

## DECENTRALISED ENERGY – TRIGENERATION MASTER PLAN BRIEFING

### **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 per cent 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 per cent by 2030 from 2006 levels.

Of the city's greenhouse gas emissions, 80 per cent 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 combined cooling, heat and power or 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 greenhouse intensity by about 35 per cent. This will need at least 330MW<sub>e</sub> of trigeneration 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.

However, how does a City implement such a massive undertaking from a standing start with little or no prior history, experience or expertise in tackling climate change or implementing any form of decentralised energy? What the City needed to do was to take up the challenge of delivering the energy and climate change goals in Sustainable Sydney 2030 through the development and implementation of a 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.

### **Centralised Power Generation Efficiency and Grid Losses**

More than two thirds of primary energy is lost at remote power stations in the form of waste heat, a natural by-product of thermal electricity power generation, rejected into the atmosphere through power station cooling towers using significant quantities of water to reject the waste heat.

The efficiency of power stations in NSW<sup>1</sup> range from 28 per cent efficiency for the coal fired plant in the Hunter Valley to 42 per cent for the combined cycle gas fired plant in Smithfield. 9 out of the 11 primary power stations in NSW are coal fired plant with an average efficiency of 34 per cent. Grid transmission and distribution losses in NSW amount to 8.3 per cent reducing the efficiency of NSW grid electricity delivered to consumers to 31 per cent. The city's grid efficiency is likely to be worse than this since the city's very large electrical load is at the end of the network and very peaky due to the very large electric air conditioning load.

The poor efficiency of centralised energy has a cost that is now being felt by NSW electricity consumers with huge rises in electricity bills, primarily driven by network charges transporting the electrons from remote centralised energy power stations to end consumers.

### **Grid Network Charges**

The Institute of Sustainable Futures, University of Technology Sydney 'Close to Home: Potential benefits of Decentralised Energy for NSW Electricity Consumers' report<sup>2</sup> 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 per cent increase on the previous 5 year period. Average electricity prices in the Sydney electricity distribution network area are expected to increase by 83 per cent during this period with the proportion of electricity bills that goes to pay network charges to rise from 40 per cent to 60 per cent.

The Institute of Sustainable Futures estimates that the City's plans to supply 70 per cent of the Local Government Area's electricity needs from a 360MWe trigeneration network by 2030 could achieve savings in deferred electricity network costs and

---

<sup>1</sup> Cooperative Research Centre for Coal in Sustainable Development 'A Life Cycle Assessment of the NSW Electricity Grid 2007' [http://www.ccsd.biz/publications/files/TA/TA\\_per\\_cent2062\\_per\\_cent20LCA\\_per\\_cent20of\\_per\\_cent20Aust\\_per\\_cent20Elec\\_per\\_cent20Grids\\_per\\_cent2004\\_web.pdf](http://www.ccsd.biz/publications/files/TA/TA_per_cent2062_per_cent20LCA_per_cent20of_per_cent20Aust_per_cent20Elec_per_cent20Grids_per_cent2004_web.pdf)

<sup>2</sup> 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>

avoided costs of new power station capacity to serve the city's growing demand in the order of \$1.5 billion by 2030.

### **Electric Air Conditioning and Peak Power**

A key part of the reason for surging electricity prices is the need to build electricity assets for peak power demand, primarily electric air conditioning, for 4 days of the year to meet high demand on hot days. An estimated \$11 billion of network assets is built to meet demand for just 100 hours a year and as much as 25 per cent of electricity costs result from peak demand, primarily electric air conditioning, that occurs over a period of less than 40 hours a year.

A 2kW reverse-cycle air conditioner costs \$1,500 a year to operate and yet imposes costs on the electricity network of \$7,000 since it adds to peak demand<sup>3</sup>. These network costs are not paid by the consumer operating the air conditioner but by all NSW electricity consumers whether or not they own air conditioners.

These network costs are significantly amplified by a city such as the Sydney CBD. For example, the Trigeneration Master Plan will displace 542MW of electricity peak demand, primarily electric air conditioning, which all NSW electricity consumers are currently paying for. This is equivalent to taking 271,000 - 2kW reverse-cycle air conditioners off from peak electricity demand.

### **Decentralised Energy and Distributed generation**

Distributed generation is generation connected to the low voltage distribution network rather than the very high voltage grid transmission network. Although decentralised energy is a form of distributed generation it is very different in its concept and design than distributed generation.

Distributed generation is typically implemented for a specific purpose, ie, diesel standby generators for standby power, renewable energy to generate an income or a saving for a particular building or project or stand alone cogeneration or trigeneration schemes for individual buildings to achieve a particular GreenStar or NABERS rating. These systems are typically connected to the low voltage (230V or 400V) part of and anywhere on the distribution network without any consideration of load balancing, fault levels, etc, which can create significant connection and associated technical and cost issues.

In order to overcome the regulatory barriers to distributed generation these systems are normally designed not to export electricity into the network minimising the potential reduction in greenhouse gas emissions and economics of such technologies.

Decentralised energy, on the other hand, is designed to replace centralised energy, particularly for cities and other large energy load centres. This is achieved by designing the decentralised energy network for the city or part of the city as a whole to take the place of centralised energy.

Centralised energy transmits electricity from remote power stations across the transmission grid to grid supply points in the local distribution networks. Grid electricity is then distributed from various node points on the high voltage distribution network. This is where decentralised energy is normally connected, typically at the

---

<sup>3</sup> Australian Government 'Draft Energy White Paper – Strengthening the Foundations of Australia's Energy Future December 2011 <http://ret.gov.au/energy/Documents/ewp/draft-ewp-2011/Draft-EWP.pdf>

11kV or 33kV parts of the network, and simply replaces remote electrons with local electrons but without the grid losses. As decentralised energy is developed it gradually changes the distribution network from a passive network to an active network providing further opportunities for network cost savings and the facilitation of a smart distributed network system through the active management of local two-way electricity flows and demand management to the benefit of the distribution network and connected customers as a whole.

As island networks, the thermal reticulation networks are impervious to where the energy centre electricity connections are made so it is important to determine the best places to connect the energy centres first and then design the thermal reticulation networks accordingly. Ausgrid, the electricity distribution network operator, advised the best places and maximum capacities to connect to their distribution network to deliver the specified trigeneration network.

The term decentralised energy was developed in London to differentiate between these types of systems and distributed generation. It also helps to explain the difference as it is the exact opposite of centralised energy and helps people understand the concept.

### **Interim 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<sub>e</sub> of trigeneration which would exceed the City's 330MW<sub>e</sub> trigeneration target under Green Transformers in Sustainable Sydney 2030.

The 360MW<sub>e</sub> of trigeneration systems set out in the interim Master Plan would 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 for the mid-growth scenario. This represents a reduction in greenhouse gas emissions of between 39 per cent and 56 per cent for the building sector and between 18 per cent and 26 per cent 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 energy dense zones connect to the network.

The interim Master Plan would also reduce electricity consumption by 30 per cent and electricity peak demand by 60 per cent.

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 energy dense zones is estimated at \$950 million (\$440 million in 2010 dollars when discounted using 7 per cent 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.

The resolution of the outstanding issues, stakeholder feedback and the 2 year long procurement process for the appointment of an energy services provider to design, finance, build and operate the city wide trigeneration network also informed the Master Plan. Completion of this work has now enabled the City to publish the final Trigenation Master Plan.

### **Reductions in Greenhouse Gas Emissions**

Reductions in greenhouse gas emissions were based on the National Greenhouse Gas Factors – Scopes 2 and 3 emission factors for consumption of purchased electricity by end users and emission factors for the consumption of natural gas distributed in a pipeline. The emission factors for electricity are the mixed grid emissions, although 88 per cent of electricity is supplied by coal fired power stations in NSW. The emission factors for natural gas supplying trigeneration/cogeneration have all been assigned to the electricity output with the thermal energy as a zero carbon as it is waste heat, a by-product of electricity generation.

### **Efficiency of Trigenation**

The procurement for the city wide trigeneration network required gas engines of the highest electrical efficiency available. The Master Plan was based on 4MWe gas engine modules as the optimal module size for the Low Carbon Zones. The gas engine module selected by the successful energy services company comprise, in the main, 4MWe modules with an electrical efficiency of 46 per cent and a thermal energy efficiency of 39 per cent. Turbo-charged 10MWe gas engines with an electrical efficiency of 49 per cent and a thermal efficiency of 41 per cent have recently become available and these may be utilised where optimal modularisation is not compromised and space is available for a larger energy centre.

### **Coefficient of Performance**

The coefficient of performance (COP) is a measure of the output to input energy of an air conditioning chiller or similar plant. It is not a measure of efficiency since this ignores the primary energy supplying the input. A common mistake is made in the assumption that grid electricity is 100 per cent efficient. It is not. For example, the average COP of electric chilling plant in the city is 2.5, ie, 2.5 units of chilled water output energy to 1 unit of electrical input energy. However, the electrical efficiency of the grid is only 31 per cent or less in the city so the overall COP or primary energy efficiency is 0.77 or less.

In order to avoid this misunderstanding and potential misuse of the term coefficient of performance (COP) the European Union determined that the energy efficiency of electric and gas chillers, heat pumps and similar equipment be calculated on the primary energy ratio (PER), which takes account of the efficiency of the electricity and grids, not just the COP. For electrically driven chillers,  $PER = COP \times 40$  per cent (the efficiency of the EU electric grid) and for gas driven chillers,  $PER = COP \times 91$  per cent (the efficiency of the EU gas grid). For heat driven chillers,  $PER = COP \times 100$  per cent (as waste heat of decentralised electricity generation is the primary energy).

When considering greenhouse gas emissions for chillers the refrigerant used by the chillers in addition to the energy consumption must also be taken into account. The Global Warming Potential (GWP) of the refrigerant most often used in electric chillers is HFC 134a which has a GWP of 1,430. In other words, 1 tonne of HFC

134a is equivalent to 1,430 tonnes of carbon dioxide. For heat fired absorption chillers the refrigerant used (water/liquid salt) has a GWP of zero.

When designing a trigeneration network a holistic approach needs to be taken. The waste heat in decentralised energy (that would otherwise be rejected into the atmosphere at remote centralised energy power stations) is captured and used to provide heating and hot water services to buildings directly and cooling to buildings indirectly via heat fired absorption chillers. Single effect heat fired absorption chillers with a COP of typically 0.76 provide the best fit for trigeneration with Sydney's climate since this recovers all of the waste heat available from 100 per cent local electricity generation matched to supply the precinct.

If a chiller with a higher COP was used this would significantly distort the overall energy balance and reduction in greenhouse gas emissions for that precinct. For example, if double effect heat fired absorption chillers (twice the COP) were used this would have the effect of either reducing electricity generation by 50 per cent (and therefore, not capable of supplying 100 per cent of the precinct's electricity demand) or rejecting 50 per cent of the waste heat into the atmosphere. Neither of these solutions are desirable or efficient demonstrating the need to design trigeneration systems holistically, taking account of all the energy outputs and selecting the chiller COP to take most, if not all, of the waste heat available to provide the most energy efficient engineering solution overall.

It should also be remembered that trigeneration uses waste heat for absorption chillers that would otherwise be thrown away at remote power stations. It is not primary energy, unlike grid electricity supplying electric chillers.

### **Combined Cycle Gas Turbines**

Combined cycle gas turbines (CCGT) outside the city were considered during the early stages of the Master Plan. Although manufacturers claim 55 per cent electrical efficiency this is a peak efficiency rate and not an annual rate of efficiency on which trigeneration is based. Australia does not publish annual energy statistics but the UK, which has a high level of CCGT penetration, does. This is known as the Digest of UK Energy Statistics<sup>4</sup>, otherwise known as DUKES, and this shows that the gas power station fleet in the UK achieves 46-48 per cent electrical efficiency less grid losses over the year as a whole.

The only example of a base load CCGT power station in NSW is the CCGT cogeneration plant at Smithfield (with an overall efficiency > 60 per cent in cogeneration mode) which achieves an annual electrical efficiency of 42 per cent delivering less than 39 per cent efficiency to end consumers after grid losses.

Peaking power plant such as the Tallawarra CCGT power station can achieve electrical efficiencies of 50 per cent delivering less than 46 per cent efficiency to end consumers at times of peak power demands. Peaking power plant is only run at times of peak power demands, such as electric air conditioning on hot summer days. The electricity produced is incredibly expensive costing up to \$12,500 per MWh (\$12.50/kWh) of wholesale electricity with the cost spread across all electricity consumers increasing power prices. This compares with the annual average wholesale electricity price of between \$40 and \$50 per MWh or 4 to 5 cents per kWh. If peaking CCGT power stations had to run as base load power stations their annual efficiency would be similar to the Smithfield CCGT power station.

---

<sup>4</sup> Digest of UK Energy Statistics 2011 <http://www.decc.gov.uk/assets/decc/11/stats/publications/dukes/2312-dukes-2011--full-document-excluding-cover-pages.pdf>

Australian Government's Water and the Electricity Generation Industry report<sup>5</sup> established that grid power stations also use and consume significant quantities of water. Approximately, 65 per cent of the generating capacity in the Australia's National Electricity Market currently depends on freshwater for cooling (to reject waste heat into the atmosphere) in coal or gas fired power stations. The value of water used in CCGT power stations is around \$14,000 per ML with a typical 1000MW power station using 6.6GL/year. To this must be added the 3.8GL/year of water used by the (to be displaced) electric air conditioning cooling towers across the four Low Carbon Zones of the city.

The 2003 to 2010 drought led to increased volatility in wholesale electricity prices as well as government intervention in arrangements for supplying water to power stations. While electricity price volatility is of concern, changed water availability resulting from climate change and drought is of even greater concern where inefficient water consuming power stations compete with other demands for water such as households and industry.

Sustainable Sydney 2030 and the City's Green Infrastructure Plan are holistic environmental instruments and remote grid power stations, including CCGT, are not supported by the city as they are inefficient in the use of primary fuels, reject waste heat into an atmosphere that is already warming and compete with other uses of water in the driest habitable continent on Earth.

### **Final Trigeneration Master Plan**

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;
4. Additional precinct scale trigeneration in trigeneration 'hotspots';
5. Additional small scale cogeneration and fuel cells outside of the Low Carbon Zones and trigeneration 'hotspots';
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.

### **Air Quality Assessment**

The trigeneration systems for the four Low Carbon Zones will reduce absolute Nitrogen Oxide (NOx) emissions by over 5,000 tonnes a year. However, these NOx

---

<sup>5</sup> Australian Government Water and the Electricity Generation Industry 2009  
<http://www.nwc.gov.au/publications/waterlines/water-and-the-electricity-generation-industry-implications-of-use>

emissions will be reduced at the coal fired power stations, ie, in the Hunter Valley, and replaced by 220 tonnes of NOx emissions in the city. Across the Sydney metropolitan area, NOx emissions are approximately 91,000 tonnes a year so trigeneration would represent 0.2 per cent of Sydney's NOx emissions compared to transport which represents 78 per cent of Sydney's NOx emissions. Even the 0.2 per cent on NOx emissions will be more than offset by the implementation of other City of Sydney strategies, particularly the 'Connecting our City – Transport Strategies and Action Plans.

Following the procurement process the trigeneration systems will use Best Available Techniques in reducing NOx emissions by fitting selective catalytic reduction to the gas engines to reduce NOx emissions to 50mg/m<sup>3</sup> of air compared to the Interim DECC Nitrogen Oxide Policy for Cogeneration in Sydney and the Illawarra which specifies a maximum of 250mg/m<sup>3</sup> of air. 50mg/m<sup>3</sup> of air is about half of the NOx emissions of a modern gas fired boiler.

### **Gas Network Augmentation**

The Jemena gas network augmentation feasibility study confirmed that the medium pressure gas network in the city was capable of connecting 360MWe of trigeneration. However, two levels of gas network augmentation would be required:

1. Secondary augmentation at 47MWe by 2015; and
2. Primary augmentation at 147MWe by 2020.

The primary gas network augmentation would also enable 360MWe or more of trigeneration to be connected without further augmentation. The costs of the gas network augmentations would be funded by most, if not all, against a long term Use of System agreement with the trigeneration operator. This is similar to how gas connections to power stations are funded.

### **Green Square**

The increase in gross floor area in the Green Square Low Carbon Zone has increased the trigeneration capacity from 20MWe to 32MWe and the trigeneration capacity in the four Low Carbon Zones from 360MWe to 372MWe. The revised assessment showed that the reduction in total greenhouse gas emissions had increased to 140,176 - 147,311 tonnes a year for the Greater Green Square study area based on Option 3 – residential and non-residential hot water, space heating and space cooling.

### **Trigeneration 'Hotspots'**

The four trigeneration 'hotspots' where precinct scale trigeneration networks could be implemented are:

1. University of Sydney;
2. Australia Technology Park and Carriageworks;
3. Entertainment Quarter near Centennial Park; and
4. the industrial precinct in the south of the LGA.

The trigeneration 'hotspots' will increase precinct scale trigeneration capacity from 372MWe to 410MWe across the LGA.

## **Domestic Fuel Cell CHP**

The trigeneration/cogeneration capacity outside the four Low Carbon Zones and the four trigeneration 'hotspots' amounts to 67MWe and will increase trigeneration/cogeneration from 410MWe to 477MWe across the LGA.

The capacity is based on small scale cogeneration systems, primarily for individual residential and small scale commercial buildings. Given that there are a range of small scale cogeneration or combined heat and power (CHP) technologies available that could deliver this capacity the Master Plan has based the domestic CHP technology on domestic fuel cell CHP due to its much higher electrical efficiency and its ability to double the reduction in greenhouse gas emissions against other available domestic CHP technologies.

However, this is currently an expensive new technology and may require some support to materialise these efficiency gains and reductions in greenhouse gas emissions by 2030. Domestic fuel cell CHP technologies are being installed in Germany, France, the UK, Japan and the USA with measures such as feed in tariffs. In Germany, one of the energy services companies are providing domestic fuel cell CHP free of charge to households, which then pay for the gas they use and take the electricity and heat outputs. Some fuel cell CHP units have also been installed in Australia but receive no support from government even though one of the leading fuel cell CHP manufacturer's is Australian.

## **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 per cent of the 30 per cent renewable electricity target can be delivered within the LGA and 45 per cent from outside the LGA. In addition, 150 per cent and 95 per cent of the renewable gases and fuels needed to displace natural gas for the 360MW<sub>e</sub> of trigeneration in the Trigeneration Master Plan can be sourced from feedstock within 250km of the city for peak/shoulder (07:00 to 22:00 Mondays to Fridays) and 24 hours per day supply, respectively. Developing more than 95 per cent renewable gas and fuel supply resources or supplying more than 360MW<sub>e</sub> of trigeneration can be achieved by moving slightly beyond the 250km on the proximity principle and/or developing geothermal hot water resources in proximity to the city.

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

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

## **Leading by Example**

Leading by example is an important principle for the public sector as you cannot expect others to do what you are not prepared to do yourself. A carbon reduction plan not commissioned and implemented by a tier of government is just that – a plan to join many other plans gathering dust on a bookshelf.

The “show by doing” principle as adopted in Woking and London demonstrates that if the public sector leads, others will follow.

The City has already reduced greenhouse gas emissions in its buildings by 18 per cent from 2009 to 2011 by building energy efficiency retrofits and has let a further building energy and water efficiency retrofit contract to reduce emissions by a further 24 per cent, increasing the total emission reductions to 42 per cent by the end of 2012/13. The City has also let a contract to replace all City owned street lighting with LEDs over the next 3 years which will reduce emissions in its street lighting by 51 per cent.

Tenders have also been received for a large scale programme of solar photovoltaics on the City’s buildings which will be reported to Council in July 2012.

These ‘show by doing’ projects, together with the City’s Trigeneration project will set the City on the path towards reducing emissions on the City’s own buildings and operations by 70 per cent by 2030.

### **City’s Trigeneration Project**

Following completion of the 2 year long procurement programme 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 supply 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 January 2014.

Stage 3 represents the balance of the trigeneration network to be rolled out by 2030, if not before.

Allan Jones MBE  
Chief Development Officer, Energy and Climate Change  
25 June 2012

*Allan Jones is Chief Development Officer, Energy and Climate Change at the City of Sydney. Allan is also a Board member of the National Climate Change Adaptation*

*Research Facility based at Griffith University. Prior to his appointment Allan was Chief Executive Officer of the London Climate Change Agency, Director of London ESCO Ltd, Director of the London Better Buildings Partnership and Director/Trustee of the Sustainable Environment Foundation. Prior to that he was Woking Borough Council's Director of Thamesway Limited where he reduced CO<sub>2</sub> emissions by 77.5 per cent from 1990 levels to 2004.*

*Allan was appointed a Member of the British Empire in 1999 for services to energy and water efficiency and was instrumental in Woking Borough Council gaining the Queen's Award for Enterprise: Sustainable Development 2001 in the development of Local Sustainable Community Energy Systems, the only local authority ever to receive a Queen's Award for Enterprise.*