD and Green Square are set out in Chapter 4: Financial and Economic Viability of the Trigeneration Master Plan. However, it should be remembered that trigeneration is different to electricity only power stations in that there are two energy outputs from one energy input with trigeneration – electricity and thermal energy (heating and cooling). Trigeneration also displaces electricity demand. In this case, 360MWe of trigeneration displaces 542MWe of electricity demand from the grid. The figures to back up the Trigeneration Master Plan numbers are detailed in the Trigeneration Master Plan – Technical Appendix.

Q9. Finally, we are also looking to understand the current regulations and how they could be changed to better accommodate distributed generation technologies and would be interested to hear what regulatory impediments, in the NEM or elsewhere, the City of Sydney has had to confront in getting the project approved and operational.

There are significant regulatory and institutional barriers to the deployment of distributed generation or decentralised energy. The electricity market was designed for a centralised energy system, not a decentralised one. The consequence of this is to penalise decentralised energy by imposing centralised energy market and administration costs for something that makes little or no use of the big transmission networks and the costs and regulation are out of all proportion to the scale of the generation, distribution and supply. The laws of physics dictate that electricity will flow to the nearest load, so wherever decentralised energy is located the generation, distribution and supply will be integrated and will always be very local. It should not be treated as if it were centralised energy.

In the UK, decentralised energy was stimulated by the Electricity (Exemption from the Requirements for a Licence) Order 2001³ which led to the Woking private wire and other decentralised energy systems. These were class exemptions, so permission was not required from any of the vested interest energy players, including the distribution network operator, or the regulator – the Office of Gas and Electricity Markets (Ofgem). Compliance with the order was sufficient to implement decentralised energy projects.

The exemption supply limits were up to 50MW (without Secretary of State approval) or up to 100MW (with Secretary of State approval) for each generation site over private wires. This enabled significant growth in non-residential supply and some growth in residential supply. However, the exempt limit for home use was only 1MW (about 1,000 homes) for each generation site with limited exempt aggregated supply over public wires.

Because decentralised energy was the key carbon reducer for London (as well as cutting energy costs and helping tackle fuel poverty), the Mayor of London and the London Climate Change Agency (of which the Mayor was chair and Allan Jones CEO) decided to do something about this through negotiation with government.

This resulted in a call for evidence and the setting up of the Ofgem/ Department of Trade and Industry/Business Enterprise and Regulatory Reform Distributed Generation Working Group (on which Allan Jones sat) to investigate and remove the regulatory barriers to distributed generation or decentralised energy. The London Climate Change Agency submitted evidence⁴ to the Working Group which demonstrated the regulatory barriers to decentralised energy and the associated economic barriers in participating in the National Electricity Trading Arrangements or NETA (similar to Australia's National Electricity Market or NEM) which created market failure by electricity regulation.

³ The Electricity (Class Exemptions from the Requirement for a Licence) Order 2001
<http://www.hmso.gov.uk/si/si2001/20013270.htm>

⁴ London Climate Change Agency Submission of Evidence to the Ofgem Distributed Energy Review – September 2007 <http://www.ofgem.gov.uk/Networks/ElecDist/Policy/DistGen/disenwg/Documents1/LCCA%20Paper%20-%20Review%20of%20Arrangements%20for%20DE.pdf>

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The evidence of costs to decentralised energy of participating in the UK's National Electricity Trading Arrangements was carried out at two levels - 5MW and 50MW to demonstrate the economic barriers to decentralised energy brought about by NETA. The costs can be summarised as follows:-

5MW_e £77,626 (\$194,065 AUD) to £151,226 (\$378,065 AUD)
 on establishment plus;
 £274,634 (\$686,585 AUD) pa

50MW_e £152,826 (\$382,065 AUD) on establishment; plus
 £2,583,296 (\$6,458,240) pa

The UK/Australian exchange rate at the time (2007) was about \$2.50 AUD to £1 and the equivalent in AUD is shown in the brackets above.

The details of the costs and charges are detailed in Annex 4 of the attached evidence report. This demonstrated to UK Government that UK electricity regulation was behaving in an anti competitive way and creating an unfair economic barrier to decentralised energy which was a key part of UK Government's policies and targets to tackle climate change

Although the barriers were easily identified, the conundrum for the UK regulator Ofgem was how to tackle the problem without upsetting the market approach to supplying electricity to domestic consumers and the protection given to domestic consumers. A compromise was reached leading to the creation of the "virtual private wires" over public wires concept.

Ofgem determined that if decentralised energy is restricted to using the public wires distribution network and the maximum supply limits removed it can be licensed according to its size and treated as a second competitive (decentralised) energy market. Arrangements can be made for any imports into or exports from transmission networks (which would be minor) via the back-up agreement with grid electricity suppliers. This would allow the decentralised energy developer or Energy Services Company (since more than just electricity would normally be supplied) to charge its customers competitive retail electricity prices (less the distribution use of system charges) rather than the much lower wholesale price it would get by selling electricity into the grid. Ofgem enacted the Electricity Supply Licence Modification Order on 19 March 2009⁵ to bring about this second competitive (decentralised) energy market.

The City's proposal to introduce a new local electricity supplier licence based on the UK's Electricity Supply Licence Modification 2009 formed part of the

⁵ Ofgem Distributed Energy – Electricity Supply Modification 2009

<http://www.ofgem.gov.uk/Sustainability/Environment/Policy/SmallrGens/DistEng/Pages/DistEng.asp>

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City's submission to the Prime Minister's Task Group on Energy Efficiency on 30 April 2010⁶. Similar submissions have also been submitted to the NSW Special Commission of Inquiry Electricity Transactions, Australian Energy Regulator, Australian Energy Market Operator and the Australian Energy Market Commission.

Other regulatory barriers to decentralised energy identified in Chapter 6 of the Trigenation Master Plan that should also be addressed, are summarised below:

1. Reform BASIX to recognise low carbon infrastructure zones;
2. Recognise the decentralised energy network in mandatory Commercial Building Disclosure and NABERS;
3. Incentivise energy efficiency and low carbon energy;
4. Standardise connection fees for gas and electricity networks;
5. Introduce demand management rebates;
6. Introduce Environmental Upgrade Agreements for new development;
7. Streamline State Environmental Planning Policy planning approvals for decentralised energy; and
8. Streamline easements and access arrangements for decentralised energy.

As regards the City of Sydney trigeneration project the regulatory barriers will be partly overcome by being able to export surplus electricity across the public wires distribution network to other buildings within the low carbon zones or precincts, paying a Distribution Use of System charge to Ausgrid. This will be facilitated by trading software (*CogentPower*) to enable electricity to be netted off and therefore, increase the value of this electricity outside of the wholesale electricity market in the National Electricity Market.

However, it should be noted that only Cogent Energy/Origin Energy has this trading software and a better approach would be to remove the regulatory barriers to trigeneration and other forms of decentralised energy similar to the regulatory regime in the UK to create a level playing field for decentralised energy providers.

Allan Jones MBE
Chief Development Officer, Energy & Climate Change
11 July 2012

⁶ City of Sydney Submission to the Prime Minister's Task Force on Energy Efficiency – 30 April 2010 <http://www.climatechange.gov.au/government/submissions/pm-task-group/~media/submissions/pm-taskforce/papers/102-city-of-sydney.ashx>