

Sydney's energy revolution

Building a low carbon city

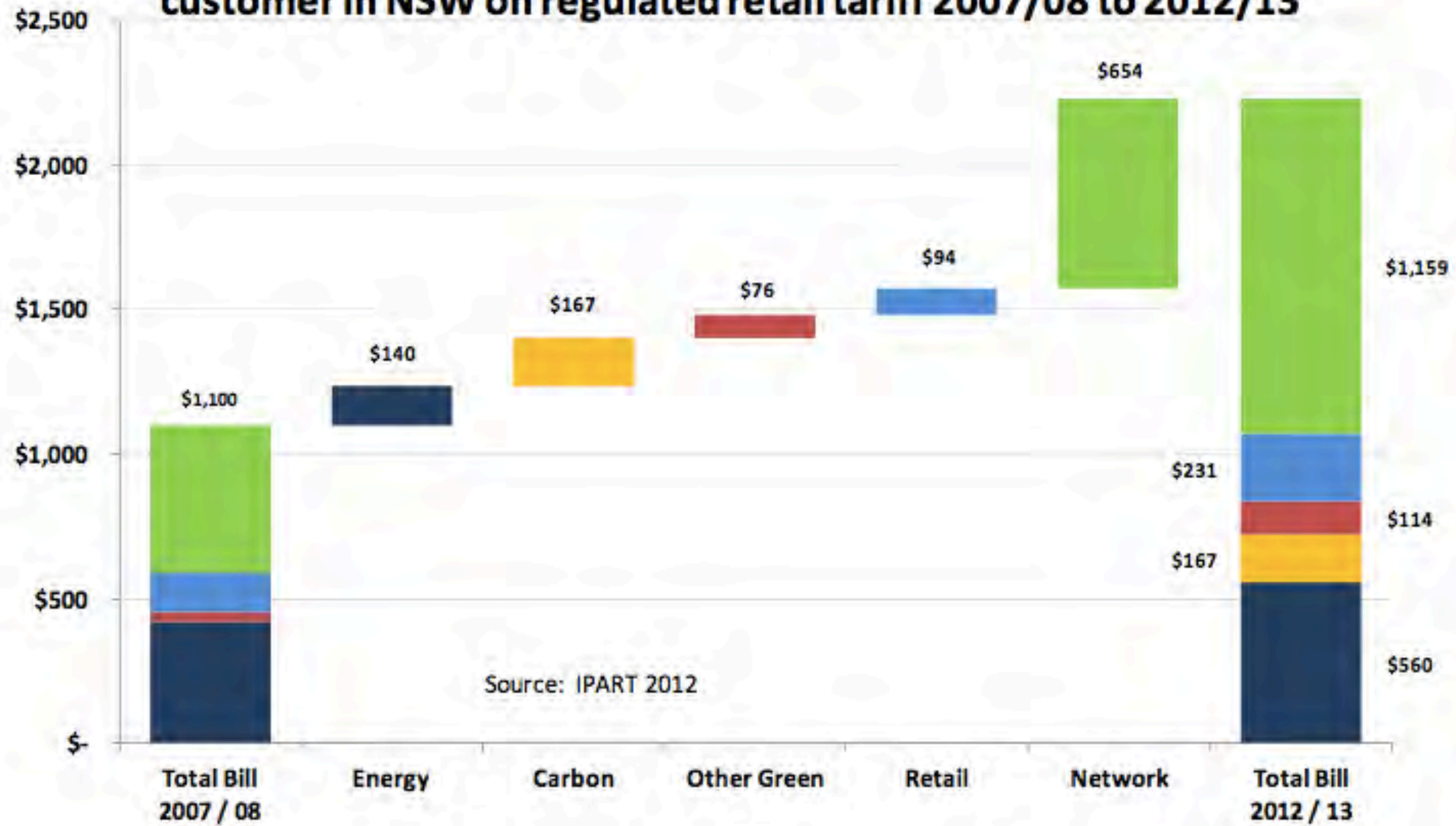
Allan Jones MBE

Chief Development Officer, Energy & Climate Change

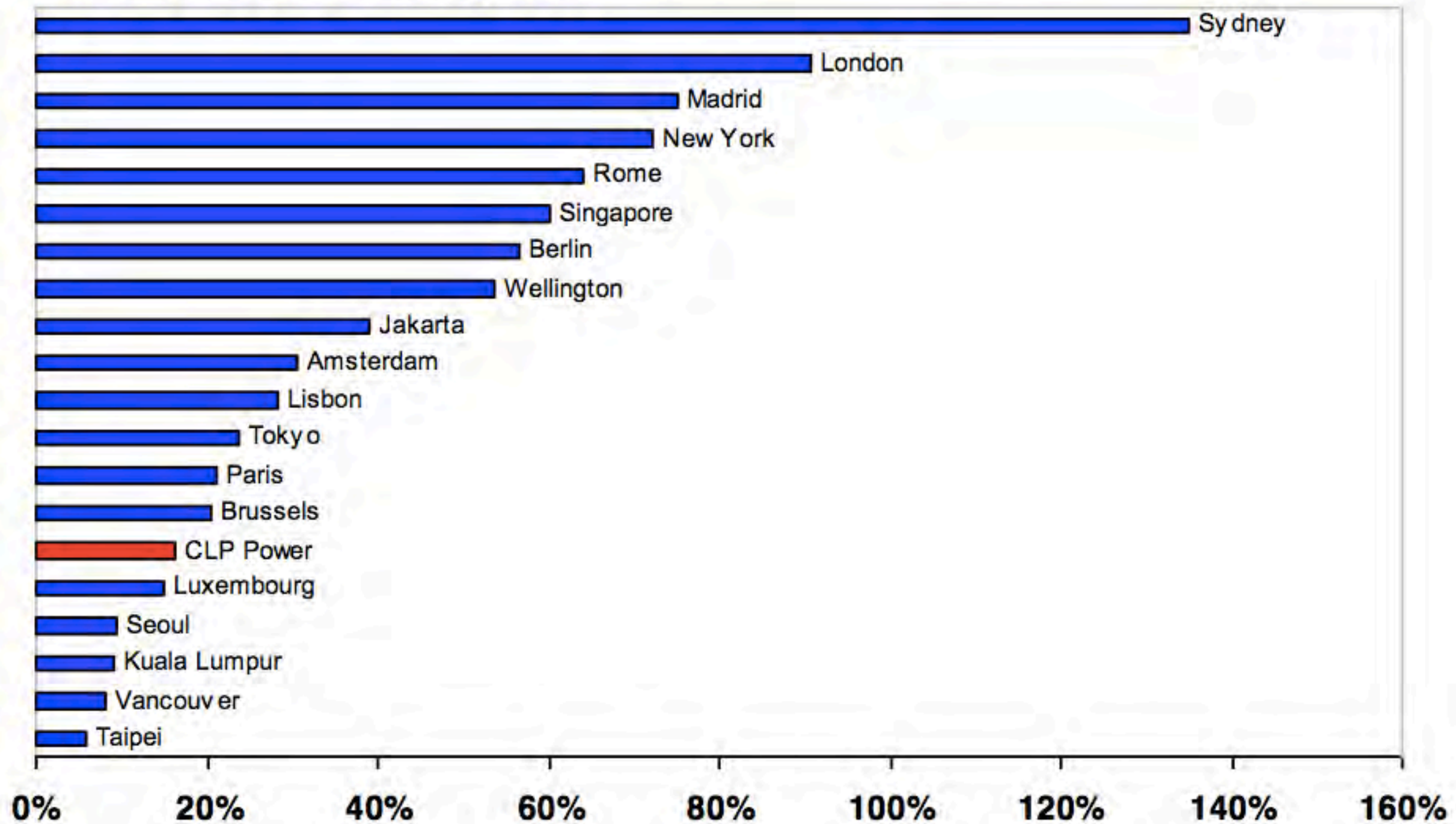
City of Sydney



Change in the average electricity bill for a typical residential customer in NSW on regulated retail tariff 2007/08 to 2012/13



Comparison based on annual residential consumption of 3,300 kWh - From 2005 to January 2013





70%
reduction in emissions

green infrastructure plan

trigeneration masterplan

renewable energy masterplan

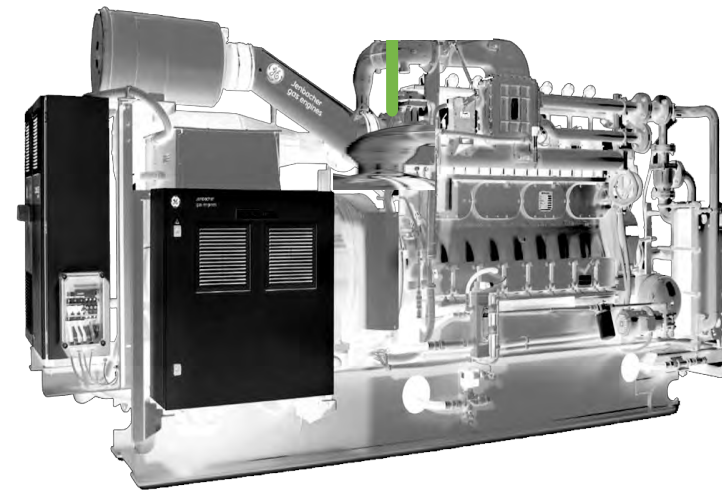
advanced waste treatment masterplan

decentralised water masterplan

energy efficiency masterplan



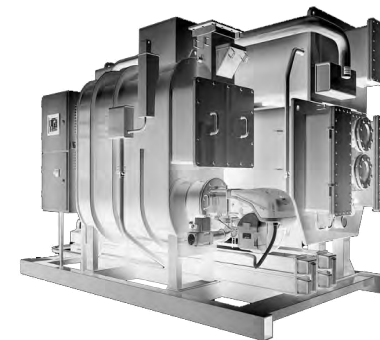
natural gas



40%
energy
to the
grid

electricity

heated
water



45%
energy
to the
grid

cooling



hot water

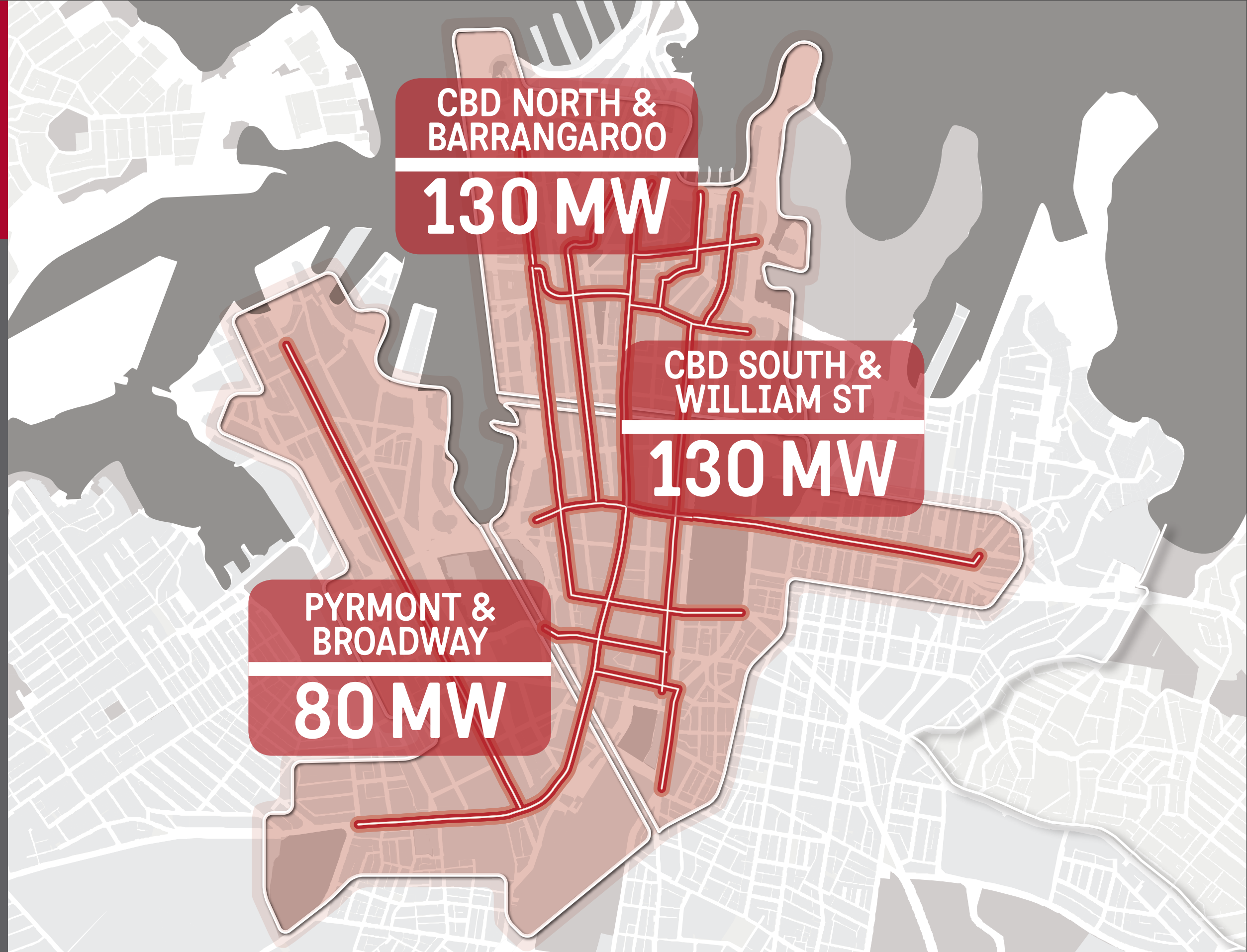
trigeneration

15%

energy lost

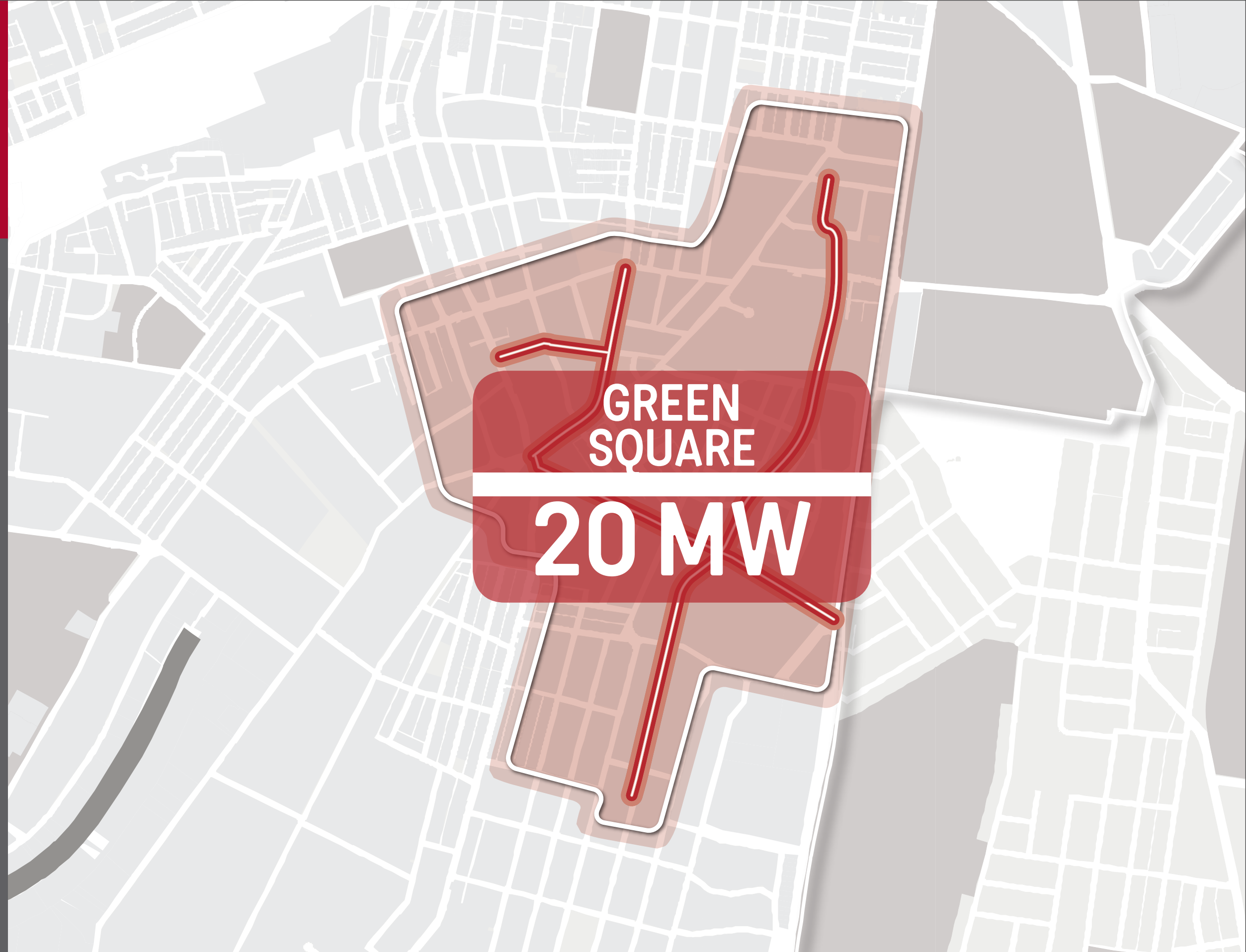
MEGAWATTS OF TRIGENERATION ENERGY SUPPLY

By 2030, 65% of commercial, 50% of retail and 30% of residential floor space will be connected to a low carbon zone



MEGAWATTS OF TRIGENERATION ENERGY SUPPLY

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Development agreement
between City of Sydney and
Cogent Energy for:

Council owned buildings &
street lighting by 2014

Low Carbon Zones

Design, Finance, Build,
Operate & Maintain

Council owned thermal
reticulation network

Renewable gases included in
Development Agreement

City-wide trigeneration first
precincts

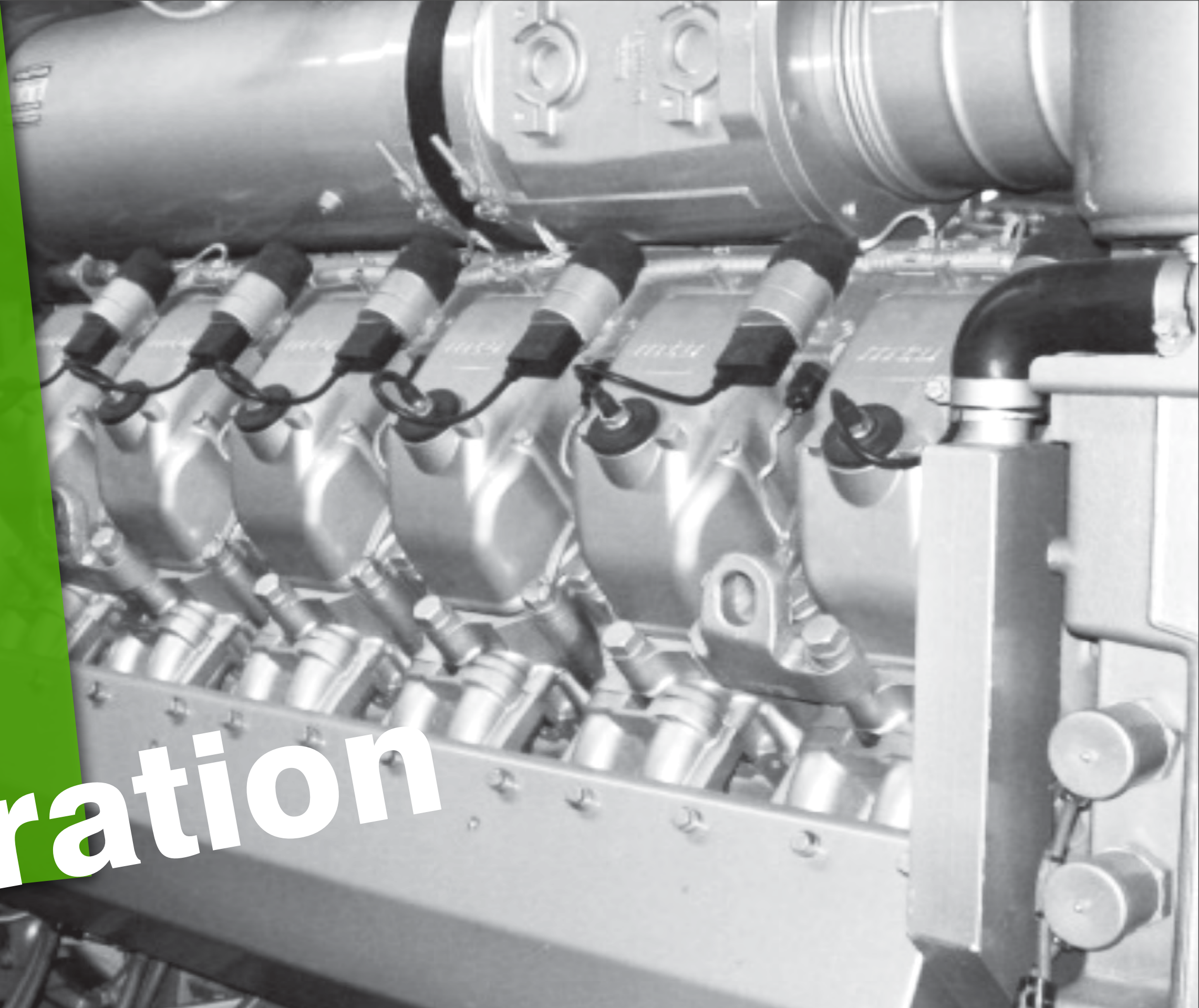
CBD North

CBD South

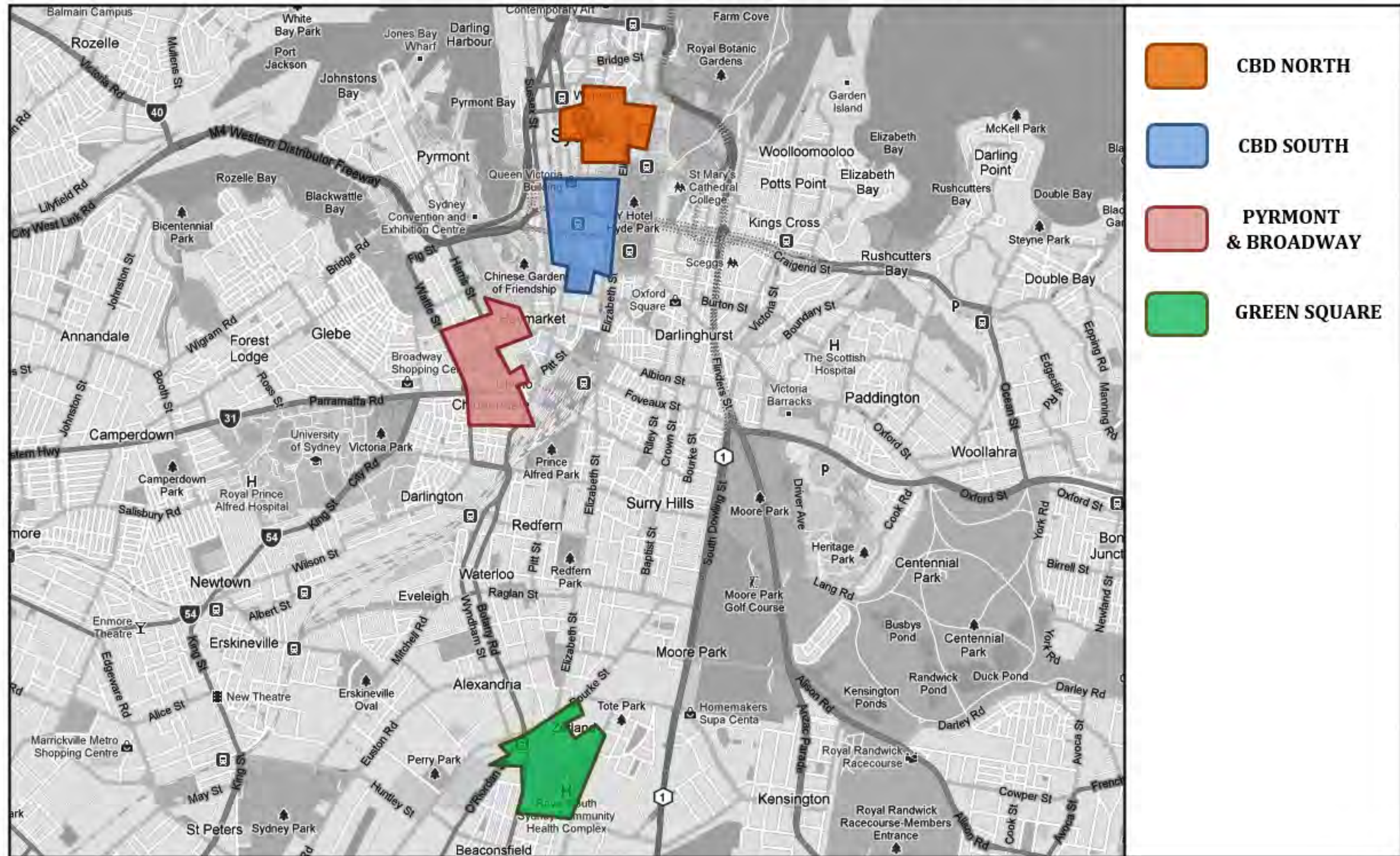
Green Square

Pymont/Broadway

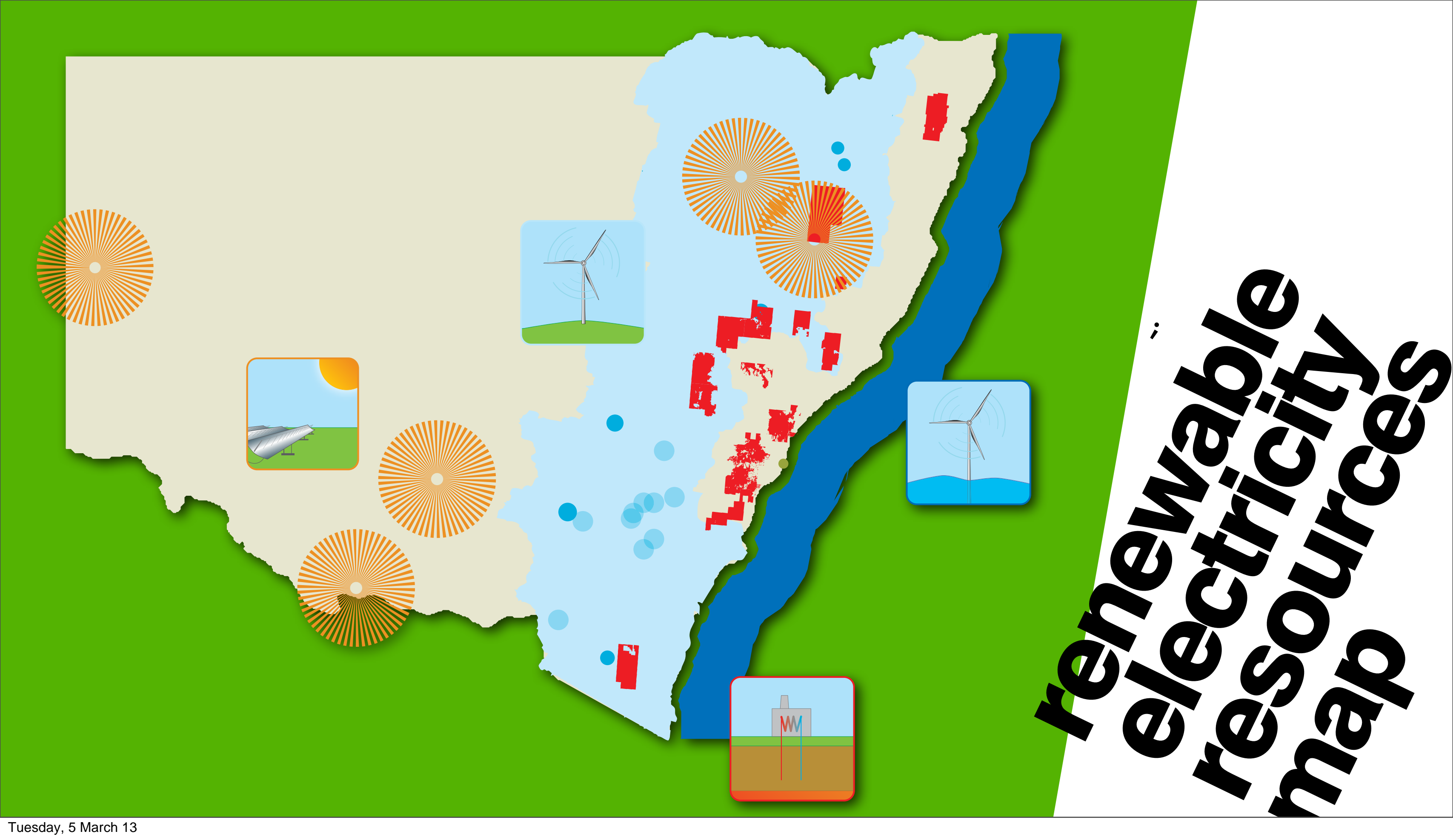
trigeneration



CITY OF SYDNEY PRECINCTS - STAGE 1 & STAGE 2





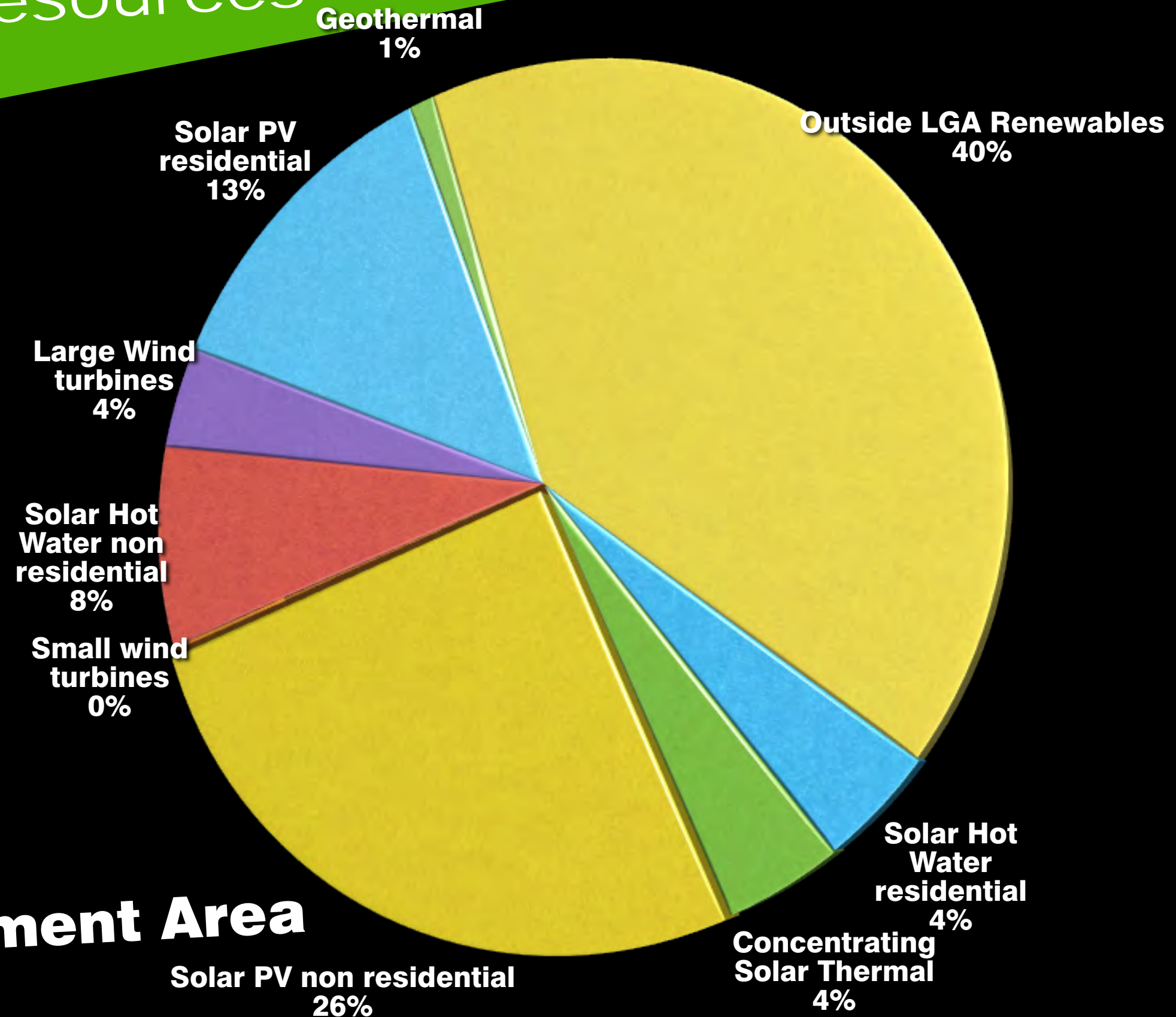


renewable electricity resources map

renewable electricity resources

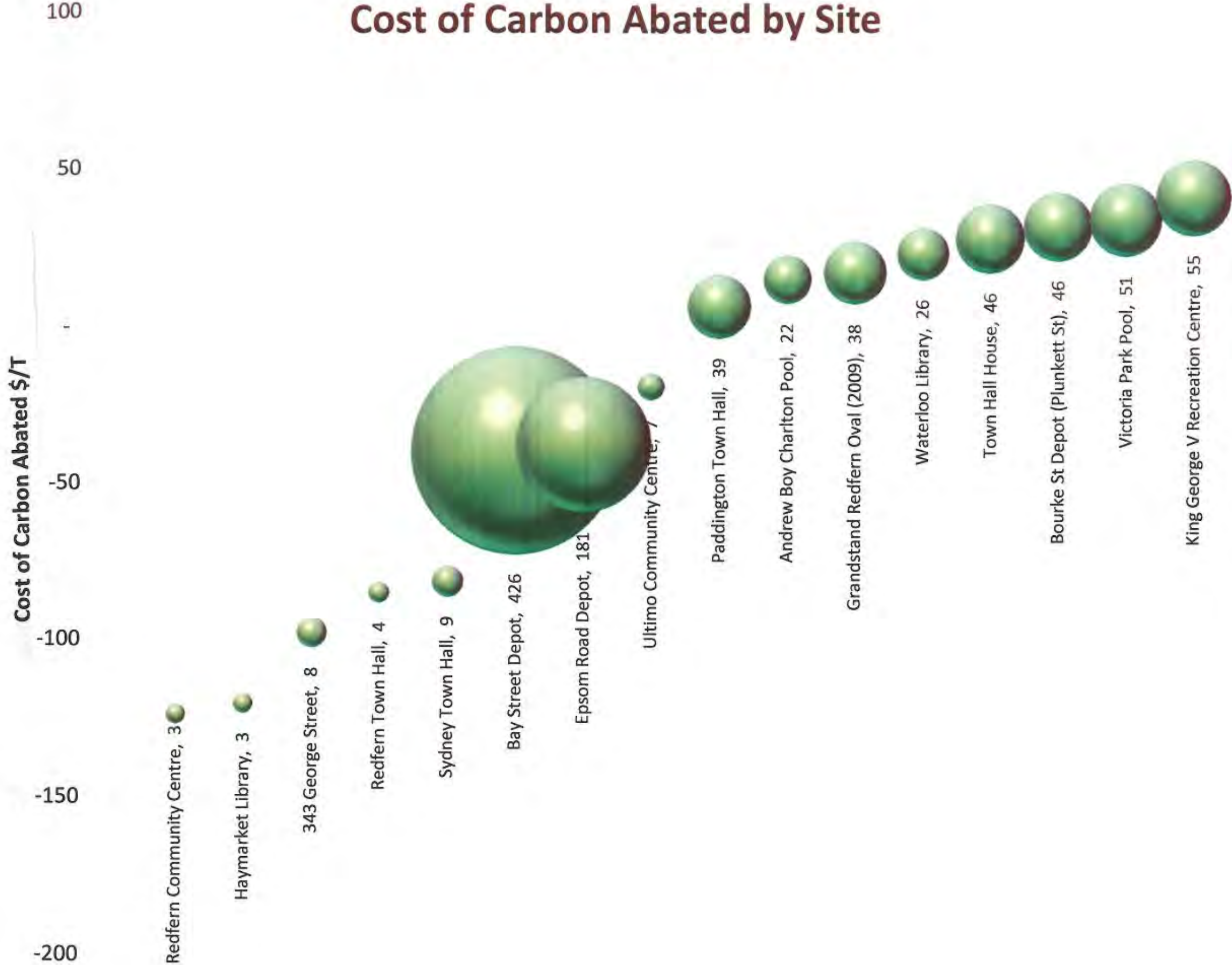
1.2 TWh

60% within Local Government Area





Cost of Carbon Abated by Site



SOLAR THERMAL COOLING AND HEATING, ESSLINGEN, GERMANY

SOURCE: SOLARSERVER



Capacity: 1.2MWth

Annual Output: 500MWh

**Annual saving: 435 tonnes CO2-e (based on Germany grid emissions)
530 tonnes CO2-e (based on NSW grid emissions)**

Solar panels: 1,330m²

Thermal Storage: 17m³

BUILDING INTEGRATED WIND TURBINES, STRATA SE1, LONDON, UK

SOURCE: SKYSCRAPERCITY



Capacity: 19kW

Annual Output: 50,000kWh pa

Annual saving: 29.5 tonnes CO2-e (based on UK grid emissions)

53 tonnes CO2-e (based on NSW grid emissions)

Optimal Wind speeds:

8m/s to 16m/s

CONCENTRATED SOLAR THERMAL FIELD 1, CSIRO, NEWCASTLE

SOURCE: CSIRO



Thermal Peak
Heliostats

Solar Field 1
550kW
180

Solar Field
1.2MW
451

SOLAR DISTRICT HEATING SYSTEM, MARSTAL, DENMARK

SOURCE: DENMARK.COM



Capacity: 12.85MWth

Annual Output: 8,824MWh pa

Annual saving: 2,500 tonnes CO2-e (replacing oil)

Solar panels: 18,365m²

Thermal Storage: 14,000m³

MEAUX GEOTHERMAL PLANT, PARIS GEOTHERMAL DISTRICT HEATING NETWORK, FRANCE

SOURCE: FRENCH ENVIRONMENT & ENERGY MANAGEMENT AGENCY



Capacity: 235MWth

Annual Output: 1,200GWh pa

Bores: 1.5 to 1.8km doublet depth

Annual saving: 500,000 tonnes CO2-e

DAGENHAM WIND TURBINE (1), LONDON, UK

SOURCE: WIKIMEDIA COMMONS



Capacity: 5.9MW

Annual Output: 11.4GWh pa

**Annual saving: 6,725 tonnes CO2-e (based on UK grid emissions)
12,085 tonnes CO2-e (based on NSW grid emissions)**

Optimal Wind speeds:

2.5m/s to 28m/s

HARBOUR WIND TURBINES, COPENHAGEN, DENMARK

SOURCE: i-SUSTAIN



Capacity: 40MW

Annual Output: 91GWh pa

Annual saving: 76,500 tonnes CO2-e (based on Denmark grid emissions)

96,460 tonnes CO2-e (based on NSW grid emissions)

Optimal Wind speeds:

7.2m/s

AVEDORE 2 RENEWABLE HYBRID CITY-WIDE COGENERATION NETWORK, COPENHAGEN, DENMARK

SOURCE: CITY OF COPENHAGEN



Capacity: 585MW electricity

570MW heat (+ thermal storage = 44,000m³)

Annual saving: 406,006 tonnes CO₂-e (based on Denmark grid emissions)

832,400 tonnes CO₂-e (based on NSW grid emissions)

Annual Output:

4,832GWh pa electricity

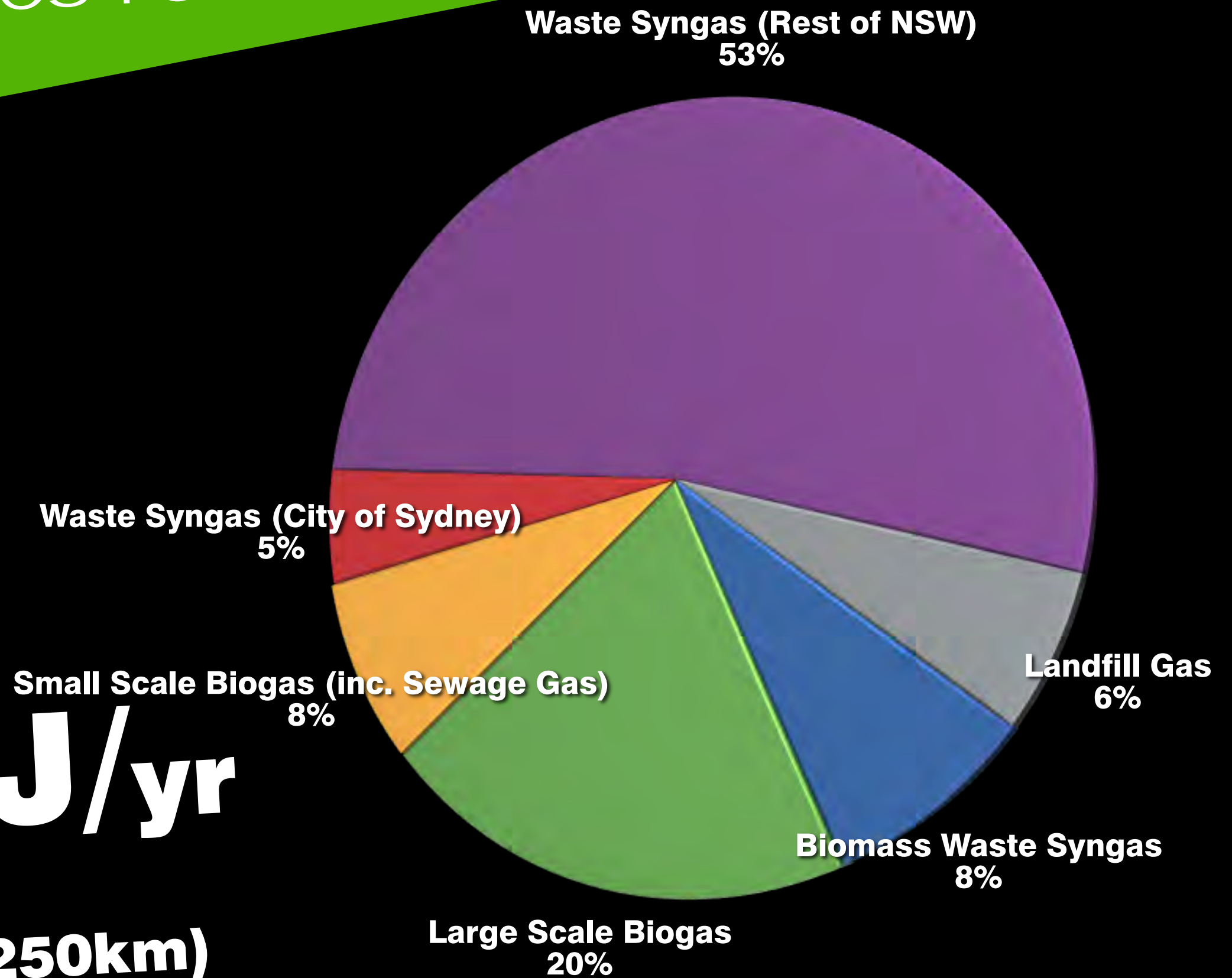
4,708GWh pa heating

renewable gases & fuels resources map

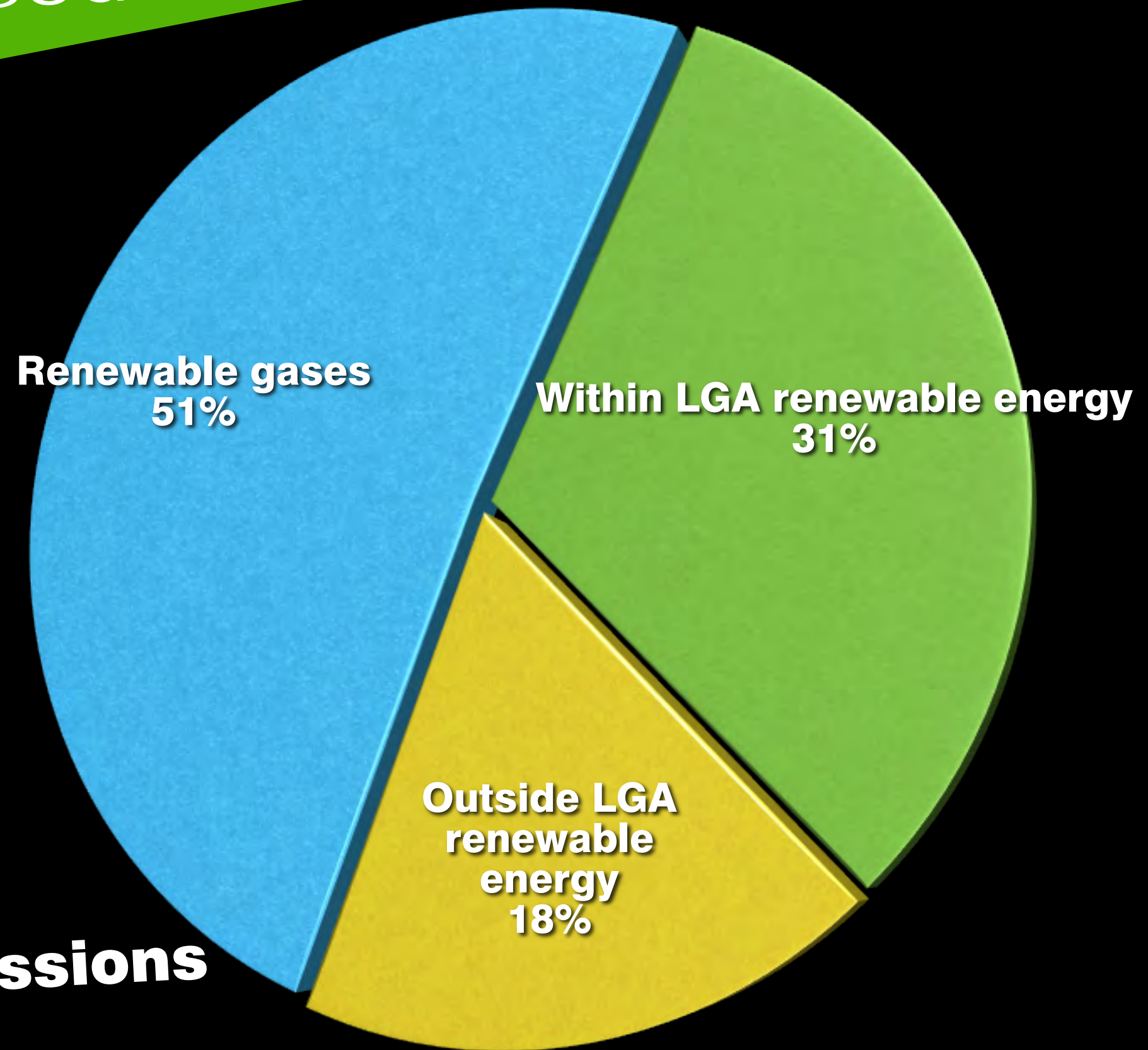


renewable gases resources

27.57 PJ/yr
100% within 100km
(37.06 PJ/yr within 250km)



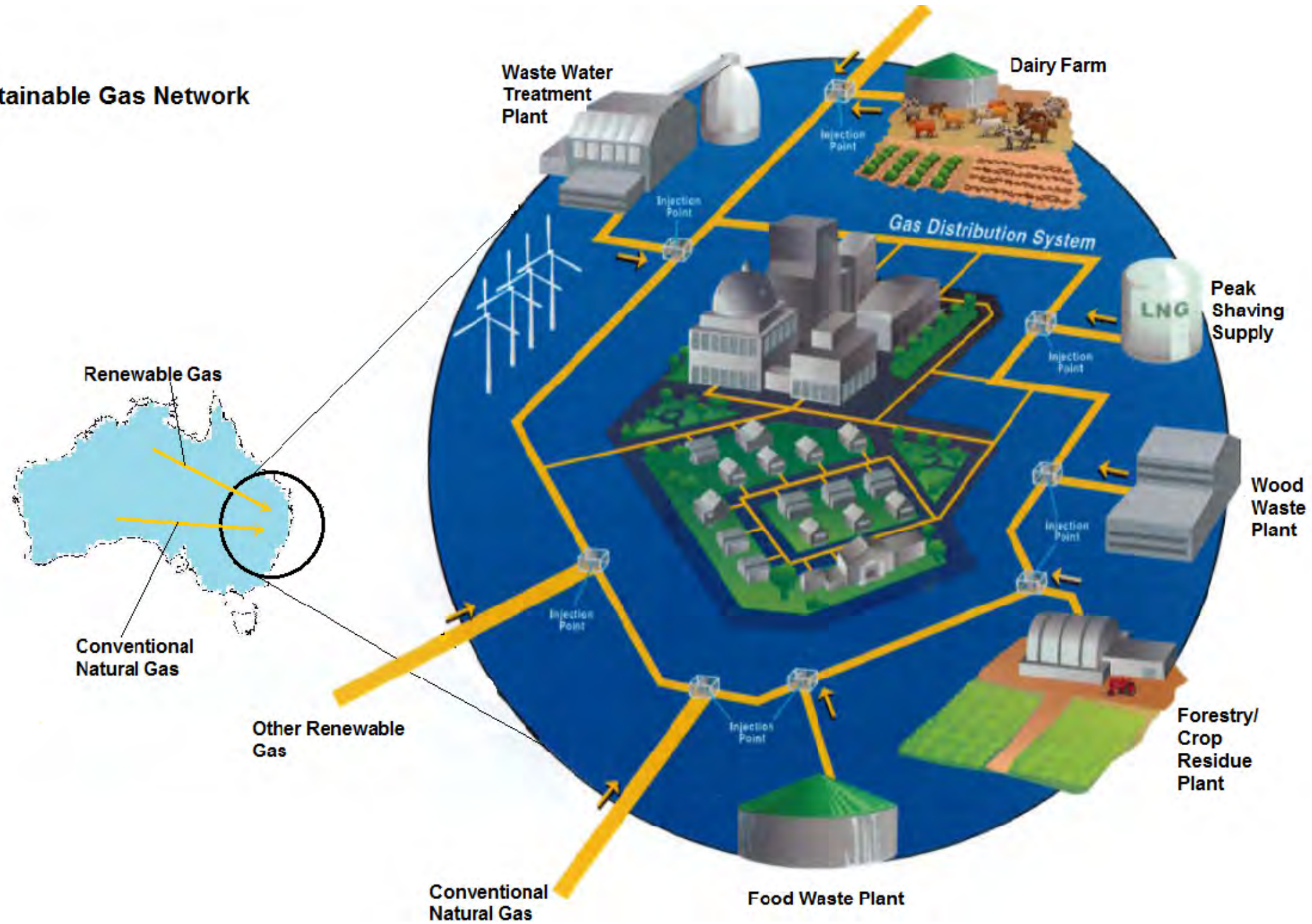
renewable energy resources

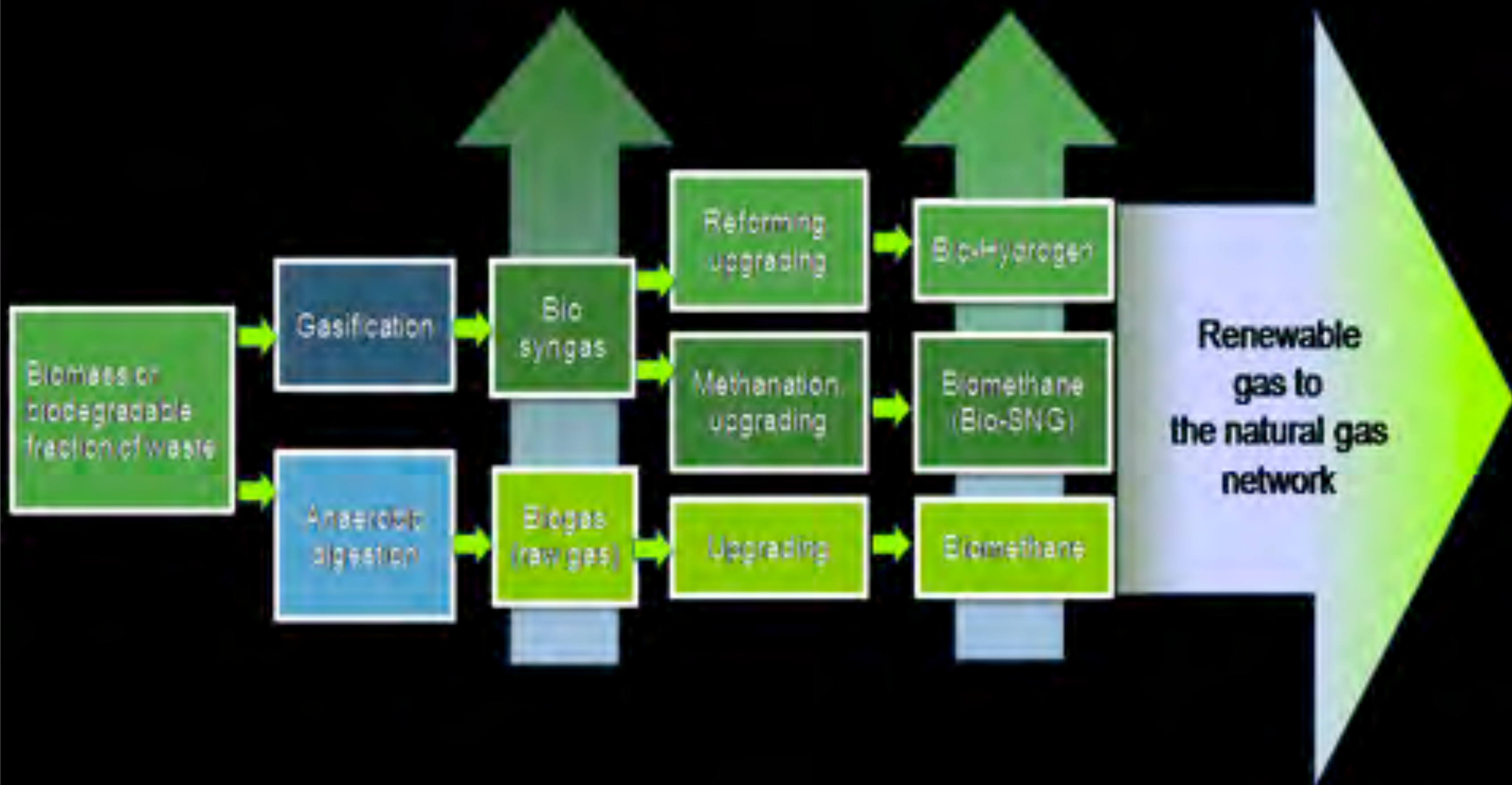


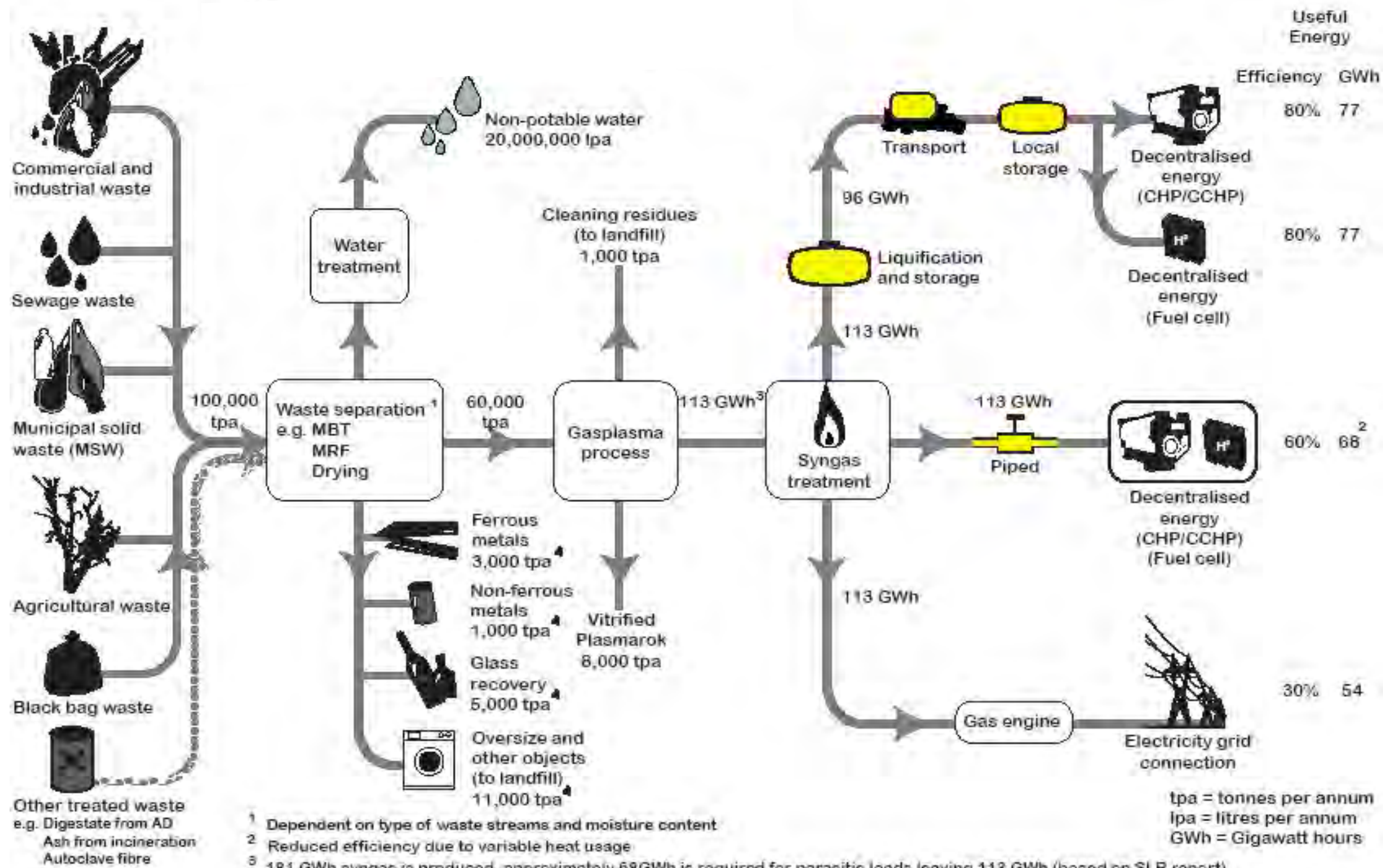
2.38 MtCO₂e

37.2% reduction on 2006 emissions

Sustainable Gas Network







- ¹ Dependent on type of waste streams and moisture content
- ² Reduced efficiency due to variable heat usage
- ³ 181 GWh syngas is produced, approximately 68GWh is required for parasitic loads leaving 113 GWh (based on SLR report)
- ⁴ Based on Eunomia report with MSW assumed as input

Waste to energy

POUNDBURY RENEWABLE GAS GRID INJECTION, DORSET, UK

SOURCE: JV ENERGEN



CHP Capacity: 400kW electricity
 430kW heat

CHP Annual Output: 3.2GWh pa electricity
 3.4GWh pa heat

Annual Gas Grid Injection: 20GWh or 72,000GJ **Gas Grid Injection Capacity:** 400m³/hour

Annual saving: 4,435 tonnes CO₂-e

BIO2G BIOMASS GASIFICATION RENEWABLE GAS GRID INJECTION, GOTHENBURG, SWEDEN

SOURCE: GÖTEBURG ENERGI



Feedstock: 1Mt/yr of low quality pulpwood and forestry residues			
CHP Capacity:	23MW electricity	CHP Annual Output: 172.5GWh pa electricity	
	55MW heat	412.5GWh pa heat	
Annual Gas Grid Injection: 1,500GWh (5.4PJ)		Gas Grid Injection Capacity: 21,000m³/hr (200MW)	
Annual saving: 120,360 tonnes CO2-e		354,000 tonnes CO2-e (if sequestered)	

KYLMÄJÄRVI 2 MUNICIPAL WASTE GASIFICATION RENEWABLE GAS FOR CHP NETWORK, LAHTI, FINLAND

SOURCE: LAHTI ENERGIA



Feedstock: 250,000 tonnes of municipal waste

CHP Capacity: 50MW electricity
 90MW heat

Annual saving: 180,000 tonnes CO₂-e

CHP Annual Output: 300GWh pa electricity
 600GWh pa heat

Fuel Storage: 15,000m³ (two 7,500m³ silos)

BIOGAS GRID INJECTION PLANT AT RONNENBERG FOR HANNOVER CHP NETWORK, GERMANY

SOURCE: ENERGYCITY (STADTWERKE HANNOVER AG)



Feedstock: 1.6 million hectares

CHP Capacity: 5.11GW electricity (end use)
4.33GW heat (end use)

CHP Annual Output: 41,650GWh pa electricity
35,300GWh pa heat

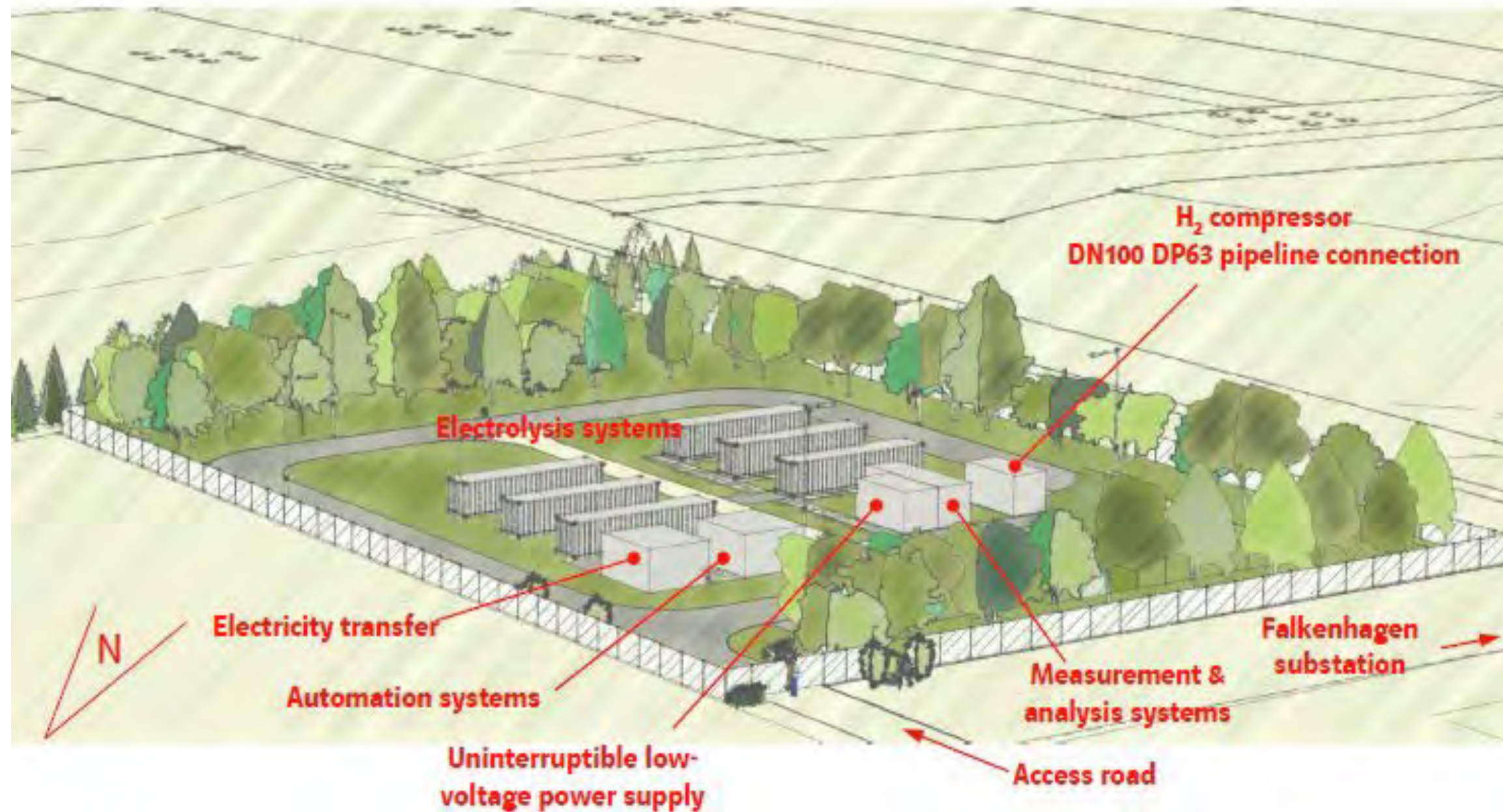
Annual Gas Grid Injection: 100TWh (360PJ)

Gas Grid Injection Capacity: 1,166,670m³/hr (11.1GW)

Annual saving: 11,420,200 tonnes CO₂-e (displacing natural gas CHP emissions)

E.ON 'POWER TO GAS' PROJECT, FALKENHAGEN, GERMANY

SOURCE: E.ON



Wind Capacity: 14.2MW

CHP Capacity: 0.9MW electricity (end use)
0.8MW heat (end use)

Annual Gas Grid Injection: 10GWh or 36,000GJ

Annual saving: 1,142 tonnes CO₂-e (displacing natural gas CHP emissions)

Surplus Wind: 2MW

CHP Annual Output: 4,165MWh pa electricity
3,530MWh pa heat

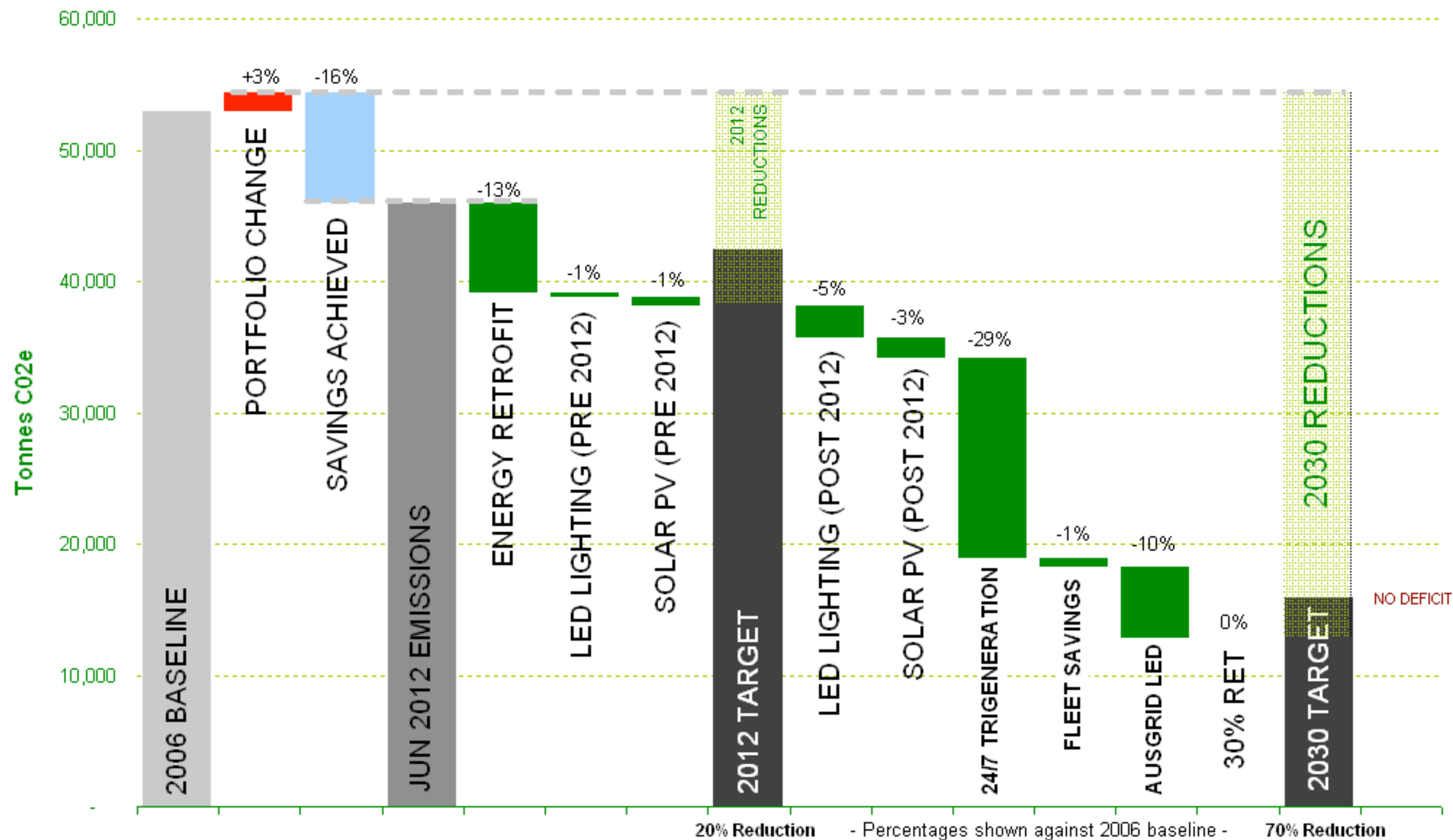
Gas Grid Injection Capacity: 360m³/hour (2MW max)



City of Sydney - Council Operations

Greenhouse gas emissions plan

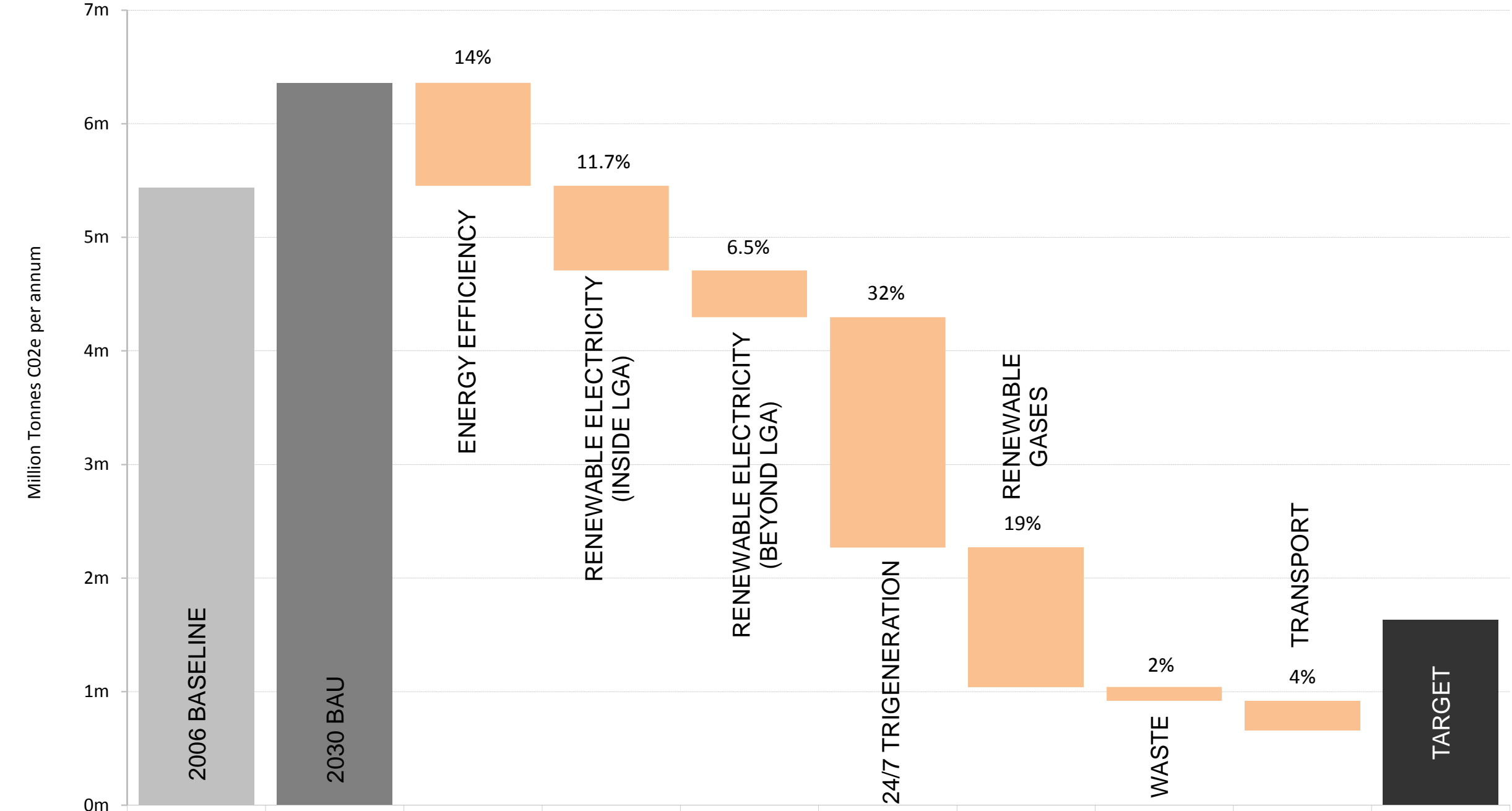
24/7 TRIGENERATION



Tracking 2030 - Greenhouse Gas Emissions

City of Sydney Local Government Area

15-Feb 2013 update




City of Sydney target to reduce 2006 emissions by 70% by 2030 requires 74% reduction against 2030 Business and Usual (BAU) due to growth. Percentages shown against 2030 BAU

<http://www.sydney2030.com.au/development-in-2030/city-wide-projects/powering-sydney-allan-jones>


Powering Sydney (Allan Jones) » Sydney 2030 – Green/Global/Connected

http://www.sydney2030.com.au/development-in-2030/city-wide-projects/powering-sydney-allan-jones



Sydney 2030

Live in 2030 | Explore in 2030 | Learn in 2030 | Business in 2030 | Community in 2030 | Vision in 2030 | Development in 2030 | Council in 2030



**Development in 2030:
Energy master plan**

You gave us the vision » Development in 2030 » City wide projects » Powering Sydney (Allan Jones)

Making it happen – clean, green energy

The City has an ambitious plan to reduce greenhouse gas emissions by 70 per cent by 2030 which can also cut electricity bills for NSW consumers.

To help achieve this target the City has appointed UK energy expert Allan Jones. His previous work reduced greenhouse gas emissions at the city of Woking by 80 per cent and produced similar results for the city of London.

Navigation

- > City wide projects
- > Affordable housing
- > Architectural and planning excellence
- > Green infrastructure

