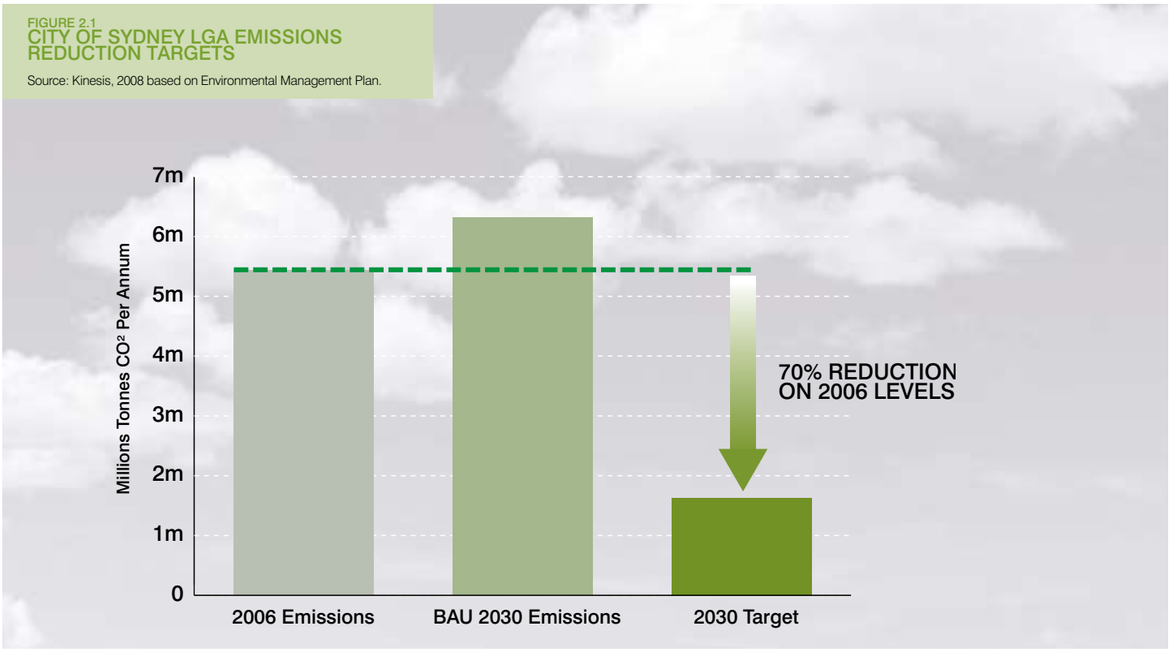
STRATEGIC DIRECTION 2

A LEADING ENVIRONMENTAL PERFORMER

FIGURE 2.1
CITY OF SYDNEY LGA EMISSIONS REDUCTION TARGETS

Source: Kinesis, 2008 based on Environmental Management Plan.



*BAU (Business as usual)

CITY CONTEXT

The City of Sydney has adopted ambitious greenhouse emissions reduction targets in response to mounting evidence of a warmer, more unstable climate

In February 2007, the International Panel on Climate Change (IPCC) released the most comprehensive scientific analysis of climate change ever undertaken. *Climate Change 2007: The Physical Science Basis* confirmed that 'the warming of the climate system is unequivocal'. Eleven of the last 12 years (1996-2006) rank among the twelve warmest years on record.[1]

The *UK Stern Review* (2006) provided a comprehensive account of the science and costs of climate change. By detailing the costs associated with not reducing global greenhouse emissions the report changed public perceptions: climate change is no longer solely an environmental issue, but also a pressing economic and social equity issue.

The *Kyoto Protocol* is the most important global policy response to climate change. The Protocol, ratified by the Australian Government in December 2007, sets a target to reduce greenhouse gas emissions by 60 per cent on 1990 levels by 2050.

The City of Sydney endorsed the principles of the *Kyoto Protocol*, and has established a target of a 70 per cent reduction and offset of greenhouse gas emissions from the City by 2050 from 1990 levels, and a 30 per cent reduction in greenhouse gas emissions from 1990 levels by 2020.

For Sustainable Sydney 2030, this means a 70 per cent reduction against current emissions (FIGURE 2.1 shows what these targets mean for the City of Sydney). Taking into account Local Government boundary changes and the last 20 years of growth, this translates to a need to halve current emissions in the next 12 years, regardless of planned growth. Put simply, early meaningful action must occur.

The City of Sydney must stabilise and reduce its greenhouse gas emissions and mitigate the unavoidable impacts of climate change.

Global warming is the most important urban management issue for the city in the 21st century

Average temperatures in Australia have risen by 0.9°C over the last 100 years. Moderate predictions of climate change for the Sydney Region by 2030 include:

- a further warming of 1°C
- a five per cent decrease in rainfall
- more hot days with temperatures over 35°C
- increased storm events.

Changes in regulations and market and weather patterns will impact every aspect of the City's social, built, natural and economic environment. Both regulators and developers who are responsible for the growth of urban and regional communities must act on and understand the current and future risks associated with a warmer, more unstable climate if the City is to prosper.

Observatory Hill

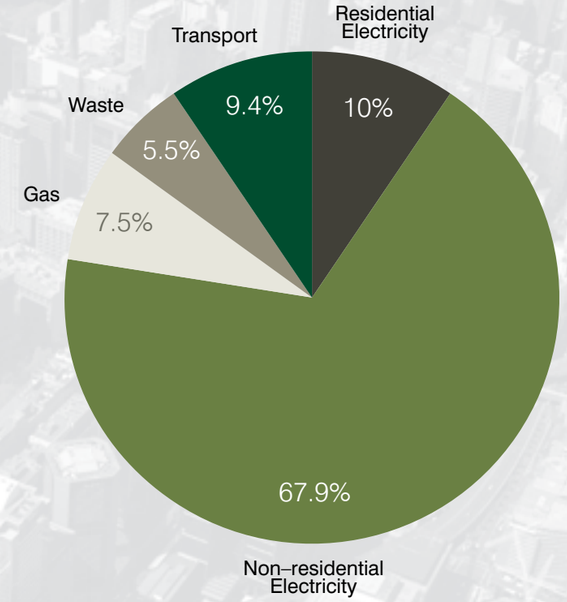
City of Sydney

Effective action is required across a number of fronts

Many sectors contribute to greenhouse gas emissions in the City (see FIGURE 2.2). These sectors are influenced by the various tiers of government. To reduce emissions from these sectors, the City of Sydney requires an analytical understanding of how each sector and particular initiatives will help achieve the set targets. This will help to define the responsibilities and expectations of all levels of government, business and community, with a particular focus on the effectiveness of Sustainable Sydney 2030 initiatives.

FIGURE 2.2
CITY OF SYDNEY LOCAL GOVERNMENT AREA GREENHOUSE GAS EMISSIONS BREAKDOWN

Source: Kinesis, 2008 based on various sources.



City of Sydney

Multiple benefits of home gardens

All levels of government, the private sector and the community have a vital role

Being 'green' presents real challenges. The City of Sydney will not achieve its goals without other tiers of government, the private sector and the community playing a role. However, for the City of Sydney to be successful, it must take the lead, and ensure Sustainable Sydney 2030 'promotes sound market signals, overcomes market failures and [has] equity and risk mitigation at its core'.[2]

The City's global status presents significant advantages and opportunities. Its density means interventions to improve environmental performance can be collective, with costs shared across many beneficiaries. As a destination for significant investment there is a high degree of renewal and regeneration in buildings, the public domain and transport. The IPCC has identified the potential for the building sector to reduce emissions (against 'business as usual' projections) by 30 per cent, which reinforces the necessity for the City of Sydney to lead this challenge.

Significant opportunities exist to build new efficiencies, technologies and best practice urban management into the heart of the City, future proofing homes and businesses by generating new levels of adaptive resilience and self sufficiency in the provision of water and energy services.

Sustainable Sydney 2030 will be the blueprint to broker and deliver the transition technologies and urban management framework to implement the deep cuts in greenhouse gas emissions required to stabilise the Earth's atmosphere to prevent unacceptable levels of warming.

WHAT THE COMMUNITY SAID

The consultation undertaken for Sustainable Sydney 2030 consistently highlighted that the community's environmental concerns focus heavily on climate and water issues. By and large most stakeholders are aware of their own responsibilities but are unsure about which tier of government is responsible for addressing these issues.

People want a City…

"…with greater self-sufficiency"

"…which is less congested"

"…with clean, healthy, efficient, sustainable, low-carbon footprint"

"…with efficient use of energy, water and reduced waste"

"…which is a healthy City"

"…which has more green space"

"…with environmental leadership"

"…which uses renewable energy for most energy needs"

City of Sydney

WHY ACTION IS NEEDED

Challenges facing the City:

1 Stabilising emissions to maintain an acceptable global climate
2 Ensuring the City can cope with the impacts of rising sea levels and increased flooding
3 Reducing the unsustainable growth in energy, water and waste resource demands
4 Ensuring the City has greater energy security

Communities and businesses are demanding higher standards for environmental performance across all areas of City life. Intervention must address the following challenges to the environmental performance of the City.

1. Stabilising emissions to maintain an acceptable global climate.

Continuing to emit carbon dioxide at current levels will almost double the pre-industrial levels of greenhouse gas emissions by the middle of the century, and is projected to cause a temperature rise of 2ºC to 5ºC. (Reference Stern Review page 15). According to Stern, a warming of 5°C on a global scale would be 'far outside the experience of human civilisation to date, and comparable to the difference between temperatures during the last ice age and today.'[3]

The atmospheric concentration of carbon dioxide in pre-industrial times was approximately 280 parts per million (ppm). This has risen to the current level of 380 ppm. The *Stern Review* concluded that stabilising at or below 550 ppm carbon dioxide equivalent (CO_2-e) at 2050 would require global emissions to peak in the next 10 to 20 years, and then fall at a rate of at least one to three per cent per year. By 2050, these emissions would need to be around 25 per cent below current levels. Similarly, to stabilise at 450 ppm CO_2-e, global emissions would need to peak in the next 10 years and then fall at more than five per cent per year, reaching 70 per cent below current levels by 2050.

A recent CSIRO report forecasts that Sydney's average temperature will rise by up to 1.6°C by 2030 and 4.8°C over the next 70 years. A decrease in rainfall of up to 40 per cent is predicted over the same period.[4]

If these forecasts are realised the City would be hit hard. In fact, although changes in average temperature and rainfall will have long-term consequences for the City, the impacts of climate change are more likely to be felt through extreme weather events, placing human life, property and the City at increased risk. For example, with more hot days over 35°C, experts in epidemiology have estimated a potential five-fold increase in the number of deaths related to heat stress in Sydney by the middle of the century[5].

The aggressive greenhouse gas reduction targets established by City of Sydney are consistent with the extent and rate of emissions abatement established by IPCC to maintain an acceptable climate.

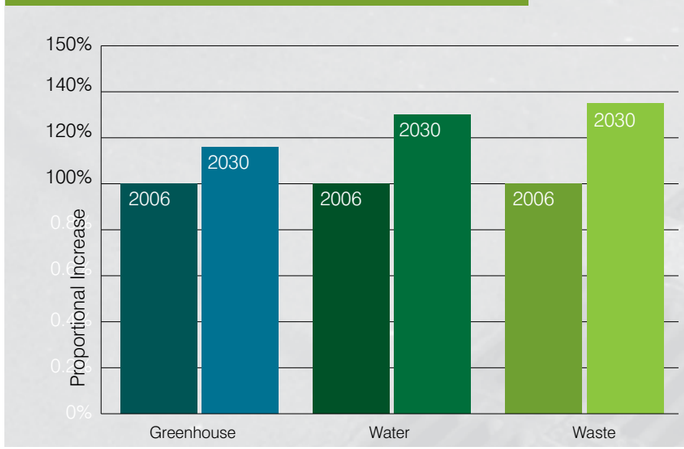
2. Ensuring the City can cope with the impacts of rising sea levels and increased flooding.

CSIRO projections for Sydney are for sea level rises in the order of 3–16cm by 2030. Beyond 2030, physical assets including homes, retail and commercial centres are likely to be directly vulnerable to droughts, floods, storms and a rise in sea level. Climate change will also affect core infrastructure; already the ability of sewage and stormwater systems to cope with rising sea levels and increased flooding has been identified as a potential major cost, further impacting the potential of industry or government to fund the development and maintenance of urban infrastructure in our cities. Other social impacts could include increased heat exhaustion and water shortages to civic agitation and social disorder arising from price rises, homelessness, weather impacts and food shortages. The City must be well positioned to respond.

3. Reducing the unsustainable growth in energy, water and waste resource demands.

Recent trends and projections based on future population growth and waste products show that our consumption of energy and water and the production of waste products are increasing. Energy demand in the City increased by almost 20 per cent in the past five years. Although water consumption decreased by five per cent over the last five years (due to the constrained supply and water restrictions), the general trend has been increasing consumption. By 2030, the City's annual water consumption is predicted to increase by 30 per cent, while greenhouse gas emissions are predicted to increase by 16 per cent. On current trends, the City's residential waste stream is predicted to increase by 35 per cent by 2030.

FIGURE 2.3
CITY OF SYDNEY GREENHOUSE, WATER, AND WASTE BUSINESS AS USUAL (BAU) PROJECTIONS.



Source: Kinesis, 2007

4. Ensuring the City has greater energy security.

The City is totally reliant on large centralised infrastructure to deliver its energy and water services, including coal-fired power stations. Because of this, the City depends on these providers to enhance their efficiency, reduce waste and reduce their environmental impact in the future through the introduction of new technologies enforced by regulation or stimulated by market forces.

WHAT THE **CITY OF SYDNEY** IS ALREADY DOING

Working towards being a carbon neutral City

The City of Sydney is already responding to the issues of greenhouse emissions and water conservation. Among a host of leading initiatives, the City of Sydney has endorsed the *Kyoto Protocol's* principles and in 2008 became Australia's first carbon neutral Local Government. The City of Sydney's commitment to leadership has extended to endorsing a series of aggressive resource consumption reduction targets for its own activities and in the City itself. See green box below for targets.

These targets are ambitious but appropriate. They provide the framework to develop a decisive and meaningful response to climate change by addressing emissions, water, and waste. These targets represent an immense challenge, but also provide the motivation to act.

Working with International Cities to address Climate Change

The City of Sydney is participating in the *c40 Cities Climate Leadership Group*, a group of the world's largest cities aiming to tackle climate change by facilitating the spread of knowledge and experience, which will be critical to combat climate change.

Energy and Water Savings Plans

The City of Sydney developed energy and water savings plans as part of the State Government's *Metropolitan Water Plan* and the *NSW Greenhouse Plan*.

CitySwitch Green Office Program

This national program, formerly 3CBD's, is now underway.

Other Initiatives

Other initiatives such as the *Cycling Strategy*, *Earth Hour*, *Live Green* are requiring major events to be environmentally responsible and contribute towards the City of Sydney being a leading environmental performer.

ENVIRONMENTAL MANAGEMENT PLAN TARGETS

- 100per cent offset of greenhouse gas emissions from Council operations and services by 2008.This includes a minimum 15 per cent reduction of Council emissions by 2012 based on 2006 levels through energy savings measures.
- 70 per cent reduction and offset of greenhouse gas emissions from our local government area by 2050 based on 1990 levels. This includes:
  - Accurate annual emissions data by 2008
  - Slowed rate of emissions increase by 2010
  - Stabilisation by 2012
  - 30 per cent reduction by 2020
- 25 per cent electricity used in our local government area to come from renewable energy by 2020.
- 20 per cent of total trips in the local government area between 2 and 20 kilometres to be made by bicycle by 2016.
- No increase in mains water consumption of both Council and the City of Sydney by 2015 based on 2006 levels. This includes 25 per cent of water used by both Council and the City of Sydney to be recycled by 2015
- 66 per cent resource recovery of residential waste from the City of Sydney by 2014.
- 66 per cent resource recovery of waste generated by Council and its contractors by 2014.
- 63 per cent resource recovery of commercial and industrial waste from the City of Sydney by 2014.
- 76 per cent resource recovery of construction and demolition waste from the City of Sydney and Council projects by 20 14
- 24 square meters of public open space per resident.

Royal Botanic Gardens and Harbour

A LEADING ENVIRONMENTAL PERFORMER

Green Infrastructure proposed in Sustainable Sydney 2030 includes:

Green Transformers
Green Transformers are the infrastructure hubs to reinvent the supply of energy and water in the City of Sydney. Green Transformers describes a network of distributed energy plants producing low carbon electricity, heating and cooling, from gas. Green Transformers offer the potential to convey waste water and solid waste to a low carbon energy source. These systems could be installed in a number of configurations in both urban renewal areas and existing residential and commercial areas. This infrastructure will lower emissions, reduce potable water consumption, and guarantee a level of energy security and self-sufficiency for the City.

Green Reticulation
Distributing heating and cooling potential throughout the City expands the pool of potential users of recovered thermal energy beyond the industrial sector to include commercial, institutional and multi-unit residential buildings.

The 2030 Vision assumes the extension of current City of Sydney policies and articulates additional innovative measures for urban management. In particular, it re-imagines the provision of energy, water, and waste infrastructure within the City. The technologies and policies integral to delivering this infrastructure are almost all currently available, and are widely recognised as the lowest cost methods to transition to a low-carbon economy.

The Vision also outlines the basis and rationale for the City of Sydney to broker agreements and strategic alliances which will contribute to meeting the aggressive Environmental Management Plan targets.

Supplementary and complementary local systems are proposed. The introduction of Green Infrastructure in the City, comprising 'Green Transformers' and 'Green Reticulation' is a deliberate strategy which can be brokered by the City of Sydney.

AN OVERVIEW OF THE KYOTO PROTOCOL

The Kyoto Protocol is an international agreement that was agreed in 1997 and has been ratified by 178 countries.

It will reduce global greenhouse gas emissions by requiring developed countries to meet national targets for greenhouse gas emissions over the five year period form 20008 to 2012.

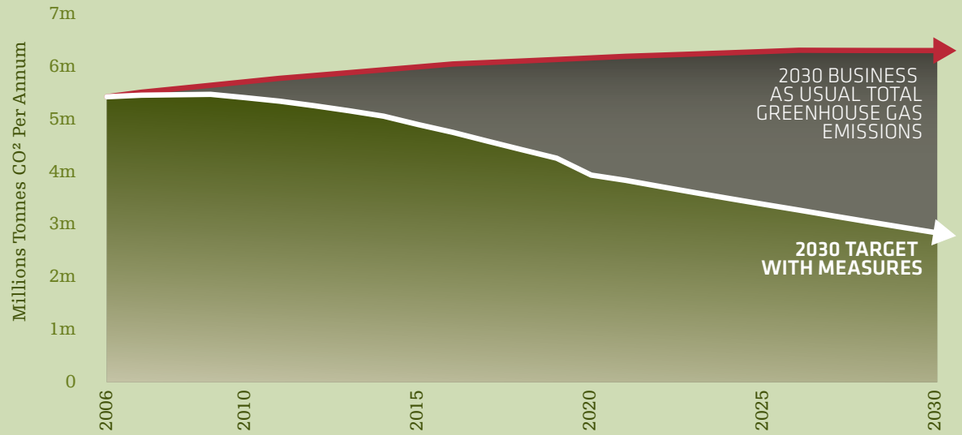
The protocol recognises that developed countries have a responsibility to take the lead in international action because they are responsible for most of the world's past emissions.

Each developed country's target was negotiated and agreed internationally. Australia's annual target is 108% of our 1990 emissions.

Australia deposited its "instrument of ratification" on 12 December 2007. It came into force for Australia on 11 March 2008 following a mandatory 90 day waiting period.

Reference www.climatechange.gov.au/international/kyoto

FIGURE 2.4
CITY OF SYDNEY 2030 EMISSIONS REDUCTIONS PORTFOLIO



Source: Kinesis, 2007

Given an increasing awareness of the environmental costs of current power generation technologies, major investment to meet the predicted growth in Australia's energy demand will require a different approach. Green Transformers offer a low cost, low greenhouse option for the City's forecasted energy growth by providing energy (electricity, heat and cooling) and improved efficiency at the point of use in industrial, commercial and residential applications, avoiding the need for costly transmission and distribution network upgrades and new large centralised generation assets.

Building owners and tenants are receptive to a long-term energy supply system that is fuel flexible. This insulates them from the impact of market price shocks. Linking buildings through local green reticulation networks enables installation of co-generation and other technologies within the City's Green Transformers that are technically and commercially proven, economically viable and environmentally attractive.

Distributing heating and cooling potential through a Green Reticulation network is an important part of the Green Transformer strategy. It expands the pool of potential users of recovered thermal energy beyond the industrial sector to include commercial, institutional and multi-unit residential buildings.

Energy security is an important national and international policy issue. Green Transformers and green reticulation can play a key role in increasing energy security by:

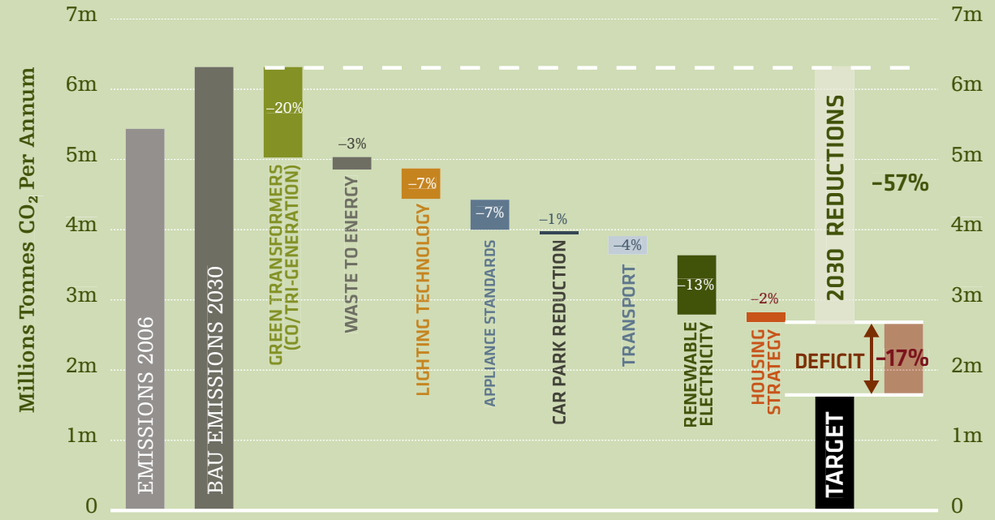
- **Facilitating power generation in load centres.** By generating power close to the load, the Green Transformer captures energy normally exhausted through large cooling towers at coal fired power stations and avoids or reduces power transmission and distribution constraints.
- **Reducing cooling-related peak power demand.** Air conditioning is a big contributor to peak power demands. By cooling through heat-driven chillers, district cooling reduces peak power demand.
- **Shifting demand to off-peak periods.** By incorporating advance battery or thermal energy storage systems that store hot water, chilled water or ice at night for use during the day, Green Transformers can shift power loads to off-peak periods.
- **Increasing fuel flexibility.** Green Transformers boost reliability and energy security by providing flexibility to use a variety of energy resources, thereby reducing the impact of supply and price variations.

An analytical framework to measure and evaluate the effectiveness of Local, State and Federal policy and urban management actions has been developed. The *Environmental Performance Framework* provides the City of Sydney with an estimate of the City's emissions in 2030. It describes a range of interventions that will be required to reduce emissions, making a portfolio of emissions reduction measures (see FIGURE 2.5).

The results of modelling the 2030 interventions indicate an annual shortfall or deficit of one million tonnes of carbon dioxide against the aggressive Environmental Management Plan targets.

Sustainable Sydney 2030 deploys all the best transition technologies at scale with fuel switching, increased efficiencies and renewables responsible for the majority of the 57 per cent reduction in emissions. To make further reductions and remove the deficit, a further shift to renewables or carbon zero fuels would be required, necessitating the deployment of technologies such as large scale battery storage and fuel cell generation systems. The continuous improvement approach adopted in this Support Document and ongoing monitoring and review will ensure that the City of Sydney is best able to assess and adopt the required innovations to address this shortfall.

FIGURE 2.5
CITY OF SYDNEY 2030 EMISSIONS REDUCTIONS PORTFOLIO
SOURCE: KINESIS



Major policy interventions modelled in the Sustainable Sydney 2030 Emissions Reduction Portfolio include:

1.Green Transformers—installing 330 megawatts (MW) of natural gas generation. When combined with other demand reduction measures (see below), this provides approximately 70 per cent of the electricity requirements for the City in 2030 and lowers the greenhouse intensity of electricity by approximately 35 per cent.[7] The by-products of this generation provide low greenhouse hot water, heating, and cooling to approximately 36 per cent of all dwellings in the City, and 43 per cent of all non-residential buildings in the City, significantly reducing both electricity and gas consumption.[8] Intervention begins in 2010, with small installations increasing from to 25 MW by 2015. From 2015 to 2030, approximately 20 MW is added every year, totalling 330 MW is enough to power over 300,000 homes.

2. Waste to Energy—Diverting 50 per cent of the non-recycled residential and non-residential waste stream from landfill would provide renewable methane to power a 5 MW waste to energy plant. This will require cooperation with the State Government to determine the best means to harvest non-residential waste stream. This Waste to Energy plant is assumed to be operational by 2020 in the modelling.

3. Retrofit of Lighting Technologies—The Australian Government should maintain its commitment to phase out incandescent lightbulbs and policy must ensure new lighting solutions are as efficient as possible. The reduction is approximately 10 per cent across all building types (six to nine per cent in dwellings, 12 per cent in non-residential buildings). As this outcome could be achieved by a market instrument, 100 per cent of all buildings are affected.

4. Appliance Standards—This outcome requires a meaningful commitment to lower the electricity consumption of major and minor appliances, including standby electricity consumption. The intervention is expected to save 10 per cent of electricity across all building types. Like lighting, this outcome would be implemented primarily through a market instrument, affecting 100 per cent of buildings.

5. Reduced car parks—The 'business as usual' scenario assumes all new multi-unit residential buildings will have 1.1 carpark spaces per dwelling. The 2030 scenario implements a 40 per cent reduction on this allocation, reducing consumption of lighting and ventilation electricity consumption from car parks.

6. Transport Initiatives—Reductions in transport emissions can be achieved by reducing vehicle emission intensity by approximately 50 per cent, encouraging uptake of cycling, reducing car parking, and improving public transport to reduce private car use.[9]

7. Renewable Electricity—In accordance to the Environmental Management Plan target, 25 per cent of electricity used in the City will come from renewable energy by 2020. The actual source of this renewable energy could be via incentives for Green Power or a similar scheme, or onsite generation, or both. This leaves approximately five per cent of the electricity used in the City as coming from NSW coal-fired generation. Under the 2030 and beyond scenario of extra growth, renewable electricity and additional Green Transformer generation will combine to provide all of the electricity consumed by the City.

8. Housing Strategy—Additional savings can be claimed by housing additional residents within the City. If transport patterns remain the same, for each person living in the City instead of the wider Sydney metropolitan area, 1.5 tonnes of CO_2 are saved due to reduced transport emissions, especially private car use.

Sydney Park

The City of Sydney has resolved that utilising the most progressive emission reduction transition technologies at scale is by far the fastest and the most cost-effective transition to a low carbon economy by 2030. To achieve the Environmental Management Plan targets while increasing energy security and self-sufficiency, the results produced by Sustainable Sydney 2030 will be unprecedented if achieved.

- Emission reductions 57 per cent less than 2030 'business as usual' projections will result in 42 million tonnes less carbon dioxide at a cost of approximately $1.5 billion over 23 years. These emission reductions are equal to an immediate installation of 1.3 million rooftop solar systems running uninterrupted over the next 23 years at a initial capital cost of approximately $20 billion.
- In 2030, emissions will be 50 per cent lower than current emissions even allowing for projected growth.
- Annual per capita greenhouse gas emissions for City residents will reduce from the current level of 35.4 tonnes to 11.9 tonnes by 2030—a 66 per cent reduction.
- By 2030 the City will not be reliant on any coal fired electricity (under the 2030 and beyond growth scenario). If all other major urban centres followed suit, NSW would not need any new base-load power stations and could plan for the decommissioning of all coal fired power stations.
- Significant electricity generation within the City of Sydney would increase the emissions of air pollutants such as NO_X. However, with appropriate exhaust gas treatment, direct NO_X emissions from cogeneration would be equivalent to about 10 per cent of current car emissions within the City. Unlike both coal-fired power stations and motor vehicles, gas-powered electricity generators emit very few air polluting particulates. By displacing coal-fired electricity, Green Transformers would lead to a large reduction in overall air pollution.
- Beyond 2030, infrastructure developed to reticulate the fuel (natural gas) for Green Transformers could evolve into a hydrogen/biofuel supply network for a zero emission economy.

To be a leading environmental performer the City of Sydney is committed to ensuring the 2030 Vision addresses the drivers, impacts and risks of climate change. To achieve this, Sustainable Sydney 2030 has the following objectives:

2.1	Increase the capacity for local energy generation and water supply within City boundaries
2.2	Reduce waste generation and stormwater pollutant loads to the catchment
2.3	Improve the environmental performance of existing buildings
2.4	Demonstrate leadership in environmental performance through the City of Sydney's operations and activities

"These emission reductions are equal to an immediate installation of 1.3 million rooftop solar systems running uninterrupted over the next 23 years..."

Objectives & Actions

OBJECTIVE 2.1 Increase the capacity for local energy generation and water supply within City boundaries

CITY NOW

Reliance on centrally provided infrastructure outside of the City.

Currently the City is reliant on coal-fired electricity and water storage dams remote to the City boundaries to deliver energy and water services. The City will miss out on major efficiency benefits if it continues to rely solely on these centralised electricity and water sources.

CITY IN 2030

A network of Green Transformers in the City.

'Green Transformers'—a network of sustainable energy, water and waste treatment facilities—will meet a substantial portion of the City's resource demands. Green Transformers will be spread between new urban renewal projects and existing parts of the City, particularly where dense mixed-use development exists. Access to, and the benefits of, Green Transformers will be distributed to business and residents through a new underground green reticulation network facilitated by the City of Sydney. This infrastructure will increase the resilience and capacity of City to manage the impacts of climate change and increase energy security.

Continuous improvement in resource efficiency.

Through the provision of real-time reporting on energy and water consumption all City residents will be able to assess the effectiveness of Sustainable Sydney 2030 policy initiatives online. The City of Sydney will provide full disclosure on progress towards Environmental Management Plan targets and the ability to monitor and analyse the effectiveness of existing and new policy proposals.

FIGURE 2.6
LOCATION OF GREEN TRANSFORMERS ACROSS THE CITY

INTERNATIONAL CASE STUDY

City Wide Cogeneration, Korea

Korea District Heating Corporation (KDHC) was founded in 1985 by the Korean Government as a response to growing climate change concerns. It is now the world's largest district heating energy provider, supplying close to 800,000 Korean homes. KDHC have demonstrated that using co-generation and massive-scale heat generation facilities to produce heating and cooling energy is far cheaper and cleaner than centralised and individual heating methods. In just 20 years, 1.4 million homes had been supplied with district heating.

District heating is a system of generating and supplying heat energy from a series of co-generation and massive-scale heat generation facilities that service the community via a network of insulated pipes. These pipes transfer hot water as an agent for heating, or alternately, cold water for cooling. This is in comparison to centralised generation, where the energy is generated at one large, regional power station, supplying power to individual heating systems, which are located separately in homes.

KDHC facilities generate heat and power simultaneously. Heat energy is supplied to homes as hot water through a structured heating pipeline network, allowing homes to control indoor air temperatures or use hot water. The district cooling system is supplied in the same way. This system uses less electricity than other cooling methods, helping to reduce the electrical load. Greenhouse gas emissions are also reduced by using water as a refrigerant rather than Freon or other greenhouse gases.

By capturing much of the heat that is normally lost in common power generating facilities and using it for district heating purposes, the co-generation facilities used by KDHC double the efficiency of the power generating process. This increased efficiency significantly reduces fuel consumption, which in turn reduces cost and air pollutants. When compared to centralised heating in 2001, for example, **the district heating system reduced fuel consumption by 53 per cent, annual cost by 72 per cent, and air pollutants by 46 per cent.**

The other main benefit of the district heat system is safety. As people do not require their own heat generating facilities, the danger of fire, explosion and suffocation is eliminated, while the costs of replacing, repairing and maintaining the users' own heat generation facilities are also saved.

www.kdhc.co.kr/eng

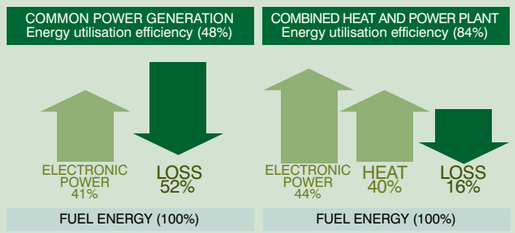


Illustration of the increased efficiency of the co-generation technique of power generation.

INTERNATIONAL CASE STUDY

Waste to Energy, Los Angeles Conversion Technology Plan

As geographically alike lands, Australia and the US are facing similar challenges with the future direction of waste management. The era of cheap landfills is coming to an end, as the suburban dumps fill up, and become recognised as environmentally harmful. The ultimate choice is becoming long haul transport of waste to distant desert landfills, or beginning to consider new options, like conversion technology. Conversion technologies have already been embraced in places like Europe and Japan, for example, where land is sparse and they rely heavily on the technologies to create renewable power and eliminate the need for disposal. Compared to the remote landfill option, conversion technologies encourage the locality to take responsibility for their own actions, and drastically reduce their ecological footprint.

Consistent with the active approach to tackling climate change in California, the City of Los Angeles has developed a 'Green LA' plan that embodies the City's approach to climate change. Waste is considered an important element in this plan, specifically in the RENEW LA component, headed by City Councillor Greig Smith, which is tagged as aiming to achieve 'zero waste'. (This idea of 'zero waste' does not mean zero trash, but aspires for a level of diversion of waste of 90 per cent or more by 2025, with the remaining inert residual waste to be disposed of constructively.)

Councillor Smith describes conversion technology is the 'kingpin' of the RENEW LA plan. Conversion technology is a non-combustion process that can be either thermal or bio/chemical, thereby not producing harmful emissions. While the cost of establishing the technology may be high, Councillor Smith believes the benefits of reducing greenhouse emissions, as well as the numerous health and sanitation issues that come with landfills, make the initial extra cost worthwhile. He also believes these conversion technology plants will become part of the growing 'green collar' workforce, with 10 jobs being created in conversion technologies for every job in landfill. To encourage local businesses to embrace the plan, the City is proposing to grant tax credits for certified 'zero waste' businesses.

The LA Department of Water and Power (LADWP), which is the largest municipally owned utility in the US, is responsible for several Renewable Energy projects, including the idea of converting waste to energy. In May 2007 the proposals for four state of the art facilities were being evaluated. It is hoped these will be in service by July 2010, and will contribute to 0.8 per cent of the City's total power generation. As part the City's long term plan, seven conversion technology plants will eventually be spread efficiently across the City by 2025, minimising transport costs and emissions.

A specific project already underway is the Terminal Island Renewable Energy (TIRE) Project. This project will involve the injection of biosolids, the soil-like byproduct of wastewater treatment, into depleted oil and gas reservoirs 5000 feet below Terminal Island. The biosolids will be converted into clean energy through the natural conditions of high temperature and pressure existing beneath the earth's surface, with the resulting biogas energy being converted into electricity through a 1 MW fuel cell. The TIRE Project is expected to save millions of dollars in capital, operating and maintenance costs that would have been otherwise necessary for dewatering facilities.

ACTION 2.1.1 Prepare a Green Infrastructure Plan for the City.

A Green Infrastructure Plan for the City will be prepared by 2009. This will require the identification of key sites and reticulation corridors for Green Transformers with emphasis on new major urban renewal projects at Green Square, Barangaroo, Frasers Broadway (the former CUB site) and Ashmore Precinct, as well as other areas anticipating investment and growth.

Implementing the Green Infrastructure Plan will require partnerships with utilities and waste services providers to overcome any technical limitations to integrating decentralised capacity within existing distribution networks. The Plan would include an economic analysis of the expected dollar per unit reduction of greenhouse gas emissions, potable water demand and waste disposal costs. It will also include further details on the actions described below.

ACTION 2.1.2 Investigate the development of Green Transformers.

In the transition to a low carbon economy, switching base load electricity from coal to gas offers immediate benefits due to the lower carbon content of gas. Green Transformers will achieve a 35 per cent reduction in the greenhouse intensity of electricity generated compared to that from existing coal-fired power stations.

Further emissions reductions can be enabled through the capture of heat from electricity generation and distribution of greenhouse-free hot and cold water. By establishing a 330MW capacity target, Green Transformers will be able to supply 70 per cent of the City's electricity demand, increasing the City's energy security.

ACTION 2.1.3 Increase the use of recycled water.

As part of the Green Infrastructure Plan, Green Transformers will be located close to appropriate sewer infrastructure to treat sewage to a level fit for use as recycled water and used for low grade water uses, displacing potable water demand. Waste heat from the Green Transformers could treat the sewage to acceptable standards, which could then be distributed by a recycled water network, including the use of recycled black water. If required, a higher level of treatment could inject the water directly into the existing potable water mains. Either way, both solutions could remove the need for the City to be reliant on large scale desalinisation plants.

Further, by establishing a 5,000 mega litres per year capacity target Green Transformers could supply approximately 10 per cent of the City's water demand.

ACTION 2.1.4 Integrate Green Transformers throughout the City by using the City's streets for reticulation.

The Green Infrastructure Plan will identify areas of the City to benefit from the broader distribution of Green Transformers.

A number of Green Transformers could be connected by a distributed heating and cooling system, including:

- heated water for building space heating and hot water supply; and
- chilled water for building space cooling.

The heat carried by the hot water loop would be directly sourced from the co-generation plant as the by-product heat of the electricity generator. By using a heat-driven cooling process, such as an absorption cooling cycle, the cooling embodied in the cooling loop could also be derived from co-generation heat.

In some cases, co-generation heat could be entirely used within the commercial building or high-density residential development in which the plant is installed. At other sites, the co-generation plant could be capable of supplying much greater thermal loads and could therefore be connected as part of a district heating and cooling system.

Through the application of community-wide energy infrastructure there is increased potential for a developer to deliver greater emission reductions at lower cost than by purely trying to abate the emissions of an individual building. By utilising the City's street network, it is estimated that underground infrastructure could be installed to distribute hot, cold and recycled water to over 40 per cent of the City's business premises and 35 per cent of dwellings. (Kinesis)

The identification and modelling of this infrastructure could form the basis of the City of Sydney seeking joint venture partner(s) to design and install green reticulation. This action could see the installation of up to 50 kilometres of underground green reticulation across the City by 2030.

ACTION 2.1.5 Improve environmental reporting and disclosure against published targets.

It is common for cities, governments and individual businesses to establish environmental performance targets. However, there is limited ability to accurately report and disclose performance against established targets.

The City of Sydney has established a number of aggressive greenhouse gas reduction and resource efficiency targets. The effectiveness of each of the City of Sydney's policies in progressing towards these targets must be clear. The environmental performance framework is the first step to developing an environmental performance model which can assess actions against their expected and actual performance.

OBJECTIVE
2.2 Reduce waste generation and stormwater pollutant loads to the catchment

CITY NOW

Invisible drains that quickly remove water which is treated like waste.

The sole design purpose of the City's maze of underground stormwater is to remove rainfall and overland flow to the Harbour and tributaries as fast as possible during rainfall to limit the risk of flood. This type of infrastructure also expedites the transfer of surface pollutants to precious natural water systems.

City generated waste is generally beyond City of Sydney control.

All waste generated within the City is currently removed to outside the city, the majority of it to landfill. The City of Sydney has no control over the major component of the waste stream which emanates from commercial and business premises.

CITY IN 2030

Water is celebrated and retained for re-use.

The Harbour and water are synonymous with Sydney. Water could be captured, cleaned and where possible re-used. Visible and functional parts of the City's stormwater system could be returned to the surface through 'Green Links', which will provide important connections to Sydney's natural setting.

Sub-surface treatment will be identified by reed beds and plants. These areas will intercept urban run-off and apply biological treatment to metabolise and reduce the volume of pollutants leaving the catchment. Where possible the Green Links could integrate with cycleways providing an attractive barrier between the cyclist and the road. Green Links could be reed beds that function as road barriers, treat stormwater effectively, and integrate with existing stormwater drains and infrastructure.

A City that sees waste as a valuable resource.

Waste could be treated as a fuel to help run the City. Embracing and investing in the strategic management of the City's waste stream will allow it to increase sustainability and be more responsible for its actions.

ACTION 2.2.1 Renew stormwater infrastructure by installing water sensitive urban design in the catchment

The Green Infrastructure Plan will identify catchment areas which can be retrofitted with sub-surface or bio-treatment systems alongside urban renewal projects and major roads. By bringing the water to the surface through reed bed and bio-filtration systems the community may place greater value on water and its role in our ecosystem.

Renewing the City's stormwater infrastructure increases visibility of hidden streams and celebrates water. It could also maintain or enhance flood protection and reduce up to 50 per cent (Source: Kinesis) of water-borne pollutant loads from treated water that otherwise ultimately make their way into the City's catchments (typically the Harbour).

ACTION 2.2.2 Develop an integrated waste management strategy with other Inner Sydney Councils and identify sites for associated processing infrastructure.

The relatively clean and separated commercial waste stream is ideal for waste digestion. As part of the Green Infrastructure Plan, the City of Sydney could work with adjoining Councils to identify a potential waste transfer station and digestion site with a view to connection with the Green Transformer network.

The City of Sydney could seek partnerships with waste services companies and research institutions to assist in the development of waste-to-energy technology and pilot installations.

This action could result in the collection and conversion of 50 per cent of waste stream to electricity or green gas by 2030 through the Green Transformer network. Beyond the reduced landfill demand (approximately 100,000 tonnes per year) it is estimated that conversion of 50 per cent* of the City's waste stream into green gas would provide an additional 5 MW of Green Transformer power and further reduce the City's greenhouse gas emissions by three per cent against the Business as Usual (BAU) scenario.

OBJECTIVE
2.3 Improve the environmental performance of existing buildings

CITY NOW

An urban management strategy that focuses on what is easier —new development.

Currently all levels of government focus their resource conservation policies on new development. This fails to address the issues that most resource consumption to 2030 will occur within existing developed areas in existing buildings. This misses many low-cost opportunities to reduce greenhouse gas emissions and save.

CITY IN 2030

An urban management strategy that focuses on sustainable new development and retrofitting existing development.

Through the development of the environmental performance model, the City of Sydney can focus on the most cost-effective greenhouse and water savings. The City of Sydney will encourage and where possible provide incentives to facilitate these efficiencies in areas of urban management that were previously outside its charter.

Urban consolidation accommodation

ACTION 2.3.1

Investigate ways to accelerate retrofitting of existing buildings for better environmental performance.

Approximately 70 per cent of the buildings that will exist in the City in 2030 have already been built. The City of Sydney must think progressively about the existing built stock and could deliver either planning or rate-based levy exempt related financial incentives to stimulate the retrofitting of existing commercial and residential buildings. These incentives will not, on their own, be a significant financial trigger to undertake capital improvements. However, they could be of sufficient magnitude to provide the impetus for action when combined with other financial stimuli, such as increased energy and water costs from “mainstream” providers.

ACTION 2.3.2

Investigate ways to accelerate the uptake of the Green Power purchase within the City.

The uptake of Green Power in the City is relatively low. To encourage greater demand-side uptake the City could establish a financial nexus within the Green Power rating system to differentiate between good and poor performing buildings and their impact on the local and global environment.

ACTION 2.3.3

Extend the work of existing programs that make a positive contribution to improved resource efficiency across the City.

The City has a range of programs and interventions that focus on improving resource efficiency. Many are being evaluated according to their implementation costs and effectiveness in reducing resource usage. Those which have demonstrated positive contributions at reasonable costs will be expanded where possible to include other areas or elements of the City.

- CitySwitch Green Office Program (formerly 3CBD’s).
- Earth Hour.
- Green Leaders.

OBJECTIVE
2.4

Demonstrate leadership in environmental performance through the City of Sydney's operations and activities

CITY NOW

A commitment to strategic environmental initiatives.

As an urban manager, the City of Sydney has always been a leader in demonstrating a commitment to strategic environmental initiatives.

CITY IN 2030

International recognition for environmental leadership across all areas of the City of Sydney activities.

The City of Sydney will be internationally recognised through its robust and accountable procurement services, establishing and encouraging a sustainable supply chain that focuses on carbon minimisation. The actions of City of Sydney as a major consumer and procurer of services will provide a flow-on effect in the market.

More open space for passive and active recreation

ACTION **2.4.1**

Investigate the application of carbon minimisation criteria to procurements and contracts.

To lead on the response to climate change, governments must look beyond their own backyard. The City of Sydney, a substantial purchaser of goods and services, could encourage and enforce low carbon commerce through its significant buying power. The City could investigate options to secure carbon assessment criteria for all major tender and procurement contracts by 2009.

ACTION **2.4.2**

Investigate best practice initiatives to prepare the City for the social and other impacts of global warming, such as peak fuel impacts, storms and flooding.

The City is yet to face the extremes of climate change as some major European cities, such as prolonged heat waves. To prepare for such events the City could investigate the viability of a database and emergency response program for those most vulnerable to the effects of climate change.

ACTION **2.4.3**

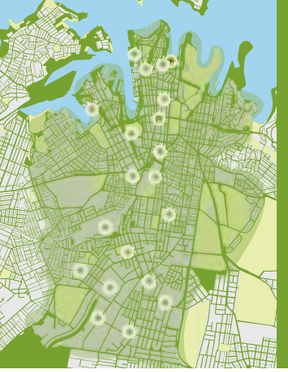
Work with other sectors to promote sustainable environmental industries and develop economic and educational benefits.

The City will work with other sectors of the economy and local tertiary institutions to leverage and invest in the sustainable industries. For example, the involvement of universities in the development of effective waste to energy technology and the investment of the private sector to pilot leading edge technologies will be critical. The City of Sydney could look locally as well as internationally to find sustainable solutions.

ACTION **2.4.4**

Continue to develop and implement education and support initiatives to assist residents, businesses, workers and visitors to the City to reduce their environmental impacts.

The City of Sydney could continue to support and foster grassroots community education projects and develop capacity building and support services for the broader business sector. Additionally, a new focus could be on locating the facilities required for practicing environmentally sound behaviour throughout the City.



PROJECT IDEA

GREEN TRANSFORMERS

Converting environmental targets for real change

LOCATION

City-wide

VISION

The City of Sydney aims to reduce its dependence on coal-fired electricity, and shift to low carbon energy and sustainable water supplies to and beyond 2030. The City of Sydney will facilitate the development of Green Transformers—infrastructure hubs which will reinvent the supply of energy and water in the City.

Green Transformers are central plants which produce low-carbon energy and recycled water, and converts waste to energy. These systems could be installed in a number of configurations in urban renewal areas and existing residential and commercial areas. Green Transformers will lower greenhouse gas emissions, reduce potable water consumption, and guarantee a level of self-sufficiency for the City.

AIMS

Provide inter-generational leadership by implementing the fastest and most cost-effective transition to a low-carbon economy by 2030.

Reduce the City's reliance on coal-fired electricity and desalinated water and transition to a low-carbon economy and sustainable water supplies.

IDEAS

- Facilitate investment in central plants to produce low-carbon energy and recycled water, and convert waste to energy.
- Increased potential to deliver emissions at lower cost through community-wide energy infrastructure rather than abate the emissions of an individual building.
- Innovative financing and funding approaches which can take advantage of the multiple likely beneficiaries.
- The City of Sydney, as the owner of the streets and roads, has the capacity to extend the environmental outcomes achieved in renewal sites to other areas.

THREE MAJOR COMPONENTS TO A GREEN TRANSFORMER

COGENERATION The simultaneous generation of electricity and heat from natural gas. Cogeneration captures the by-product of electricity generation—heat. This heat can be put to use in a variety of ways, including hot water, and even chilled water through absorption chiller technology. Natural gas is cleaner than coal and provision of hot and chilled water as electricity generation by-products prevents further greenhouse gas emissions. Systems of around five megawatts could provide power and heat for several hundred dwellings and large commercial buildings.

WATER RECYCLING Using heat from the exhaust of the cogeneration to treat grey and black water. Recycling water from sewage using heat by-products from electricity generation is cheaper and less energy-intensive than desalination. It avoids damaging super-salinated brine and reduces sewage flow volumes. A recycled water network could be developed through the City as part of State Government initiatives, allowing the City to take advantage of the distribution of the recycled water it generates.

WASTE-TO-ENERGY Using both residential and commercial waste to generate 'green gas' methane or synthetic gas. Harvesting the City's waste stream can provide a significant source of renewable fuel to generate electricity. This will reduce the residential and commercial waste stream, including landfill and resultant greenhouse emissions, and further lower the carbon intensity of locally generated electricity.

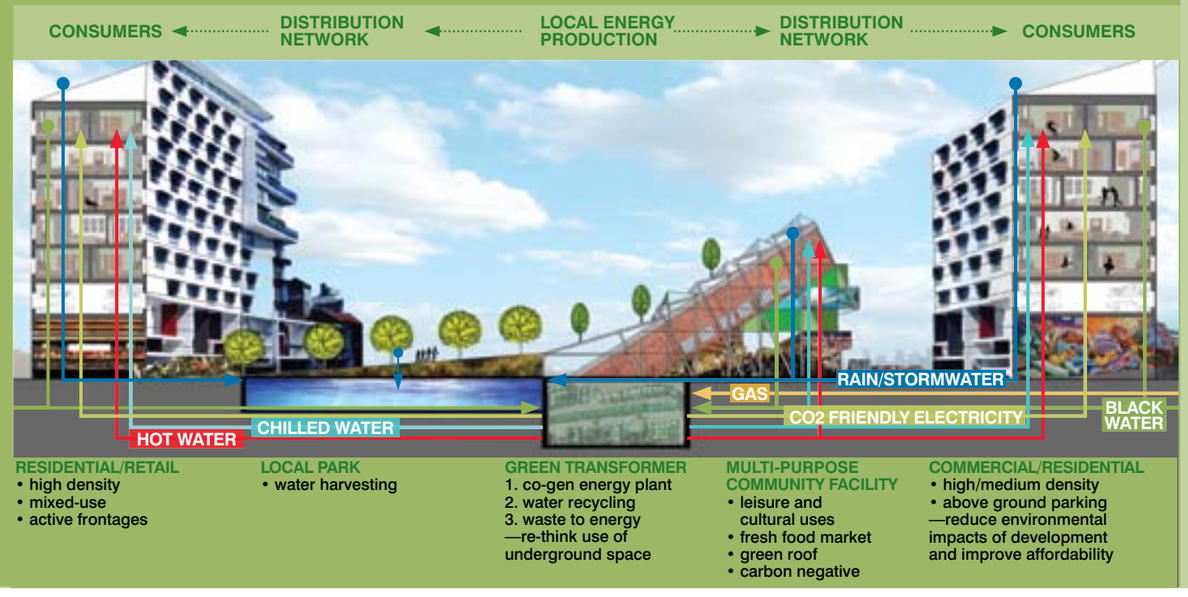
These technologies are all viable and have been installed and managed in many locations in Australia and internationally.

IMPLEMENTATION

- Preparation of a Green Infrastructure Plan by 2009 (refer to Action 2.1.1), including:
  - identification of key sites and reticulation corridors for Green Transformers considering current and future investment and growth
  - economic analysis of the expected dollar per unit reduction of greenhouse gas emissions, potable water demand and waste disposal costs
  - detailed timeline on Green Transformer installations.
- The City of Sydney will encourage and incentivise the installation of Green Transformers through a Green Infrastructure Plan, by identifying potential sites and using its assets to implement and reticulate low carbon electricity, heating and cooling.
- Aim for intervention to begin in 2010, with small installations increasing to 25MW by 2015. From 2015 to 2030, approximately 20MW is added every year, totalling 330MW.
- Partnerships with energy and water utilities and waste services providers to overcome any technical limitations to integrating decentralised capacity within existing distribution networks.

BENEFITS TO THE CITY

- Bundling existing technologies to facilitate the consolidation of infrastructure in a single location, and ease reticulation.
- Generation of an estimated 330 megawatts (MW) of natural gas fired cogeneration. When combined with other demand reduction measures provides approximately 70 per cent of electricity requirements for the City in 2030.
- Lowers the greenhouse intensity of electricity by approximately 35 per cent.
- Provides greenhouse-free hot water, heating, and cooling to approximately 36 per cent of all dwellings in the City, and 43 per cent of all non-residential buildings in the City, from the by-products of energy generation.
- Reduces carbon dioxide emissions by 20 per cent less than 2030 'business as usual' projections.
- Aim for greater environmental benefits from not being reliant on any coal-fired electricity by 2030.
- An estimated 10 per cent of the City of Sydney's water demand, supplied from within City boundaries.
- If other major urban centres in NSW implemented similar changes, it is foreseeable that over the longer term, NSW would not need any new base-load power stations and could plan for the decommissioning of coal fired power stations.
- Long-term energy security.



Reinventing the supply of energy and water