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EASTERN SUBURBS
LOW CARBON FUTURE PLAN

PREPARED BY KINESIS FOR WAVERLEY, WOOLLAHRA & RANDWICK COUNCILS

4 DECEMBER 2015

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This report has been prepared in partnership with Waverley, Woollahra and Randwick Councils

The results included in this report are provided subject to some important assumptions and qualifications:

- The results presented in this report are modelled estimates using mathematical calculations. The data, information and scenarios presented in this report have not been separately confirmed or verified. Accordingly, the results should be considered to be preliminary in nature and subject to such confirmation and verification.
- Energy, water and greenhouse consumption estimates are based on local climate and utility data available to the consultant at the time of the report. These consumption demands are, where necessary, quantified in terms of primary energy and water consumptions using manufacturer's data and scientific principles.
- Generic precinct-level cost estimates provided in this report are indicative only based on Kinesis's project experience and available data from published economic assessments. These have not been informed by specific building design or construction plans and should not be used for design and construct cost estimates.
- The Kinesis software tool and results generated by it are not intended to be used as the sole or primary basis for making investment or financial decisions (including carbon credit trading decisions). Accordingly, the results set out in this report should not be relied on as the sole or primary source of information applicable to such decisions.

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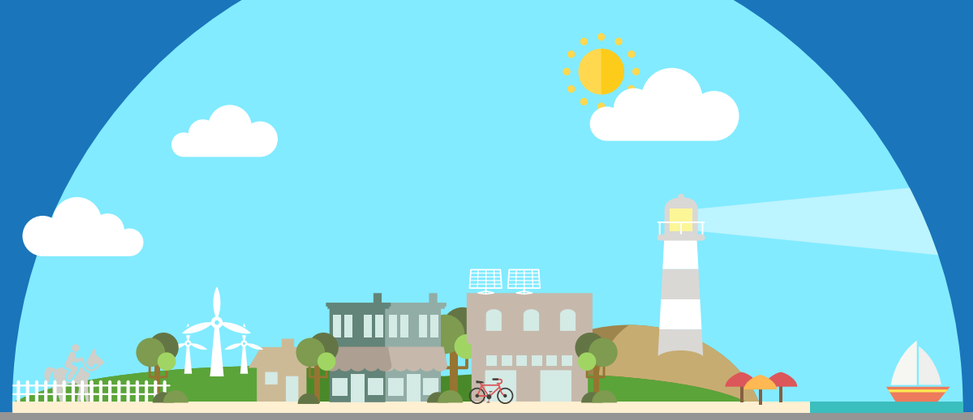
TECHNICAL APPENDIX

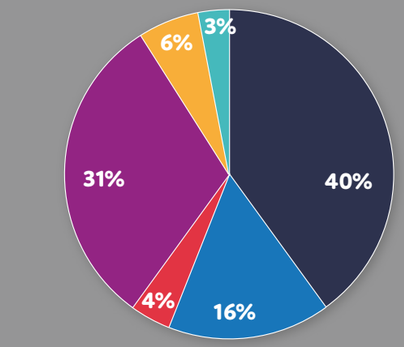
EASTERN SUBURBS - LOW CARBON FUTURE PLAN 'SNAPSHOT'

THE PURPOSE OF THIS PLAN IS TO:

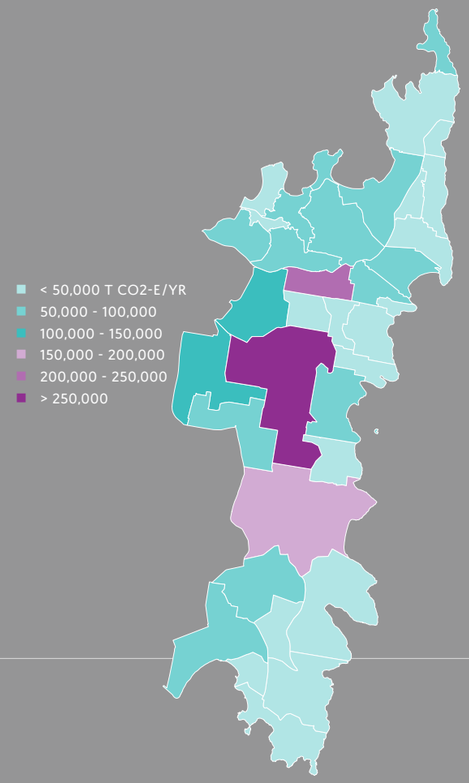
1. IDENTIFY OPPORTUNITIES TO REDUCE GREENHOUSE GAS EMISSIONS ACROSS THE EASTERN SUBURBS OF SYDNEY.
2. DETERMINE WHERE A COLLECTIVE APPROACH BY 3-COUNCILS WOULD BE MOST EFFECTIVE TO ACHIEVE THESE REDUCTIONS.



WHERE DO OUR EMISSIONS COME FROM?



- RESIDENTIAL BUILDINGS
- RESIDENTIAL TRANSPORT
- RESIDENTIAL WASTE
- NON-RESIDENTIAL BUILDINGS
- NON-RESIDENTIAL TRANSPORT
- NON-RESIDENTIAL WASTE



KEY STRATEGIES TO REDUCE OUR REGION'S EMISSIONS

ESTABLISH REGIONAL PERFORMANCE STANDARDS FOR NEW DEVELOPMENTS
8% REDUCTION

ESTABLISH A TARGETED APPROACH TO ADDRESS APARTMENTS
3% REDUCTION

INITIATE COMMUNITY RENEWABLE ENERGY
5% REDUCTION

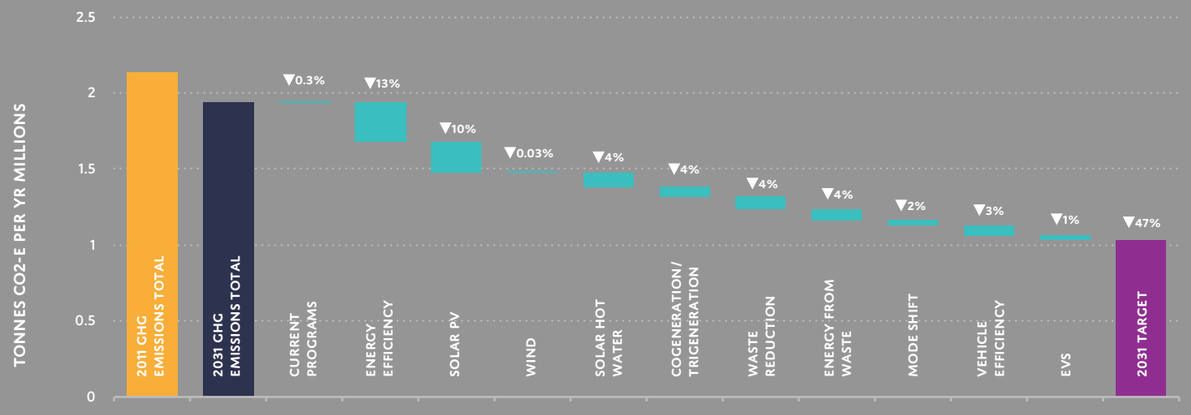
TRANSITION TO 'LOW CARBON PRECINCTS'
5% REDUCTION

ENCOURAGE THE ADOPTION OF ELECTRIC VEHICLES
1% REDUCTION

IMPLEMENT INNOVATIVE WASTE STRATEGIES
8% REDUCTION

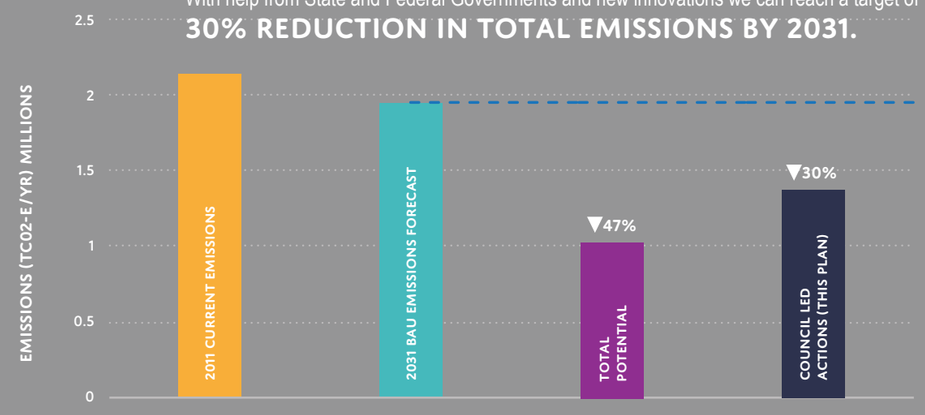
Through the implementation of these 6 strategies, the 3 Councils can facilitate a
30% REDUCTION IN TOTAL EMISSIONS.

WHAT IS THE EMISSIONS REDUCTION POTENTIAL?



WHAT IS AN APPROPRIATE REGIONAL EMISSIONS REDUCTION TARGET FOR THE EASTERN SUBURBS?

With help from State and Federal Governments and new innovations we can reach a target of
30% REDUCTION IN TOTAL EMISSIONS BY 2031.



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KINESIS

SOLAR ON LARGE COMMERICAL AND INDUSTRIAL BUILDINGS

MORE LOW CARBON TRANSPORT OPTIONS LIKE LIGHT RAIL, CYCLING AND BUSES

LOW CARBON PRECINCTS WITH ENERGY EFFICIENT BUILDINGS AND RENEWABLE ENERGY

COUNCILS PIONEER COMMUNITY SOLAR ON PUBLIC BUILDINGS

ELECTRIC VEHICLE CHARGING STATIONS AT KEY DESTINATIONS

ENERGY FROM WASTE CONVERTING GARBAGE AND SEWAGE TO RENEWABLE ENERGY

EXISTING APARTMENT BUILDINGS WITH EFFICIENCY UPGRADES AND SOLAR PV

COMMUNITY SOLAR ON PARTICIPATING BUSINESSES SUPPLYING CARBON FREE ELECTRICITY

HIGHER BASIX TARGETS PRODUCING MORE EFFICIENT APARTMENTS

HIGHER ENVIRONMENTAL PERFORMANCE STANDARDS DRIVING MORE EFFICIENT NEW HOMES

MAROUBRA

BONDI JUNCTION

DOUBLE BAY

SCHOOL

SCHOOL BUS

EASTERN SUBURBS LOW CARBON FUTURE 2030

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Waverley Council

INTRODUCTION

A COLLECTIVE APPROACH TO A COLLECTIVE ISSUE

The effects of climate change are likely to impact all communities on the planet within the next 50 years. According to the Intergovernmental Panel on Climate Change "continued emissions of greenhouse gases will cause further warming and long-lasting changes in all components of the climate system, increasing the likelihood of widespread and profound impacts affecting all levels of society and the natural world"[1].

LOCAL GOVERNMENTS ARE IN A PARTICULARLY POWERFUL POSITION TO TAKE DECISIVE ACTION ON THIS ISSUE AND DEMONSTRATE PRO-ACTIVE LEADERSHIP TO THEIR RESIDENTS AND BUSINESSES.

The issue of climate change and greenhouse gas emissions has been prominent on the agenda of the Eastern Suburbs local governments for over a decade. All three councils within the region; Waverley Council, Woollahra Municipal Council and Randwick City Council, have independently implemented various projects aimed at reducing their own corporate emissions. Their actions have ranged from energy efficiency retrofits in their assets to switching off equipment in facilities, installing solar panels on buildings, and replacing street lighting with more efficient technology. However, the resulting emission reductions from these projects represent only a small proportion of the total reduction potential across the region.

In order to achieve the scale of emissions reductions required across the three LGA's it was agreed that a regional, strategic and collaborative approach would be required.

Driven by a collective desire to create meaningful progress on this issue, all three councils in the region agreed to adopt a regional approach to addressing the region greenhouse gas emissions.

WHY A REGIONAL APPROACH?

- Greater efficiency of human and financial resources.
- Greater reach of specific projects across the entire region.
- Greater feasibility for large scale or regional scale projects.
- Greater political influence and leadership.
- Additional opportunities through integrating systems, assets and cross-boundary infrastructure

"Addressing climate change will not be possible if individual agents advance their own interests independently; it can only be achieved through cooperative responses"

R. K. PACHAURI, CHAIR OF THE IPCC2

THE ROLE OF THIS PLAN

The aim of this plan is: to identify the most cost effective and feasible opportunities for reducing greenhouse gas emissions across the Eastern Suburbs. These opportunities underpin the strategies and recommended actions outlined in the Plan and provide an evidence based approach for the 3-Councils to set a greenhouse gas reduction target for the region's future.

THE PURPOSE OF THIS PLAN:

1. Investigate where the emissions in our region come from and which areas to target.
2. Identify opportunities with the greatest emissions reduction potential, that are cost-effective and that leverage the key strengths of Local Government.
3. Develop key regional strategies to reduce emissions
4. Recommend community emissions reduction targets

[1] IPPC Press release, 2 Nov 2014, Concluding instalment of the Fifth Assessment Report: Climate change threatens irreversible and dangerous impacts, but options exist to limit its effects. Accessed at: http://www.ipcc.ch/pdf/ar5/prpc_syr/11022014_syr_copenhagen.pdf

[2] IPPC Press release, 2 Nov 2014, Concluding instalment of the Fifth Assessment Report: Climate change threatens irreversible and dangerous impacts, but options exist to limit its effects. Accessed at: http://www.ipcc.ch/pdf/ar5/prpc_syr/11022014_syr_copenhagen.pdf

UNDERSTANDING OUR REGION

In order to identify the most effective strategies to reduce our region's greenhouse gas emissions it is important to first understand the current emissions profile of the region (Figure 1). This analysis was carried out by integrating utility, Council and land-use datasets using Kinesis' web-based analytical platform - CCAP City. The results of this analysis are discussed below and the key assumptions are provided in the Technical Appendix.

Total greenhouse gas emissions for the region are calculated based on the emission sources outlined in Table 1. For each source, all relevant scopes (1, 2 and 3) are incorporated and reported as Scope 3 emissions for the region.

METHODOLOGY AND DATA SETS

The data used in this report is sourced from the best available utility, government and Council data sets. Every effort has been made to break down high-level datasets provided by these agencies into suburb and end use (e.g. lighting/ waste generation) level data where this information has not been provided. The full methodology and datasets used to provide this analysis are documented in the Appendix.

SECTOR	NOTES	SOURCE
Residential Electricity	Includes all electricity usage in residential properties (Residential General Supply & Off Peak Hot Water).	Ausgrid
Non-Residential Electricity	Published data does not include customers supplied at high voltage and supply to services such as public lighting and bus shelters.	Ausgrid
Residential Gas	Includes all gas consumption reported under the residential tariff.	Jemena
Non-Residential Gas	Includes all gas consumption reported under the business (commercial and industrial) tariff.	Jemena
Residential Transport	Travel of residents living in the local government area from all modes and all trips within and outside the local government area boundary.	Bureau of Transport Statistics
Non-Residential Transport	Travel of workers commuting by all modes to the local government area for work.	ABS Census
Residential Waste	Residential waste (landfill, recycled and organics) that is collected within the local government area boundary.	Council
Non-Residential Waste	Non-Residential (trade) waste (landfill, recycled and organics) that is collected within the local government area boundary.	Council

Table 1: Greenhouse gas emissions included in the regional emission profile analysis

EASTERN SUBURBS REGIONAL PLAN STUDY AREA

Figure 1: Eastern suburbs regional plan study area showing local government area and suburb boundaries

CURRENT LAND USE

This plan provides the first comprehensive overview of land use and development projections across the region. The purpose is not to provide a definitive prediction of growth, but to better understand how and where people consume energy and generate waste, the associated emissions, and how this is expected to change over time.

For the purposes of this plan, land use was divided into two sectors: residential and non-residential. Residential dwellings were then broken down into three dwelling types - detached, attached and multi-unit, while non-residential floorspace was broken down into three non-residential building types - commercial, retail and industrial . Rather than providing a comprehensive survey of land uses, this approach was adopted to provide an adequate breakdown and understanding of greenhouse gas emissions across the region. Full definitions of these building types are provided in the Appendix A.

The 2011 residential dwelling figures and non-residential floorspace for each LGA is shown in Figures 2 to 4.

While Waverley and Woollahra are primarily dominated by residential multi-unit apartments, Randwick contains a higher proportion of detached dwellings than Waverley and Woollahra, and the largest amount of non-residential floorspace, including the University of New South Wales, Prince of Wales Hospital, Randwick Children's Hospital, Randwick Racecourse and large industrial sites in and around Port Botany.

Notes:

- **Commercial Land Use** includes office, administration, community services and schools
- **Retail Land Use** includes main street, shopping centre and big box retail services
- **Industrial Land Use** includes light and heavy industrial uses, including warehousing, manufacturing, freight and logistics.
- **Special uses Land Use** includes University of New South Wales, Prince of Wales Hospital, Randwick Children's Hospital and Randwick Racecourse

EXISTING RESIDENTIAL DWELLINGS (2011)

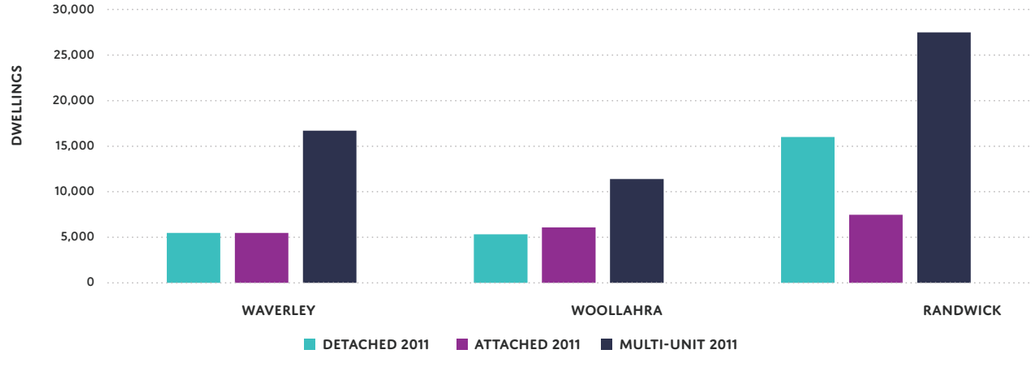


Figure 3: Residential dwellings by type across the region

EXISTING INDUSTRIAL AND SPECIAL USES FLOORSPACE (2011)

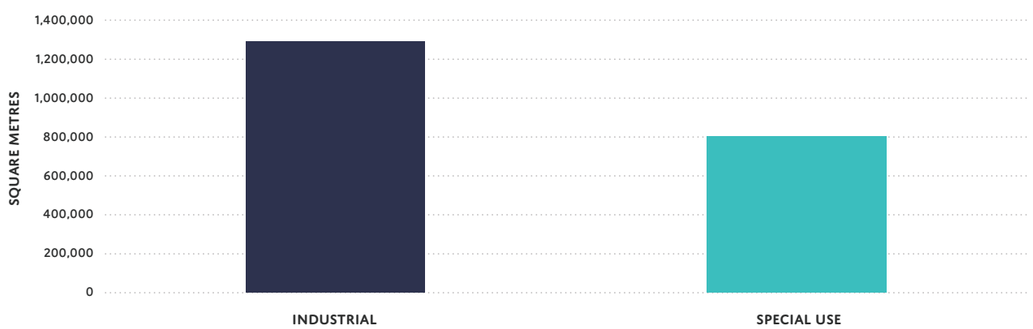


Figure 2: Industrial and special use floorspace by type across the region

EXISTING RETAIL AND COMMERCIAL FLOORSPACE (2011)

Figure 4: Commercial and retail floorspace by type across the region

PROJECTED LAND USE

Residential dwellings and non-residential floorspace is projected to 2031 based on publicly available datasets obtained from the NSW government and each Council as well as through discussions with strategic planning teams from each Council (see Appendix for data sources). Projected dwelling and non-residential floorspace figures for each LGA are shown in Figures 5 to 7.

The number of residential dwellings across the region is expected to grow by 11% (or 11,500 new dwellings) by 2031. Growth is expected across all dwelling types, with the highest growth (19%) occurring in multi-unit dwellings, compared to 2% and 3% for detached and attached dwellings respectively.

Overall non-residential floorspace is expected to grow by 14% (or 469,063 m2 of new floorspace) by 2031. Randwick exhibits the highest overall growth. This growth is predominantly in commercial floorspace (24% growth), and occurs in major commercial centres such as Bondi Junction, Kingsford, Maroubra and Randwick (suburb).

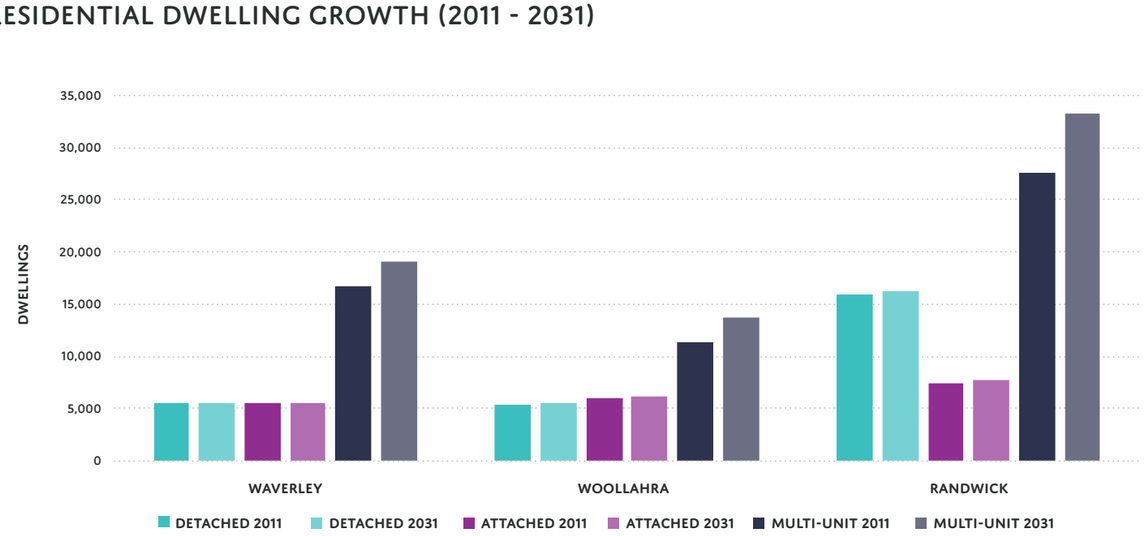


Figure 5: Estimated residential dwellings by type across the region in 2011 and 2031

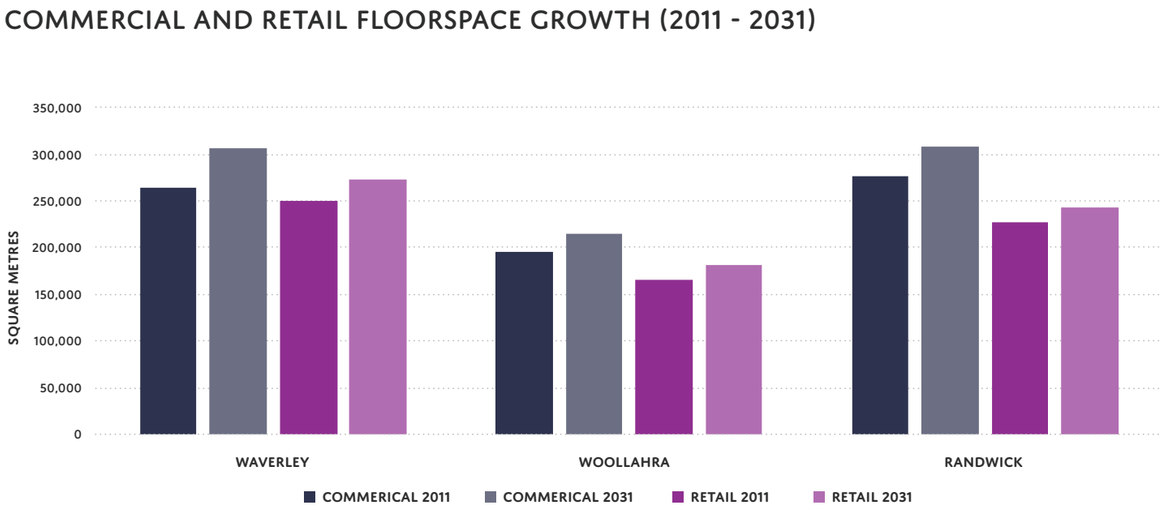


Figure 6: Estimated commercial and retail floorspace by type across the region in 2011 and 2031

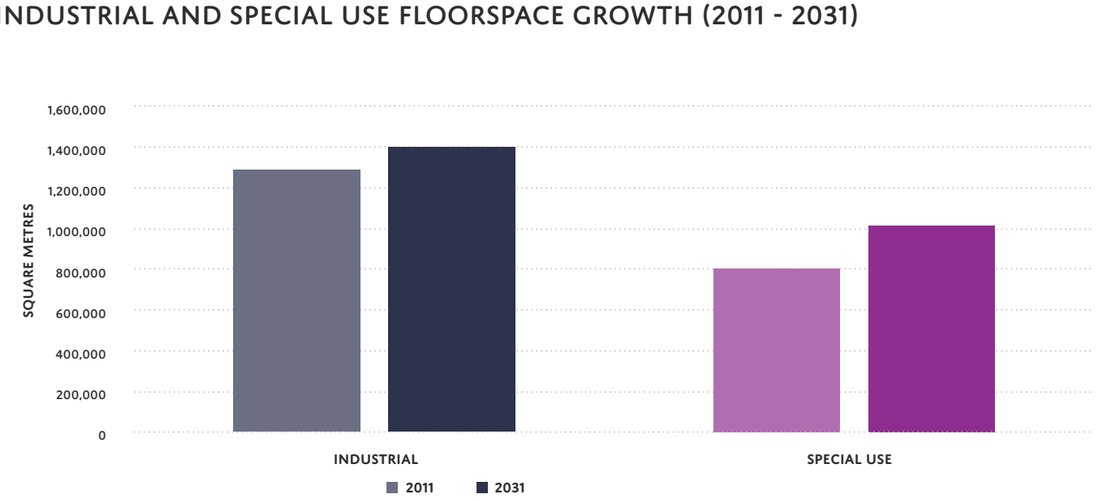


Figure 7: Estimated commercial and retail floorspace by type across the region in 2011 and 2031

WHERE DO OUR EMISSIONS COME FROM?

In 2011, the total regional greenhouse gas emissions from electricity, gas, waste and transport activities were approximately **2,139,000 tonnes-CO2-e.**

Randwick is responsible for 49% of the regional emissions, followed by Waverley (26%) and Woollahra (25%) (Figure 8). Randwick makes up the largest portion of emissions, because of its larger land area and the presence of large building developments associated with the University of New South Wales and Randwick Hospitals Precinct.

EMISSIONS BY SECTOR AND SUB-SECTOR

Figures 9 and 10 show the breakdown of emissions by sub-sector (buildings, transport and waste), and source (electricity, natural gas, transport and waste). This analysis provides guidance on the types of emission reduction strategies that are likely to have the most impact, for example:

- Residential buildings (40%), followed by non-residential buildings (31%) are the largest single contribution to greenhouse gas emissions across the region.
- Building emissions are due to energy consumption from electricity and gas. As shown in Figure 10, emissions from electricity consumption are the largest single source of regional emissions.
- Energy efficiency, fuel switching and local energy generation can be employed to reduce consumption and emissions from both building emissions and grid electricity consumption.
- Transport emissions make up a significant portion of both residential and non-residential emissions (Figure 9). Transport emissions can be influenced through strategies that seek to reduce overall travel and shift away from private car use to public transport, walking and cycling.
- Waste contributes to 7% of the region's emissions.

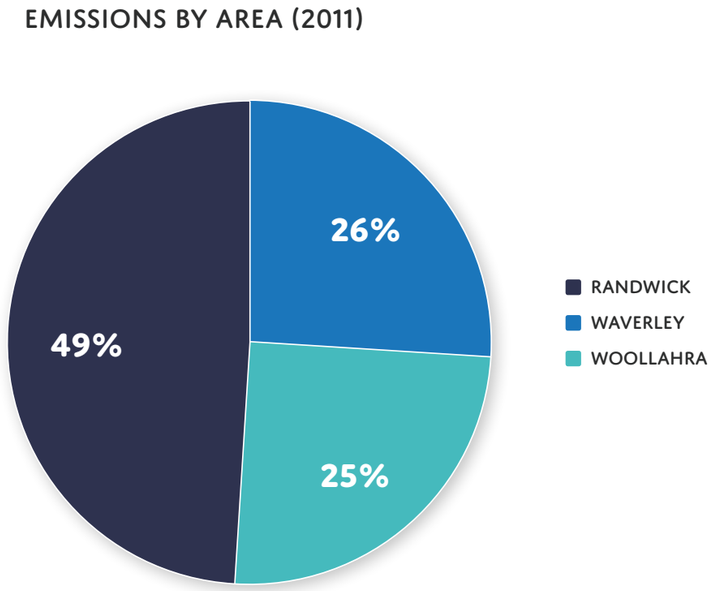


Figure 8: Greenhouse gas emissions by local government area in 2011

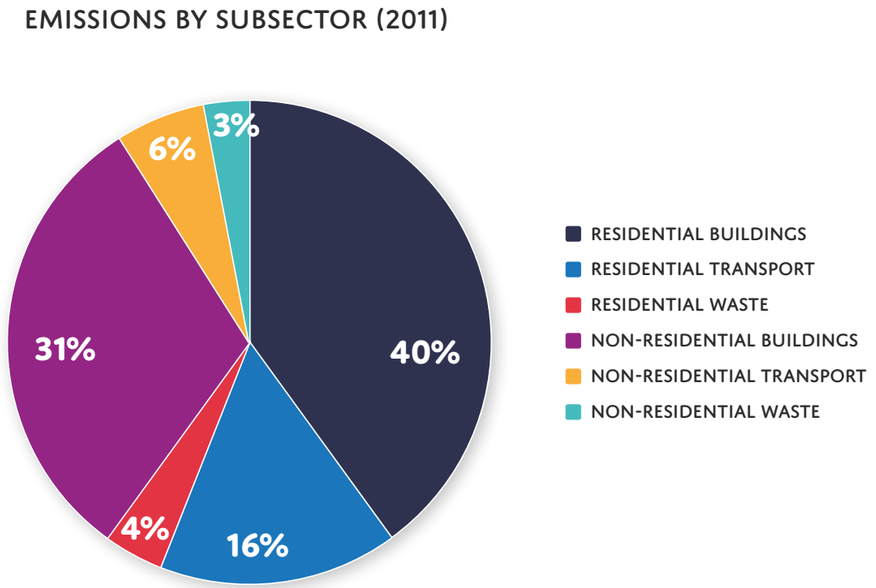


Figure 9: Greenhouse gas emissions by subsector in 2011

EMISSIONS BY END USE

Figure 11 provides a more detailed analysis of emissions by specific end uses, such as lighting, space cooling and appliances/equipment. End use consumption estimates are based on the specific building types and land uses of the Eastern Suburbs region and the specific climate zone, using a number of publicly available datasets (see Appendix for more details).

Detailed end use analysis provides guidance on the types of emission reduction strategies that are likely to have the most impact, for example:

- Water heating is the largest single contributor to residential greenhouse gas emissions, hence strategies to encourage cogeneration or solar hot water can have a significant impact.
- Lighting, appliances and equipment are the largest contributors to non-residential greenhouse gas emissions. Strategies focused on these end uses can have a significant impact.

EMISSIONS BY SOURCE (2011)

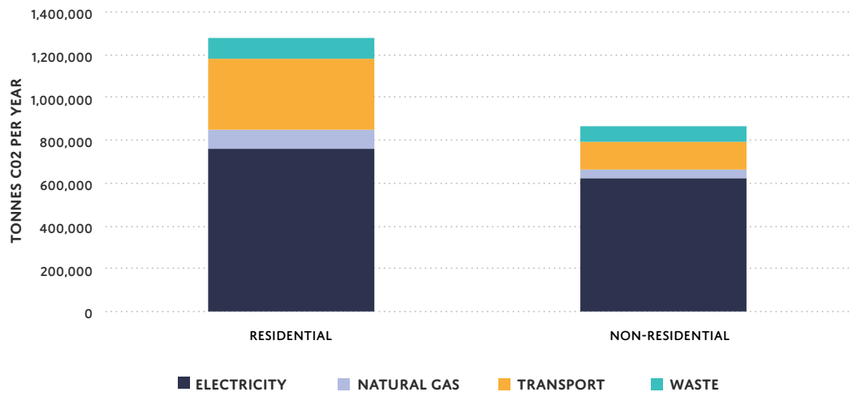


Figure 10: Greenhouse gas emissions by source (2011)

EMISSIONS BY END USE (2011)

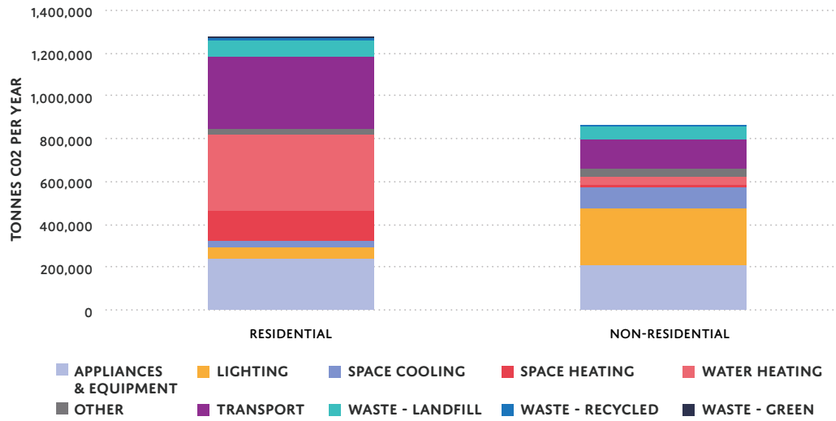


Figure 11: Greenhouse gas emissions by end use (2011)

SPATIAL ANALYSIS

Spatial analysis of the region's greenhouse gas emissions provides further insight into the location and concentration of emissions across the region.

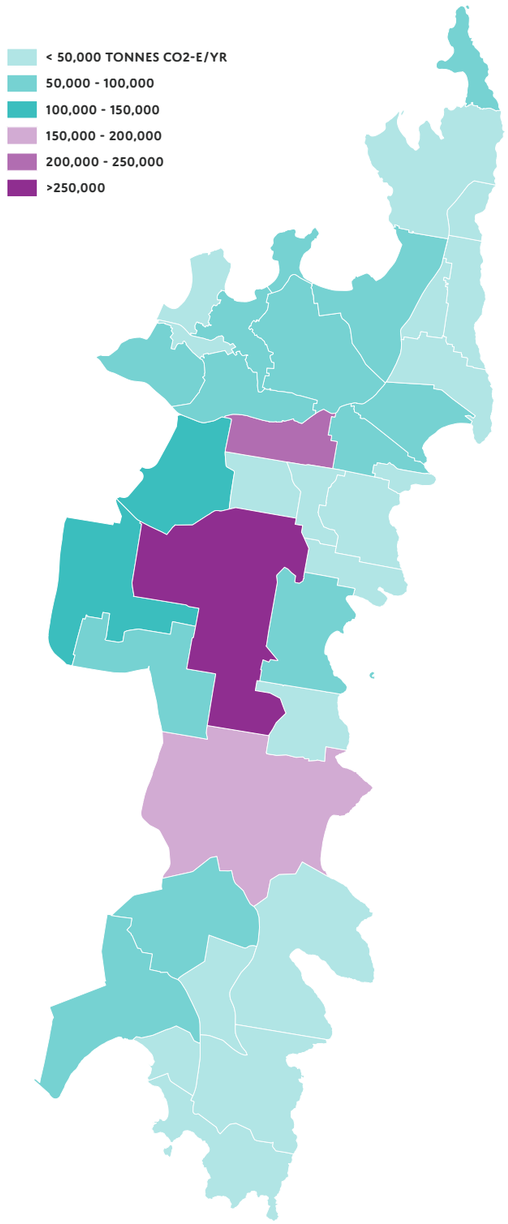
Figure 12 breaks down the emissions profile geographically.

In 2011, the suburb with the highest emissions in the region is Randwick emitting 255,000 tonnes-CO2-e, followed by Bondi Junction with 207,000 tonnes-CO2-e.

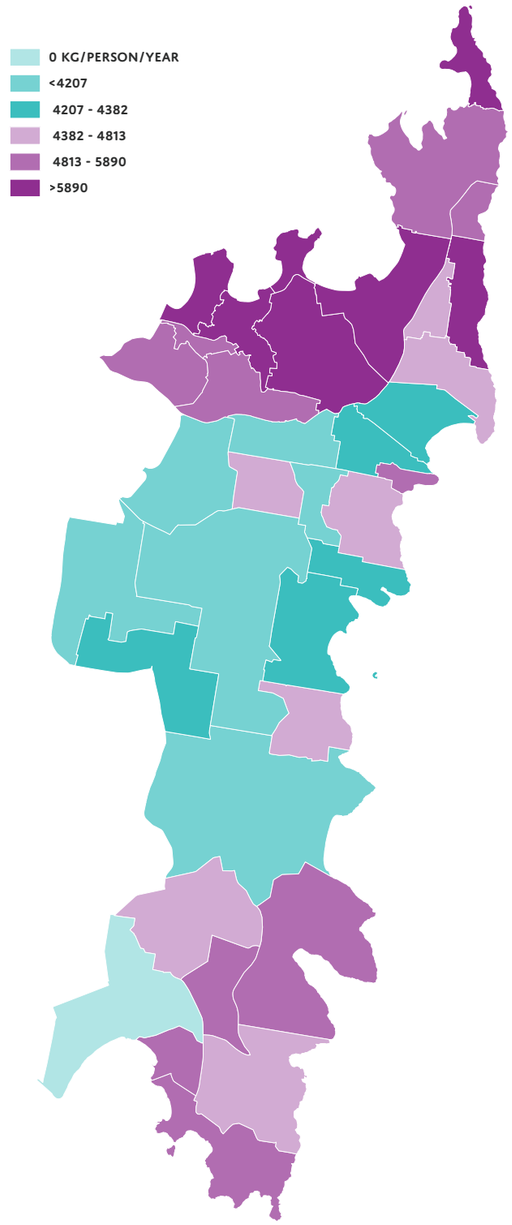
When greenhouse gas emissions are adjusted for population, this analysis shows the emissions per person (or emissions intensity) across the region (see middle map).

Differences in emissions per person may be attributed to a variety of factors including , size of dwellings, socio-economic factors and car use per person (see right map). Suburb level car use is estimated from data provided by the Bureau of Transport Statistics, taking into account local public transport access, car ownership, density and access to jobs and services. Actual fuel usage data was not available to be used. However it is possible to assume from the available data that those suburbs further from the CBD and with lower public transport access are likely to drive a car significantly further per day.

TOTAL EMISSIONS PER SUBURB



EMISSIONS PER PERSON



CAR USE PER PERSON

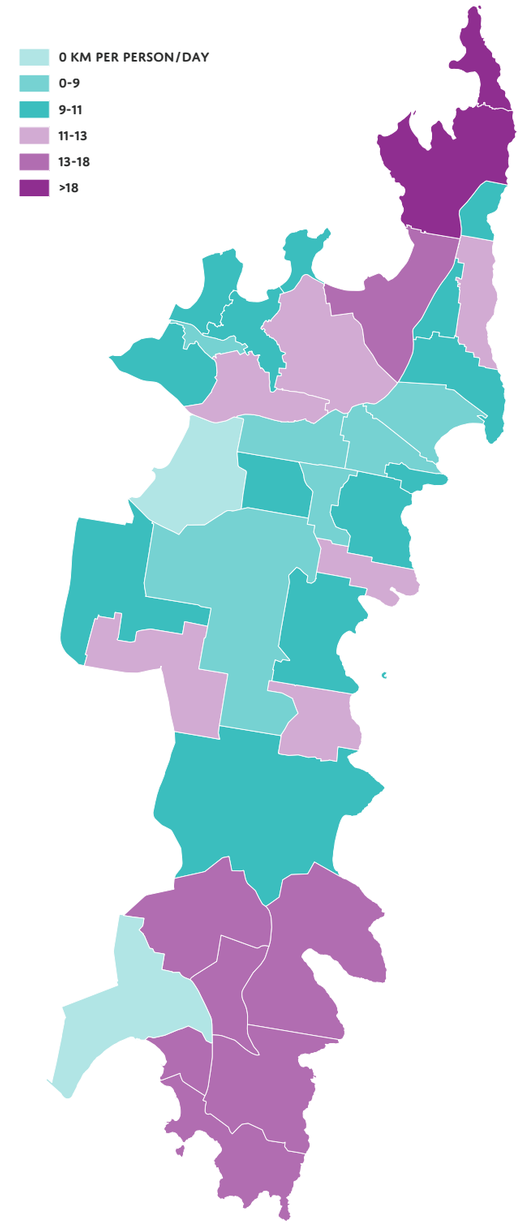


Figure 12: Spatial representation of total emissions and emissions per person.

DWELLING OWNERSHIP

The dwelling ownership rates across the region indicate that the majority of residents living in multi-unit dwellings are renters (Figure 13). Renewable energy installation data shows that individuals who do not own their home or who live in apartments are significantly less likely to install efficiency or renewable energy technology. This is primarily due to the lack of ability to make modifications to leased property, availability of viable roof space for solar PV, split incentives between owners and renters, and lack of clarity over length of occupancy. Knowing that residents in apartments and renters face significant barriers to install renewables, it is likely that only 1 in 3 dwellings in the region could expect to install solar PV, without significant changes in state government policy or new rates based finance mechanisms to encourage greater uptake.

Similarly, analysis has shown a clear correlation between household income and emissions. Households with a lower income are more sensitive to electricity costs and hence are more likely to conserve energy or install energy efficiency or renewable energy technologies.

ASSUMING THAT RESIDENTS IN APARTMENTS AND RENTERS ARE UNLIKELY TO INSTALL, AT A MAXIMUM

1 IN 3 DWELLINGS IN THE REGION COULD EXPECT TO INSTALL SOLAR.

DWELLING OWNERSHIP BY DWELLING TYPE ACROSS THE REGION

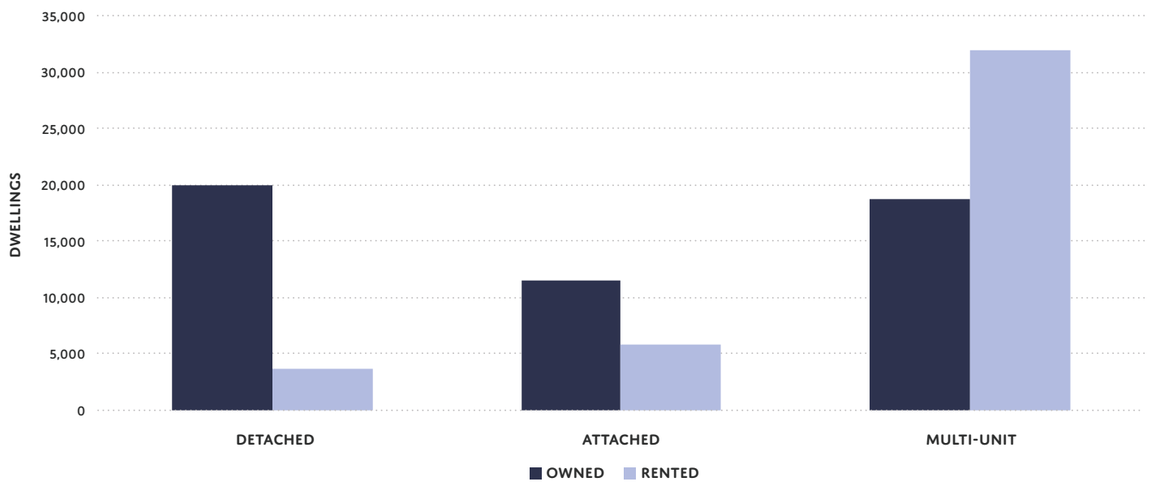


Figure 13: Dwelling ownership rates across the region

WHAT DO OUR FUTURE EMISSIONS LOOK LIKE?

BASED ON ESTIMATES ON GLOBAL EMISSION REDUCTION REQUIREMENTS FOR A GLOBAL WARMING OF LESS THAN 2 DEGREES CELSIUS, THE CURRENT TARGET CARBON BUDGET IS 52% BELOW CURRENT EMISSIONS

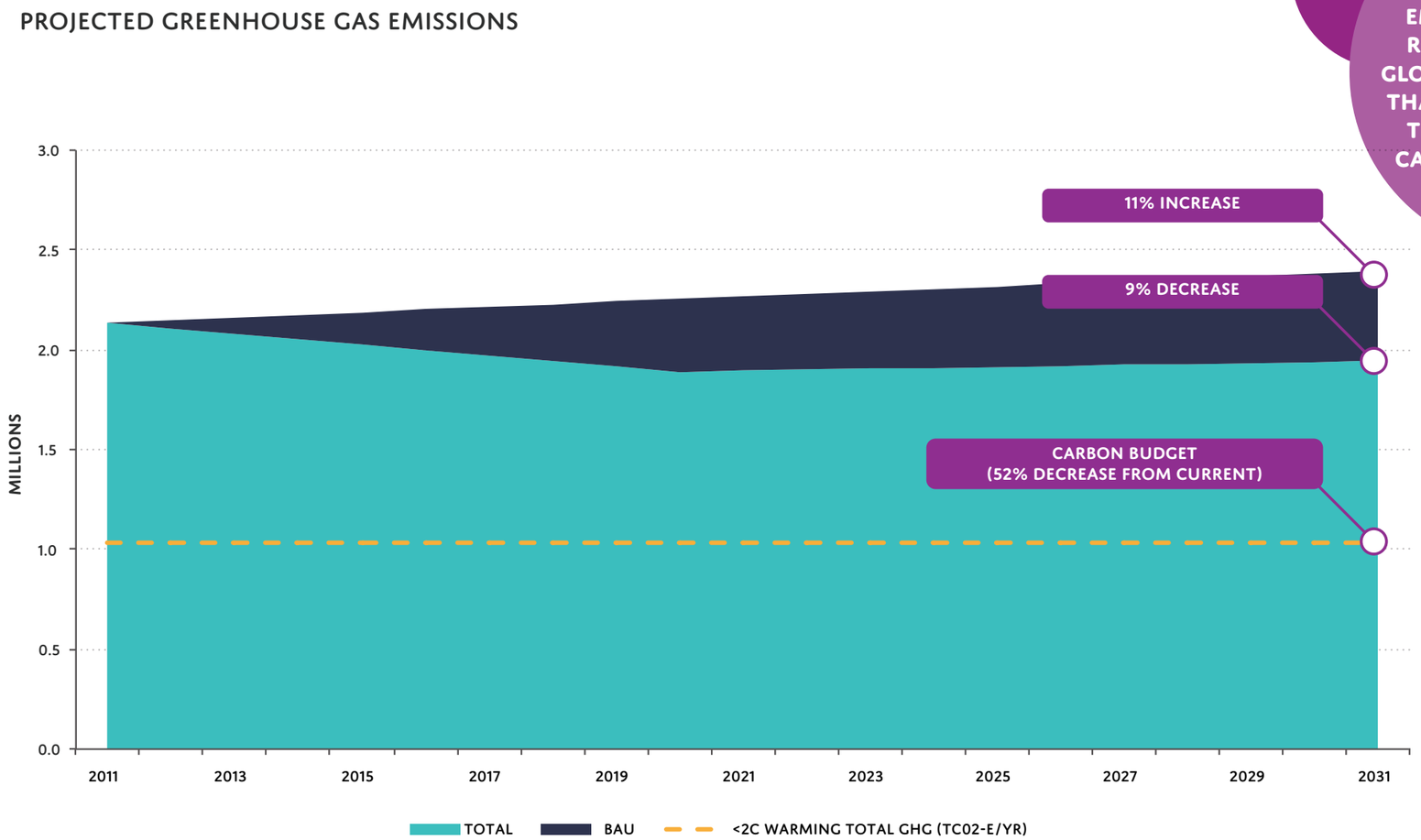


Figure 14: Projected greenhouse gas emissions under a BAU scenario

Through analysis of the existing emissions profile in combination with projected increases in residential dwellings and non-residential floorspace it is possible to estimate the future emissions of the region up to 2031. The projected emissions under a 'business as usual' (BAU) scenario show that greenhouse gas emissions of the region are likely to increase by **11% by 2031** (Figure 14).

However, the State and Federal Governments have implemented two key policies - the Renewable Energy Target[3] and BASIX, aimed at addressing this long-term growth in emissions. Incorporating the likely impacts of these policies, the projected emissions are estimated to decrease by **9% by 2031** (Figure 14). This projection will be used as the baseline for continued analysis throughout this plan.

It is important to note that a 9% emissions reduction is substantially less than the reduction required to keep global warming at a safe level[4], which most nations, including Australia, have collectively defined as 2 degrees or less. Scientists have calculated the approximate reduction in emissions per person globally required in order to limit global warming to 2 degrees or less and avoid the most critical weather events associated with a changing climate. Correlated to the population of the Eastern Suburbs, this represents an annual 'carbon budget' that is approximately 52% below current emissions[5].

[3] Modelling of the RET has assumed 20% of grid electricity is sourced from renewable energy by 2020. This assumption is consistent with current proposed changes to the RET, which call for a "real 20%" target. From 2020, emission factors are assumed to remain constant, and hence projected emissions rise at a faster rate.

[4] Australian Climate Change Authority, Targets and Progress Review, Chapter 3: A Global Emissions budget for 2 degrees or less. http://www.climatechangeauthority.gov.au/reviews/targets-and-progress-review/part/chapter-3-global-emissions-budget-2-degrees-or-less.

[5] The remaining amount in the IPCC Carbon Budget equates to approximately 3.9 tonnes CO2-e per person per year or approximately 1 MT CO2-e per year for the 3 Council region.

SPATIAL ANALYSIS OF EMISSION CHANGE (2011-2031)

Changes in greenhouse gas emissions were analysed on a suburb by suburb level. The total change in greenhouse gas emissions and the percent change between 2011 and 2031 is shown in Figure 15.

Suburbs with low or negative emission growth are areas with established residential dwellings and little development growth, suggesting a stable emission profile into the future. Areas with high growth are associated with areas with high development rates.

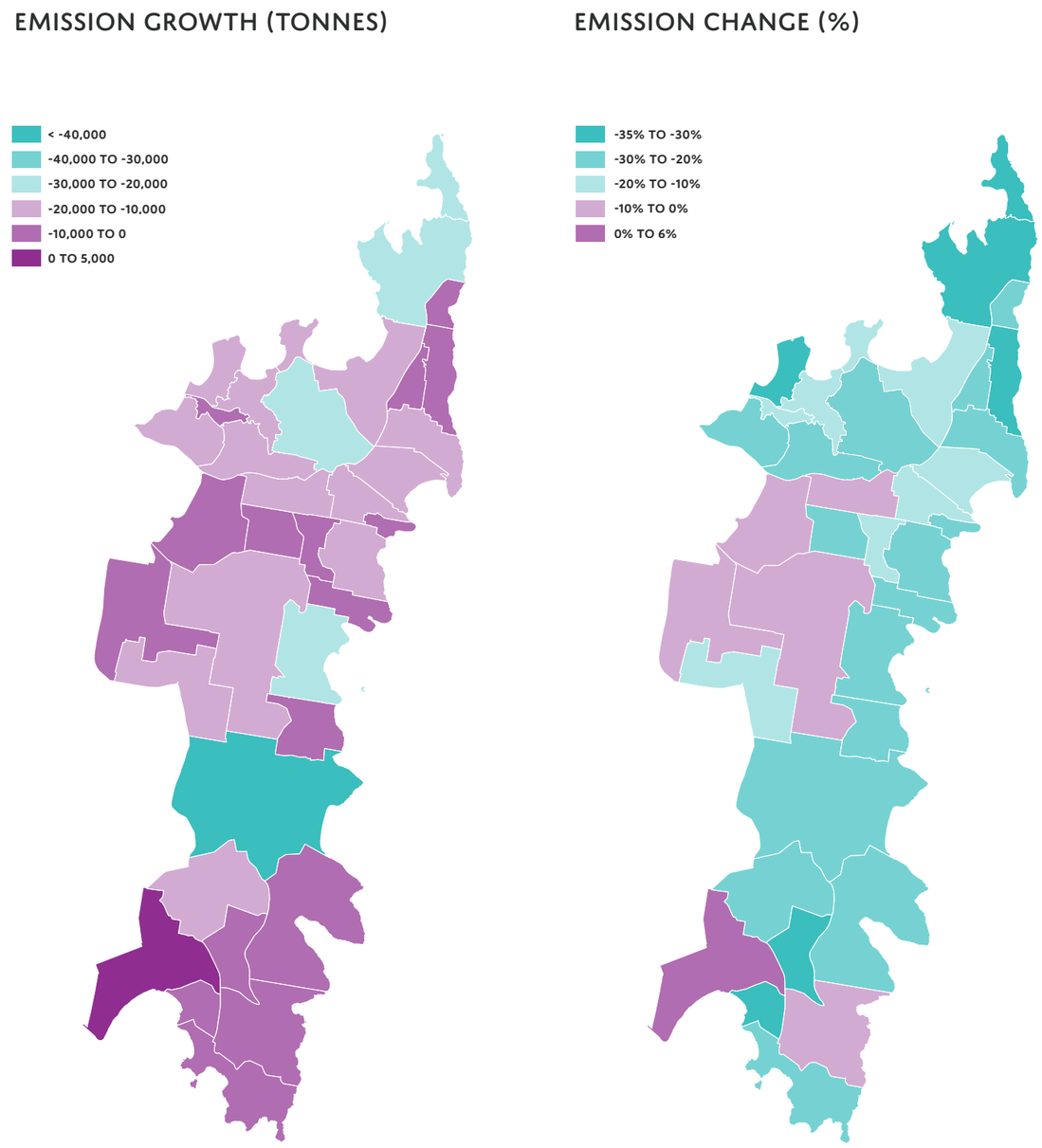


Figure 15: Spatial representation of total emissions change between 2011 and 2031 by suburb.

DEVELOPING A ROADMAP FOR A LOWER CARBON FUTURE

The challenge of reducing greenhouse gas emissions across the region will require significant effort and collaboration between all levels of government, business and the community. However, there are some key mechanisms that Local Government in particular can influence that can have a significant impact on reducing emissions across the region.

This Plan outlines the technologies, policies, programs where Council's resources can be used most effectively in reducing regional greenhouse gas emissions in the long term (Figure 16).

How did we identify the most effective strategies to realise a low carbon future?

1. Determine the total emissions reduction potential of existing opportunities and technologies.
2. Define the financial cost of each of these opportunities.
3. Determine which opportunities the 3-Councils can have the greatest influence over.
4. Establish a shortlist of key regional opportunities to be explored in the short medium and long term.

Based on this process, this plan has established a greenhouse gas reduction target based on the overall reduction potential and the implementation of key strategies.

OUR APPROACH TO DEVELOPMENT A ROADMAP FOR A LOW CARBON FUTURE

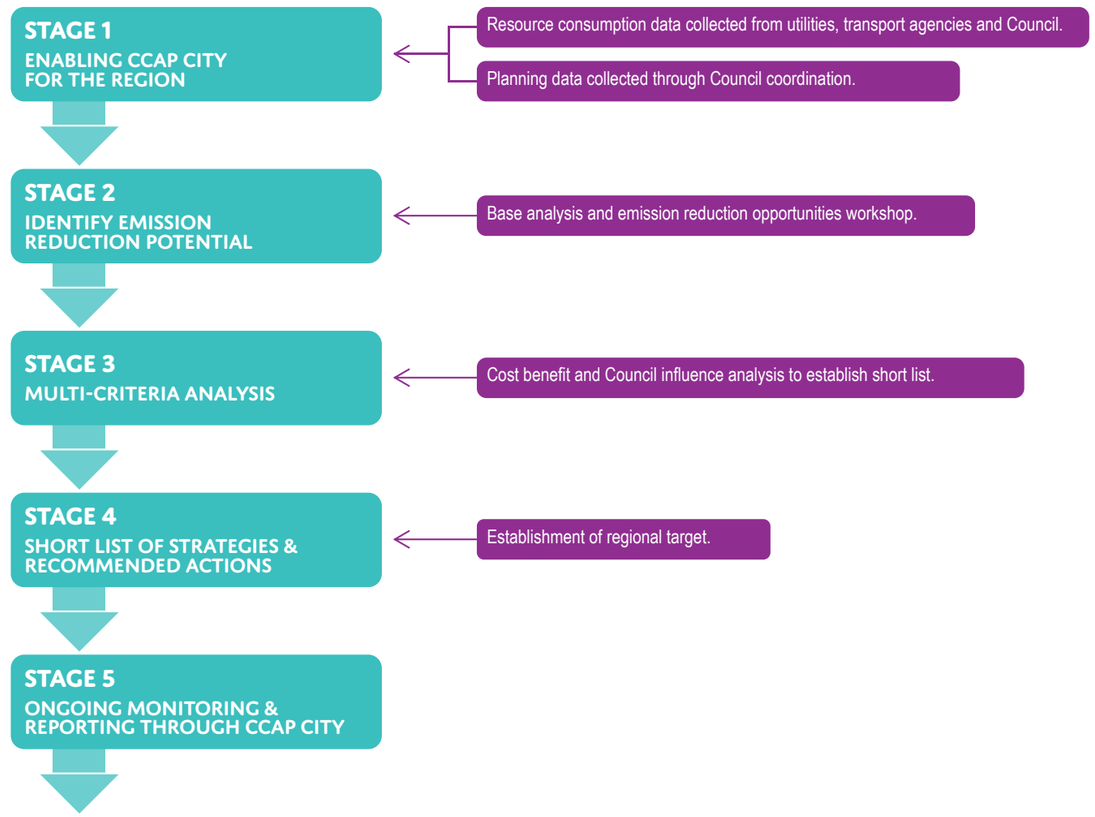


Figure 16: Key stages and inputs into the development of the Eastern Suburbs Low Carbon Future Plan

OUR EMISSION REDUCTION POTENTIAL

The total emission reduction potential was modelled using Kinesis' CCAP City analytics software, which combines the impact from different technologies and policies against the land-use, urban form, consumption and transport patterns throughout the region. For the purposes of this report, this list of technologies, programs and policies are referred to as 'opportunities'.

If all these opportunities were realised, it would be possible to reduce the regions greenhouse gas emissions by approximately 1 million tonnes CO2-e, which is equivalent to **47% reduction by 2031 (Figure 17).** This analysis indicates that the two most effective opportunities are energy efficiency (13%) and solar PV (10%).

The assumptions on which this emission reduction potential are based are outlined in Table 2.

REGIONAL GREENHOUSE GAS EMISSION REDUCTION POTENTIAL

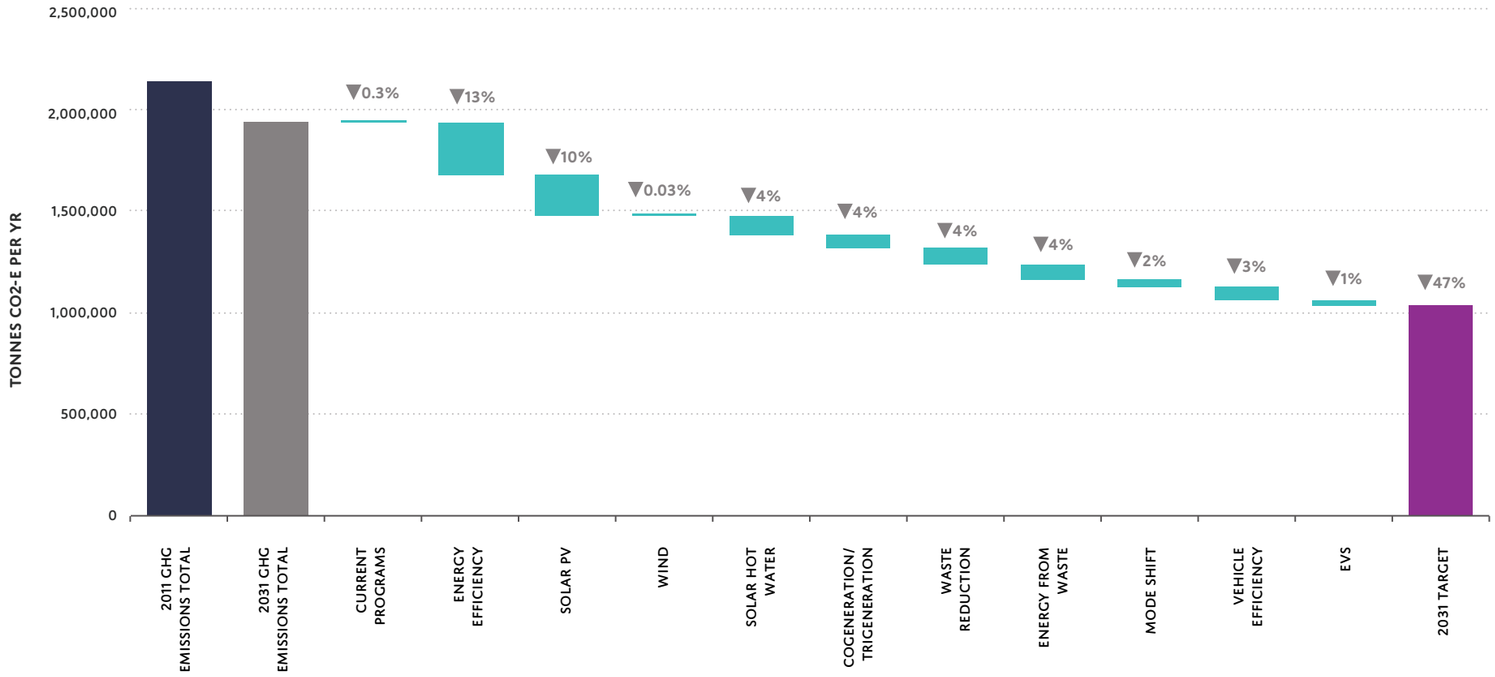


Figure 17: Greenhouse gas reduction potential for all opportunities.

TECHNOLOGY	MODELLING ASSUMPTION
CURRENT PROGRAMS	Emission reductions estimated by Council and provided to Kinesis
ENERGY EFFICIENCY	Lighting, appliance and equipment efficiency for residential and non-residential buildings. Lighting assumes a 35% to 60% reduction in non-residential buildings and 75% reduction in residential buildings. Appliance and equipment assumes a 25% to 45% reduction in non-residential buildings and a 50% reduction in residential buildings. Care has been made not to overlap with the assumed impact of BASIX in new residential dwellings.
SOLAR PV	Solar PV in residential and non-residential buildings. Residential solar PV assumes owner-occupiers install 2.5 kW per detached (assuming 86% take-up), 1.5 kW per attached (assuming 81% take-up) and 1 kW per apartment (assuming 36% take-up), taking into account shading and orientation efficiency. Non-residential solar PV assumes 30% roof coverage on 80% of roof space taking into account shading and orientation efficiency and building services such as lift wells and cooling systems (approximately 70,000 kW in total).
WIND	Assumes small scale (approximately 8 x 2.4 kW, totalling 18kW) systems installed in technically viable council public open space, accounting for wind speed, turbulence and siting requirements. Medium scale wind (three to six 50 – 100 kW turbines, totalling 300kW) has also been included along the coastline taking into account predominant wind direction, wind speed, turbulence and siting requirements.
HOT WATER EFFICIENCY	Focused on residential dwellings only and includes high take-up of solar (20%) and gas (80%) systems replacing electric systems over time. Care has been made not to overlap with the assumed impact of BASIX in new residential dwellings.
COGENERATION/ TRIGENERATION	Assumed for commercial and retail heating, cooling and hot water and apartment hot water (mini-CHP) as a focused strategy in 4 major centres of Bondi Junction, Maroubra Junction, UNSW and Prince of Wales Hospital.
WASTE DIVERSION	Assumes Waverley's waste targets implemented across all Councils which are in line with EPA State Targets (75% diversion of residential waste, 50% diversion of commercial waste and no net increase in waste per person).
ENERGY FROM WASTE	Includes remaining waste after waste diversion strategy only. MSW is sent to a low-temperature, pyro-combustion, gasification facility, while green and food waste is anaerobically digested.
MODE SHIFT	Incorporates mode shift from residential and non-residential travel. A 10-20% mode shift away from private vehicles to public transport, walking and cycling is assumed based on improved public transport, low parking rates and car share.
VEHICLE EFFICIENCY	Private vehicle fleet (resident vehicles only) assumed to reduce emissions by 20% per km travelled, in line with expected improvements over the next 20 years.
ELECTRIC VEHICLES	Assumes a 20% take-up of electric vehicles by 2031, higher than the conservative estimated from the 2008 Garnaut Review.

Table 2: Modelling assumptions used in the analysis of a regional emission reduction potential

REDUCTION POTENTIAL BY SECTOR AND SUBSECTOR

The reduction potential for each opportunity was further analysed by sector and subsector to identify specific land-use types or audiences for the 3-Councils to target specific strategies (see Make it Happen). The full technical potential of each sector and subsector is shown in Table 3 and Figure 18.

PROJECTED GREENHOUSE GAS EMISSIONS

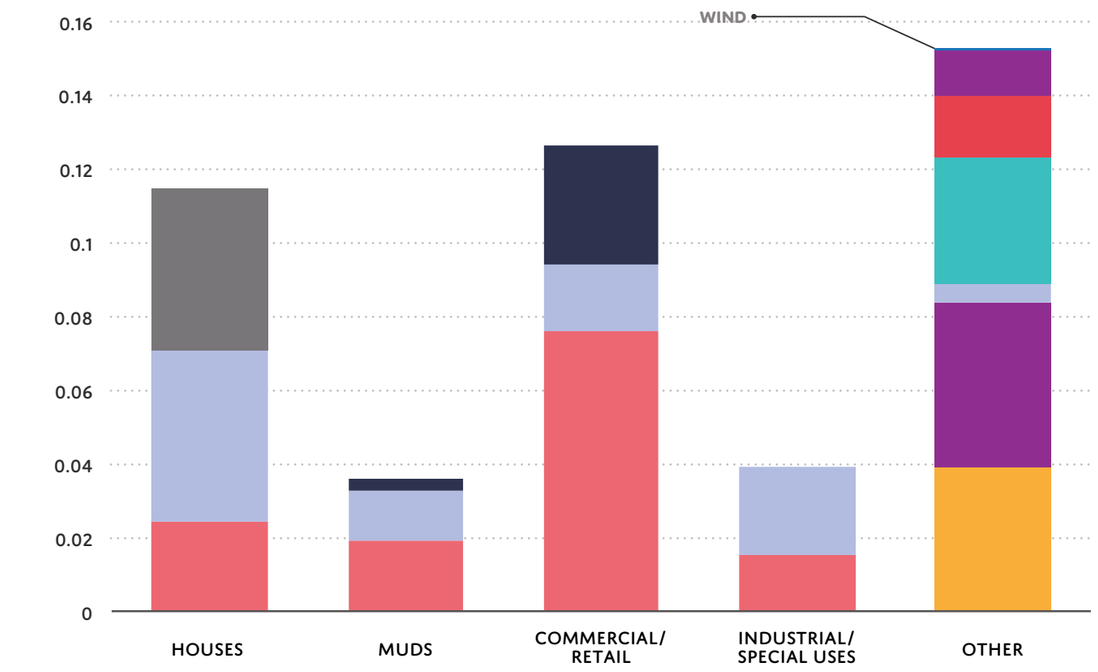


Figure 18: Emissions reduction potential broken down by subsector

OPPORTUNITY	SECTOR	SUB-SECTOR	TOTAL POTENTIAL
WASTE DIVERSION	All	All	3.9%
ENERGY FROM WASTE	All	All	4.4%
ENERGY EFFICIENCY	Non-Residential	Commercial and Retail	7.6%
SOLAR PV	Residential	Houses	4.7%
SOLAR/GAS HOT WATER	Residential	Houses	4.4%
RESIDENT VEHICLE EFFICIENCY	Residential	All	3.4%
COGENERATION + TRIGENERATION	Non-Residential	Commercial and Retail	3.2%
SOLAR PV	Non-Residential	Industrial and Special Uses	2.4%
ENERGY EFFICIENCY	Residential	Houses	2.4%
ENERGY EFFICIENCY	Residential	MUDS	1.9%
SOLAR PV	Non-Residential	Commercial and Retail	1.8%
TRANSPORT MODE SHIFT	All	All	1.7%
ENERGY EFFICIENCY	Non-Residential	Industrial and Special Uses	1.5%
SOLAR PV	Residential	MUDS	1.4%
ELECTRIC VEHICLES	All	All	1.2%
SOLAR PV	Non-Residential	Schools and Childcare	0.4%
COGENERATION AND TRIGENERATION	Residential	MUDS	0.3%
SOLAR PV	Non-Residential	Council	0.1%
WIND	All	All	0.03%
TOTAL			46.73%

Table 3: Greenhouse gas emissions reduction potential by sector and sub-sector

RESIDENTIAL SOLAR PV AND HOT WATER

Solar PV and hot water efficiency remain the greatest opportunity for attached and detached houses. This is primarily due to the availability of roof space and the impact that solar can have on household energy use.

Previous Experience: There are a number of existing council led programs promoting the installation of solar PV such as Go Solar (initiated by the 3-Councils in 2010) and Our Solar Future (SSROC initiative). These have been developed in collaboration with the private sector, which has now established a comprehensive suite of services for this market. There is a high level of understanding of the benefits of solar in this market and these existing platforms are proving successful in guiding residents through the research and purchasing process. Therefore, further regional collaboration on this opportunity is not likely to have a significant additional impact.

COMMERCIAL/RETAIL ENERGY EFFICIENCY

Energy efficiency remains the greatest opportunity for the commercial and retail sub-sector, contributing close to 8% of the total greenhouse gas emission reduction potential. This is primarily due to the large amount of equipment, appliances and lighting used in commercial and retail workspaces.

Previous Experience: Previous programs targeting business owners have proved challenging, due to an inability to gain meaningful engagement. Even in instances where free lighting retrofits were offered, Council has had to invest considerable time in chasing eligible businesses, which has proven to be an inefficient use of council resources. This can be attributed to split incentives between business owners and property owners as well as the potential disruption to operations required to retrofit existing businesses. Projects in this area will need to target specific retail/commercial hubs that allow for both business owners and property managers to collaborate with Council to find meaningful long-terms solutions. It is also recommended that these programs are comprehensive and tackle both energy efficiency and alternative energy opportunities, which will work in combination with existing State and Federal energy efficiency programs.

COGENERATION AND TRIGENERATION

Cogeneration is the simultaneous production of electricity and the use of waste heat from the electricity generation process to supply space and water heating needs. In a further step this heat can be converted into cooling via a heat–driven chiller, in a process known as trigeneration.

The potential for this technology has been identified in high-density commercial, retail and mixed use precincts, including Bondi Junction, Maroubra Junction, UNSW and Prince of Wales Hospital. These areas represent high demands for heating, cooling and hot water. While much attention has been given to potential for district trigeneration systems, this Plan does not rely on district level systems to achieve the emission reductions outlined above. Building level cogeneration, trigeneration or mini-CHP for apartment hot water has the potential to provide effective low carbon solutions to deliver equivalent carbon reductions and financial returns.

Previous Experience: Waverley Council is currently undertaking a Low Carbon and Low Energy Solutions study as part of its Green Infrastructure Master Plan for Bondi Junction. This study will assess the feasibility of low carbon technologies, including co-generation and tri-generation which can potentially result in major emissions reductions (for more information refer to the Making it Happen section of this Plan).

The City of Sydney has also previously explored the feasibility of a tri-generation network throughout the city. While there was a strong business case for this at the time, the challenges of retrofitting buildings to enable them to plug in to a district system as well as recent increases in the gas prices, have hampered the roll out of this program.

TRANSPORT

A reduction in car use and shift to alternative modes of transport (such as public transport, walking and cycling) is the most effective emission reduction strategy to address transport related emissions. Infrastructure like the South East Light Rail will create substantial mode shift away from private car use.

Given that transport emissions from both residents and people travelling to the region for work equate to 22% of total regional greenhouse gas emissions, even large mode shifts away from private vehicles deliver small emission reductions.

Previous Experience: Infrastructure based transport strategies, such as cycle paths and light rail, have previously proven to be difficult to execute without the assistance of State Government. This is due to capital costs required as well as approvals, administrative and logistic barriers that fall outside the role of local government. Infrastructure strategies are largely implemented through the State Government, such as the South East Light Rail Project, which will assist mode shift for residents living nearby. However previous challenges to implementing large-scale transport strategies at an individual Council level, should not preclude them from being considered on a regional scale.

WASTE

Council maintains significant autonomy over how waste is collected and treated and at over 8%, it represents the largest emission reduction potential across the region. Waste strategies incorporate both the diversion of waste to landfill and the potential to generate energy from waste, producing a range of low carbon energy outputs, from heat to electricity and gas. Any proposed system should match the energy generation with the energy demand requirements (electricity, gas, heat or specific end uses) for the region.

Previous Experience: When going to tender for a waste services provider Council will often commit to a contract of between 5-10 years. Naturally, this can limit their flexibility to amend the terms of the contract over this period, such as the agreed resource recovery rate. Currently, Waverley and Woollahra are locked into long-term contracts with waste providers and hence collaboration on this issue could prove to be challenging in the short term.

WIND

Due to the dense urban form of the Eastern Suburbs region and the subsequent lack of appropriate sites, commercial scale wind (>100kW and between 60-120m in height) is not considered a feasible technology for the region.

Previous Experience: In 2010, Randwick Council installed a small wind system (2.4 kW) at the Randwick Community Centre. This system produces approximately 1,200 KWh of electricity per year, approximately one third of the electricity generation output per kW of the adjacent solar PV system also installed at the community centre. Waverley Council have also undertaken a Feasibility of Distributed Wind Energy study, which assessed the feasibility of three separate sites across the LGA including Hugh Bamford Reserve, Marks Park and Bronte Park as poor.

EXPLORING COSTS & BENEFITS

Figure 19 shows the Marginal Abatement Cost Curve for the opportunities outlined in this Plan. This Curve shows the total 'cost to society' to reduce one tonne of GHG emissions, measured as $ per tonne CO2-e.

HOW TO INTERPRET THIS MARGINAL ABATEMENT COST CURVE?

- The height of the vertical or y-axis of the graph represents the cost of each of the potential energy efficiency projects, while the width of the horizontal or x-axis represents the total GHG abatement potential for each opportunity.
- The fattest block delivers the most abatement.
- The graph is ordered left to right from lowest to highest cost opportunities. Those opportunities below the line offer a 'net benefit' to society, meaning that they will pay off the initial capital required through subsequent energy savings in the short to medium term.
- Those opportunities above the line represent a 'net cost', meaning that the subsequent savings will unlikely cover the capital cost in the short to medium term.

This analysis indicates that all the opportunities, except for wind, electric vehicles offer a net financial benefit to society and will most likely pay off the initial capital required through subsequent energy savings in the short to medium term. Overall, the Curve broadly reflects the technological maturity of these opportunities - with those less mature opportunities, that require higher capital costs, sitting above the line. It can be broadly assumed that as development of these technologies continues to grow, capital costs will continue to fall.

It is important to be aware that for operational or strategic reasons, it may be preferable to implement more expensive, longer term projects that might promote a major market shift in the longer term and that further assessment of who pays and who benefits for each opportunity is needed to reflect the cost to council for any projects prior to implementation.

REGIONAL MARGINAL ABATEMENT COST CURVE

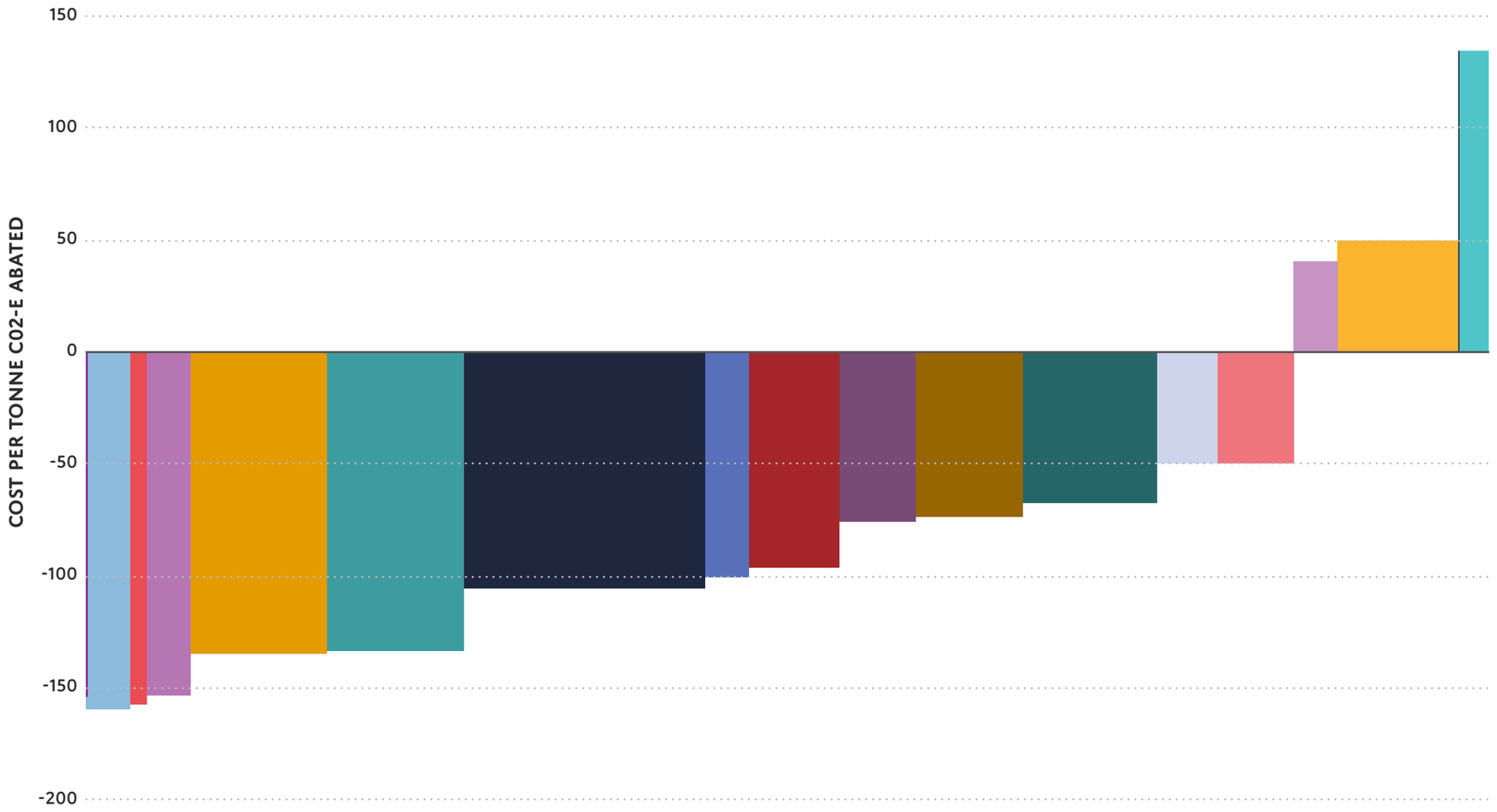


Figure 19: Marginal Abatement Cost Curve of opportunities

- SOLAR PV (COUNCIL)
- SOLAR PV (COMMERCIAL/RETAIL)
- SOLAR PV (SCHOOLS + CHILDCARE)
- SOLAR PV (MUDS)
- SOLAR PV (HOUSES)
- ENERGY FROM WASTE (ALL)
- ENERGY EFFICIENCY (COMMERCIAL/RETAIL)
- TRANSPORT MODE SHIFT (ALL)
- COGENERATION + TRIGENERATION (COMMERCIAL/RETAIL)
- SOLAR PV (INDUSTRIAL/SPECIAL USES)
- RESIDENT VEHICLE EFFICIENCY (ALL)
- SOLAR HOT WATER (HOUSES)
- COGENERATION + TRIGENERATION (MUDS)
- ENERGY EFFICIENCY (MUDS)
- ENERGY EFFICIENCY (HOUSES)
- ENERGY EFFICIENCY (INDUSTRIAL/SPECIAL USES)
- WASTE DIVERSION (ALL)
- WIND (ALL)
- ELECTRIC VEHICLES (ALL)

DETERMINING THE INFLUENCE OF THE 3 COUNCILS

The ability of the 3-Councils to influence the behaviour of their residents and businesses is closely related to the specific functions of Local Government (Figure 20). The unique role of the 3-Councils in facilitating the reduction of regional emissions can be broadly broken down into three key 'areas of influence':

Regional Leadership: Particularly focused on where leadership at a regional level (as opposed to individual council action) will have the greatest impact.

Market Facilitation: Facilitating a market transition that would otherwise not have occurred. This may be through providing the conditions to facilitate a transaction or undertaking a service that is not being provided by the Market.

Regulation & Control: Focused on Councils' role as a regulator and consent authority. This relates to the existing service areas and policies delivered by local government.

Each opportunity was scored against the criteria above to establish a basis for the role of Council and the role of regional collaboration in the delivery of various programs and policies (Table 4).

Note: The ratings below were determined through a consultation process with members of all three regional councils, to provide balance and avoid subjectivity.

AREAS OF COUNCIL INFLUENCE

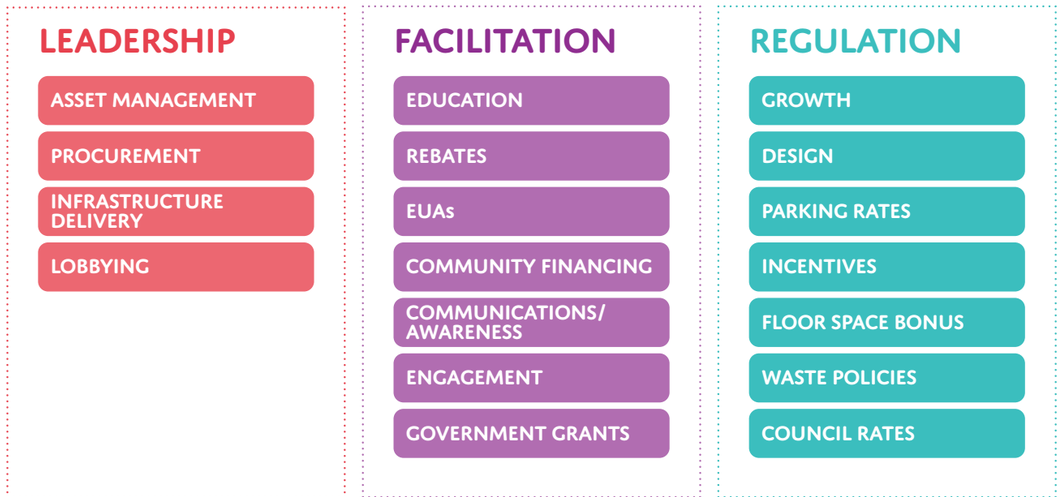


Figure 20: Areas of Council influence and impact for consideration in the development of a regional plan

TECHNOLOGY	SECTOR	SUB-SECTOR	REGIONAL LEADERSHIP	MARKET FACILITATION	REGULATION/ CONTROL	TOTAL 'INFLUENCE'	COMMENTS
WASTE DIVERSION	All	All	1	2	1.5	4.5	Without council intervention, the service would not be provided at a residential level. Challenges in waste stream contamination impact diversion outcomes
ENERGY FROM WASTE	All	All	1	1.5	2	4.5	Would not be viable without a regional scale waste stream. Council can control the waste streams included and degree of processing.
ENERGY EFFICIENCY	Non-Residential	Commercial/ Retail	1	1	1	3	Many existing energy efficiency programs with minimal levels of engagement. The business case for efficiency already exists.
SOLAR PV	Residential	Houses	0.5	1	0.5	2	This is largely led by the private sector. Programs such as 'Our Solar Future' already exist. Council has little control over the level of uptake. The business case for solar PV is highly impacted by rebates and feed-in tariffs outside of Council control.
SOLAR/GAS HOT WATER	Residential	Houses	0.5	1	0.5	2	There is a well-established industry delivering solar and gas hot water products.
RESIDENT VEHICLE EFFICIENCY	Residential	All	0.5	0	0	0.5	While a program focusing on vehicle efficiency would be innovative, Council has little control over uptake and the incentive already exists in low on-going costs.
COGENERATION + TRIGENERATION	Non-Residential	Commercial/ Retail	1.5	1	1	3.5	Council can mandate adoption through development controls. Few councils have implemented regulations around co-generation and tri-generation. Council could provide financing solutions to assist in sourcing upfront capital.
SOLAR PV	Non-Residential	Industrial/ Special Uses	2	2	0.5	4.5	Currently, there are no programs targeting solar on industrial roof space. Council can offer council owned rood spaces for Community Solar projects.
ENERGY EFFICIENCY	Residential	Houses	0.5	0.5	0.5	1.5	Many existing energy efficiency programs are, or have been implemented, with minimal levels of engagement. The business case for efficiency already exists.
ENERGY EFFICIENCY	Residential	MUDS	0.5	1.5	0.5	2.5	Council can play a role in addressing split incentives in Multi-Unit Dwellings and facilitate financing mechanisms for communal area upgrades. The business case for efficiency already exists.
SOLAR PV	Non-Residential	Commercial/ Retail	1.5	1.5	0.5	3.5	Split incentives currently exist between commercial/retail tenants and owners. Council can facilitate arrangements with business tenants and owners to address this.
TRANSPORT MODE SHIFT	All	All	1	1.5	0.5	3	While Local Government assists in promoting active transport through bike planning and DCP controls, the State Government is the key driver in delivering and improving public transportation in the region.
ENERGY EFFICIENCY	Non-Residential	Industrial/ Special Uses	0.5	0	0	0.5	Many existing energy efficiency programs with minimal levels of engagement. The business case for efficiency already exists.
SOLAR PV	Residential	MUDS	1.5	2	0.5	4	Split incentives currently exist between tenants and owners. Council can implement arrangements with tenants and owners to address this. Limited control over implementation. The business case for solar PV is highly impacted by rebates and feed-in tariffs outside of Council control.
ELECTRIC VEHICLES	All	All	1	1	0.5	2.5	Regional support required for Electric vehicles uptake. Currently, EV's are too expensive however council can address this should they be appropriately incentivised. Ultimately council has little control over take-up.
SOLAR PV	Non-Residential	Schools/ Childcare	2	2	1	5	Few existing program targeting Schools and Community Groups. Council can to facilitate community investment in solar. Limited control over implementation. The business case for solar PV is highly impacted by rebates and feed-in tariffs outside of Council control.
COGENERATION + TRIGENERATION	Residential	MUDS	1	1	0.5	2.5	Council can provide mechanisms to overcome capital cost constraints. Little control over implementation.
SOLAR PV	Non-Residential	Council	2	1	2	5	Council can provide examples with their own assets. Full control over implementation. The business case for solar PV is highly impacted by rebates and feed-in tariffs outside of Council control.
WIND	All	All	2	2	1	5	Would be innovative with high degree of control, however limited viability.

HOW 'COUNCIL'S INFLUENCE' IS SCORED':

THE OPPORTUNITIES AGAINST THE KEY 'AREAS OF INFLUENCE' ACCORDING TO THE BELOW RATING SCALE.

0 = LOW LEVEL OF IMPACT/INFLUENCE

1 = MEDIUM LEVEL OF IMPACT/INFLUENCE

2 = HIGH LEVEL OF INFLUENCE

Table 4: Total Council influence scored against 'key areas of influence'

DEFINING PRIORITY AREAS FOR A REGIONAL APPROACH

Figure 21 combines the analysis done in the previous sections into a single chart.

The location of the bubble reflects the benefit/cost and influence of each opportunity, while the size of the bubble reflects the emissions reduction potential.

This comparison shows the priority projects that Council has a high influence over, have a high benefit cost ratio and possess the greatest emissions reduction potential.

The top right quadrant contains those 'high priority' opportunities. These include projects where Council can facilitate solar PV on commercial, industrial and community owned assets. Energy from waste as well as co/tri-generation also represent key opportunities where regional Local Government co-ordination would be most effective and/or appropriate.

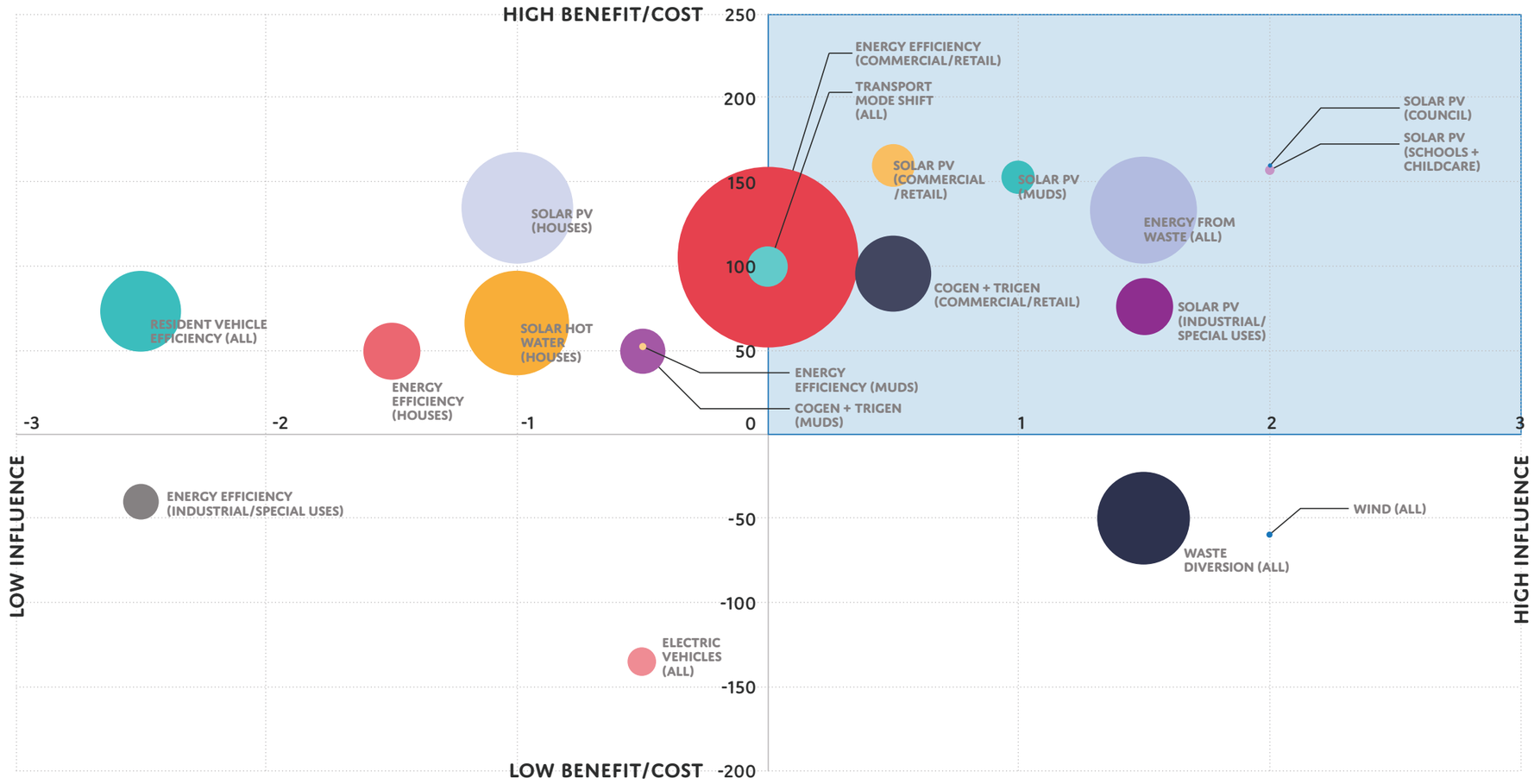


Figure 21: Bubble chart contrasting council influence, cost/benefit and emissions reduction potential

MAKING IT HAPPEN

The detailed, data-led methodology used in this study has been specifically adopted to facilitate the identification of practical actions that the 3-Councils could implement in the short to medium term.

By considering the analysis undertaken in the previous sections, this Plan has identified 6 key strategies that should be considered at a regional level.

Key Regional Strategies :

1. **Initiate community renewable energy**
2. **Establish regional performance standards for new developments**
3. **Encourage the adoption of electric vehicles**
4. **Establish a targeted approach to address apartments**
5. **Transition to 'low carbon precincts'**
6. **Implement innovative waste strategies**

The total emissions reduction potential of each of these strategies in the short and long term is highlighted in Table 5.

Through the collective sum of these strategies alone, the 3-Councils could affect a **30%** reduction in regional emissions across the region within 15 years.

REGIONAL STRATEGY	SHORT TERM IMPACT (5-10 YRS)	LONG TERM IMPACT (10-15 YRS)	ASSUMPTIONS
COMMUNITY RENEWABLE ENERGY	1%	5%	Short term: Community renewables on Council and Schools/Childcare (3 MW of solar PV) Long term: Additional community solar on Industrial, commercial/retail. (70 MW of solar PV)
REGIONAL PERFORMANCE STANDARDS	2%	8%	Building standards exceed compliance through higher BASIX targets, and higher non- residential performance. Equivalent to 40% of all buildings by 2031.
ELECTRIC VEHICLES	0.5%	1%	Assumes a 20% take-up of electric vehicles by 2031
LOW CARBON PRECINCTS	2%	5%	Key Precincts make up 20% of regional commercial/retail floorspace. Short term: 50% of buildings in Low Carbon Precincts receive energy efficiency upgrades. Long term: All buildings in low carbon precincts incorporate energy efficiency upgrades and are connected to co-generation, tri-generation (or equivalent low carbon energy systems).
TARGETED APPROACH TO APARTMENTS	1%	3%	Short Term: 25% of existing apartment buildings have undertaken energy upgrades and installed solar PV. Long Term: 50% of existing apartment buildings have undertaken energy upgrades and installed solar PV.
WASTE STRATEGIES	2%	8%	Short term: Achieve 75% residential waste separation. Long term: Achieve 75% residential and non-residential waste separation which is then processed by energy from waste technology (Gasification)
TOTAL	8.5%	30%	TOTAL PERCENT REDUCTION AS A PERCENT OF 2031 BAU GREENHOUSE GAS EMISSIONS.

Table 5: Total emissions reduction potential of regional council led strategies

1. INITIATE COMMUNITY RENEWABLE ENERGY

WHY?

Renewable energy is a cost-effective emissions reduction strategy with significant technical potential on all building types across the region. If this potential was realised, a 5% emissions reduction could be achieved. To date, land use and demographics have resulted in split incentives which have limited the uptake of solar PV across the region. 55% of dwellings are apartments, and an additional 10% of attached and detached dwellings are rented, resulting in **2 out of 3** households having little access to roof space for installing their own solar PV.

HOW IT WORKS

Community renewable energy offers introduce alternative delivery models which address some of the barriers to the uptake of solar PV. Currently, solar PV is typically purchased outright and installed by a building owner, acting as both the investor and host of the solar panels. This model is mostly attractive to long-term owner-occupiers who will benefit from savings resulting from offset and exported electricity, which will allow them to recoup the capital cost of the system over time.

A community solar delivery model separates the role of the host and investor, enabling broader participation and avoidance of upfront capital cost. Figure 22 outlines how a community-based delivery model works.

Because of the separation between host and investor, some facilitation is required including:

- **Identifying and assisting hosts:** Finding sites with suitable roof space and energy consumption patterns may involve a range of activities including marketing, communications, feasibility studies, and procurement.
- **Sourcing investors:** Marketing and communications is also required to attract investors. Investors may be linked to the host assets, such as tenants or local communities e.g. school children and their families, or they may be purely motivated to obtain an environmentally responsible financial return.
- **Financial transactions:** Facilitation is required in order to manage the financial transactions between each party to provide the upfront capital and facilitate the investor dividends and capital repayments over the life of the asset. Financial facilitation can be in the form of:
  - Rate Based Finance - hosts repay loans through their regular quarterly council rates, thus taking advantage of existing payment frameworks.
  - Direct Loan - details of transactions are agreed between the host and investor on a case by case basis
  - Power Purchase Agreement (PPA) - the host agrees to buy all generated power from the system owner at an agreed tariff, thus securing a revenue stream for investors.

ROLE OF COUNCIL

There are a number of potential roles of the 3-Councils to facilitate community renewables including:

- **Establishing Rate Based Finance capabilities:** which allows debt to be tied to the property, not the owner, provides financial security for investors and simplifies financial transactions between hosts and investors.
- **Identifying appropriate assets:** including Council's own assets, or facilitating discussions with the wider community about putting solar PV on community assets or public facilities.
- **Marketing and communications:** to raise awareness for community renewables within the LGA, and identifying and connecting hosts and investors.

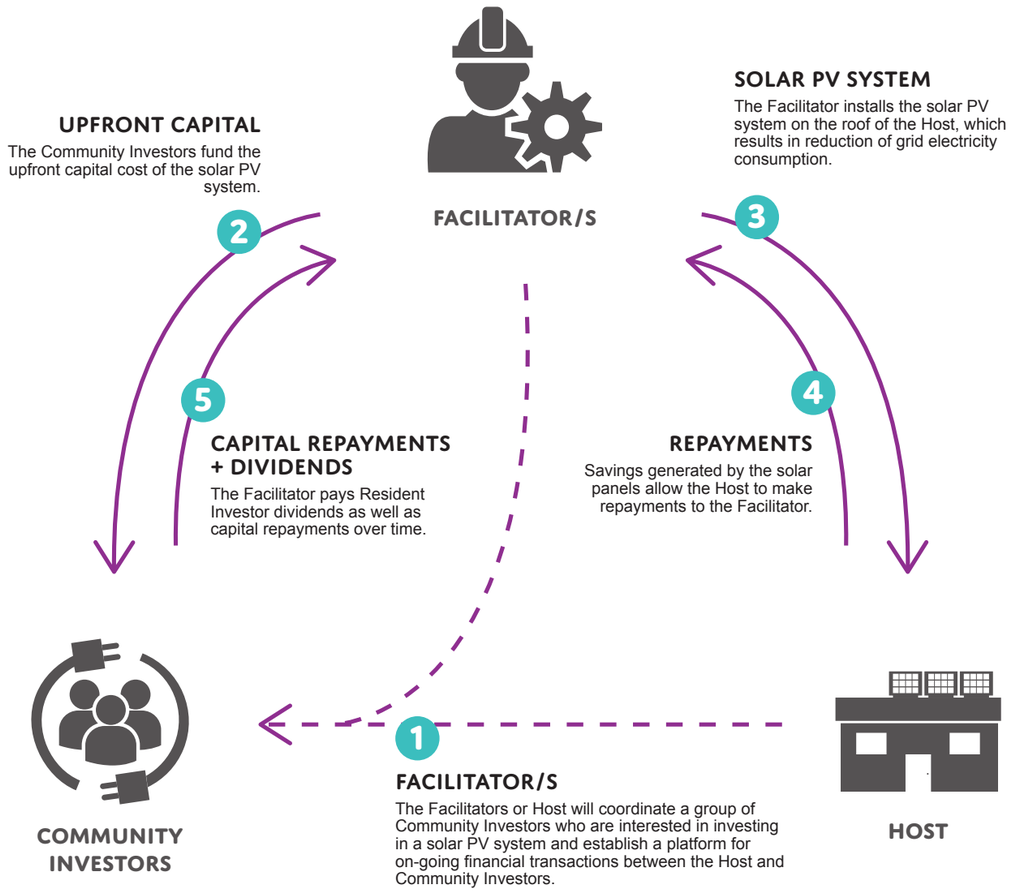


Figure 22: Community Solar Delivery Model

WHAT A REGIONAL COMMUNITY SOLAR MODEL WOULD LOOK LIKE

A coordinated approach to community renewables across the entire 3-Council region would achieve greater outcomes because of greater economies of scale. This scale provides a number of opportunities:

- **Larger pool of potential host sites:** Finding suitable host sites can be a difficult and time consuming process as there are many operational, legal and technical barriers to overcome.
- **Bulk feasibility and procurement:** While suitable community solar assets still need to be identified and established individually, they may benefit from regional facilitation providing assistance with feasibility studies, legal advice. Procurement could also be negotiated at a regional scale which would be likely to reduce capital costs on a per site basis.
- **Single community investor group:** Multiple sites can be aggregated and funded by a single community investor group. This reduces the overhead of establishing an investor group per site.
- **Increased visibility:** Marketing and communications can occur across the region which will increase the visibility of the community solar concept.
- **Virtual Net Metering:** VNM allows for electricity generated at one site to be distributed to other sites. This would increase the number of sites eligible to host a community solar PV array as they are no longer restricted by the level of on-site consumption. At present VNMs agreements must be negotiated individually with energy networks and retailers and hence are not widely established in Australia. A regional approach to campaigning for and trialling VNM sites, using the resources and influence from the 3-Councils could help to bring VNM into the mainstream and provide overcome a major barrier for community renewables.

While there are now several examples of community renewables in action, the concept is still in its infancy. Ultimately, establishing several successful community renewable models across the region will demonstrate their effectiveness and provide a catalyst for future projects.

RECOMMENDED ACTIONS

- **Further explore funding models:** The 3-Councils could explore the various funding models available to facilitate community solar including applying for the ability to provide Rate Based Finance
- **Virtual Net Metering:** The 3-Councils should campaign for Virtual Net Metering.
- **Conduct a pre-feasibility assessment:** The 3-Councils could undertake pre-feasibility assessment of potential solar sites and users with high demands across the Eastern Suburbs to assess their suitability for solar PV. Sites would include Council owned assets, schools, childcares, surf and bowling clubs, State-owned assets, commercial areas, industrial areas, etc. Council would facilitate the implementation using a Regional Renewable Energy Partnership model.
- **Establish the Eastern Suburbs Community Solar Partnership:** The 3-Councils could conduct a tender process to seek a partner or partners from the market for the various roles including:
  - **Technical assessment**
  - **Implementation/Installation**
  - **Education and promotion**
  - **Project Management**
  - **Funding**

  Potential Partners would include Community Energy groups, solar developers, solar installers and utilities. Existing community groups and providers should be engaged through this process. Note: it is anticipated that Council would have primary and secondary responsibility for some of these roles above.
- **Explore grant funding:** The 3-Councils could apply for grant funding and support from government agencies e.g. ARENA or OEH for community solar PV projects.

CASE STUDY – SYDNEY RENEWABLE POWER COMPANY

Sydney Renewable Power Company (SRPC) is one of the most recent and largest community renewable investment opportunities to hit the market. SRPC will be installing 520kW on the International Convention Centre Sydney, and is now seeking community investors to share in an estimated 4-5% fully franked return. Financial returns are funded through a fixed price contract whereby all output of the solar panels is paid for, as well as the entitlement to receive and sell Large-scale Generation Certificates (somewhat under threat by changes to the RET).

While SRPC currently has only one installation in progress, other projects which have similar timing could also be incorporated. This would effectively create a fund of solar projects where the returns are based on the combined revenues and savings of each of the projects. By aggregating projects, efficiencies are gained as only a single investor group is required, reducing management and marketing overhead. In addition, risks are reduced through diversification across the projects.

[6] The City of Sydney is currently perusing a change of rule motion to the Australian Energy Market Commission allow for better conditions for virtual net metering to occur.

2. REGIONAL PERFORMANCE STANDARDS FOR NEW DEVELOPMENTS

WHY

By 2031, the Eastern Suburbs is expected to grow by 26,850 new dwellings and 836,000 m2 of non-residential floorspace. Assuming a 1 to 2% turnover rate of existing buildings, this means that by 2031, over 30% of the current dwellings and nearly 40% of current non-residential floorspace could potentially be influenced or affected by planning controls that are implemented today.

Compared to the difficulty in existing buildings, focusing on new buildings where Council has a relatively large degree of control in incentivising or mandating higher performance outcomes, is more effective than trying to influence or retrofit existing buildings with clean energy technologies.

HOW IT WORKS

Raising the standard of environmental performance in new buildings above those mandated by BASIX and Section J of the Building Code of Australia (BCA) is often cost-effective as the initial investment is paid back over the whole life of the asset. Recent studies have highlighted the case for further increasing the environmental performance of new buildings

1. **Current average consumption is approaching BASIX targets.** Residential electricity and gas consumption has, on average, reduced in recent years due to price signals, appliance and lighting efficiency and solar PV. Existing dwelling energy consumption has reduced to the point that, on average, it achieves an equivalent BASIX Energy 25. Therefore, a new mid-rise apartment block that is built to its BASIX Energy target of 25, does not perform better than the existing housing stock. This shows that the market has shifted and BASIX no longer drives best practice performance outcomes.
2. **Recent developments are achieving beyond BASIX compliance.** Since the introduction of BASIX, the Eastern Suburbs region and Sydney as a whole has seen an increasing trend in over-compliance, i.e. new developments are achieving higher BASIX targets. In 2013/14, approximately 25% of new dwellings over-complied with BASIX Energy targets by 6 or more points and 17% over-complied by 8 or more points (see Figure 23). This trend is consistent across Sydney as a whole, reflecting the building industry's capacity and willingness to deliver high performance building outcomes.
3. **There is a lack of consistent performance criteria relevant to mixed use / non-residential developments.** The National Construction Code (NCC) establishes minimum energy performance requirements for new buildings and major refurbishments, including performance of the building fabric, glazing and shading, sealing, HVAC and lighting. However, there is no consistent approach or methodology to delivering higher performing buildings. Currently, Waverley Council require Green Star ratings for buildings where the cost of works is greater than $3 million and an energy report to show that the building is designed to deliver 30% less energy than the NCC minimum energy performance requirements. Randwick also applies site specific development controls plans, Green Star requirements, s94 Developer Contributions and Design Excellence to drive higher performance outcomes. Woollahra Council is modifying its current planning framework to provide suitable mechanisms to negotiate the delivery of public benefits (including sustainability outcomes) for key precincts.
4. **Local Councils are driving higher performance standards.** Some Councils have established planning controls that provide incentives for developments that exceed BASIX compliance. Bankstown Council's LEP 2015, Clause 4.4A provides for a FSR Bonus of 0.5:1 in the Bankstown CBD where developers can demonstrate that commercial buildings achieve 5-star NABERS Energy rating and 4.5-star NABERS Water rating and residential buildings achieve 10-point increase for BASIX Energy and BASIX Water 60.

BASIX COMPLIANCE OUTCOMES FOR THE 3 COUNCIL REGION

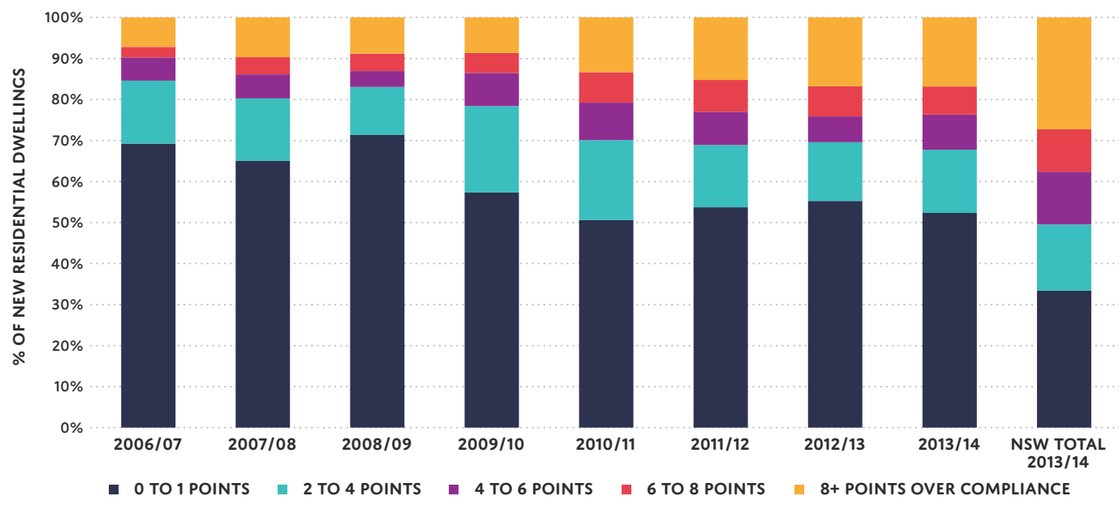


Figure 23: Percent of dwellings achieving various BASIX Energy compliance results (Source: NSW Department of Planning, 2014)

[9] Based on: Household Travel Survey data from BTS; fuel efficiency of 11L/100km; $1.50/L fuel price, and 25c/kWh electricity tariff.

CASE STUDY - LINKING ENVIRONMENTAL PERFORMANCE TO DEVELOPMENT INCENTIVES

In a first of its kind policy, clause 4.4A of Bankstown Local Environmental Plan (LEP) 2015 provides for Floorspace Ratio (FSR) Bonus of 0.5 on the FSRs allowed under the Local Area Plan for the Bankstown CBD on the condition that they achieve the following environmental design standards:

Residential component of a building:

- Energy target is a minimum 10-point increase in the BASIX score compared to current requirements.
- Water target is a minimum BASIX 60.

Non-Residential component of a building:

- Energy target is a maximum 135 kg of CO2/m2 per year.
- Water target is a maximum 0.47 kL/m2 per year for office.

As the FSR Bonus will increase the size of new buildings this will lead to increased environmental impact, in terms of increased greenhouse gas emissions from energy consumption and increased water consumption. The environmental performance standards established by Council seek to offset the impact of the increased floorspace so that buildings which receive the FSR Bonus have the same environmental performance as buildings which do not.

To date, all DAs submitted in the Bankstown CBD have requested the floorspace bonus. To date, several DAs have been approved to achieve the high performance standards outlined above.

ROLE OF COUNCIL

In NSW, local government is prevented from mandating residential building performance beyond the level specified under BASIX. The opportunity to set a higher BASIX target lies with the NSW Government. Existing BASIX targets are out of date and no longer driving best practice sustainability performance. Data and trends outlined above have shown that the current BASIX targets need to be updated and strengthened to reflect technological advances.

While BASIX is a state wide regulation, it allows for provisions which “encourages, or offers incentives for, the adoption of measures beyond those required...” . It is possible for the consent authority (Council) and the development proponent to make a voluntary planning agreement (VPA) with higher criteria, but this must be done on a case by case basis.

BASIX was always envisaged to be spatially and typology relevant. This is evidenced by the existing variation in targets between climate zones (for water) and typologies (for energy). Establishing regional performance standards for new developments across Waverley, Woollahra and Randwick establishes not only higher performance, low carbon outcomes but certainty and consistency at a regional level. This can be delivered in three key ways:

1. Councils can incentivise developers to go beyond BASIX requirements and deliver higher performance commercial and retail development via voluntary planning agreements (VPAs) or floorspace bonuses (see Case Study).
2. To work with the Department of Planning to develop the case for and establish higher BASIX targets across NSW.
3. To work with the Department of Planning to establish regionally specific BASIX targets for the 3-Council region.

RECOMMENDED ACTIONS

The following next steps are recommended to establish regional performance standards for new developments:

- A business case for increased BASIX targets should be developed. This process should include:
  - An analysis of local and regional BASIX data and building performance.
  - Understanding the impact and cost of emerging technologies and other development controls, such as parking rates.
  - Draw comparisons between BASIX and the latest NCC Standards.
  - Collaborate with relevant agencies, including the City of Sydney through their Draft Residential Apartment Sustainability Plan to meter the actual performance of new developments.
- Collaborate with the Department of Planning to establish regionally specific targets for the 3 Council area or localised precincts.
- Advocate for more frequent reviews of BASIX targets and benchmarks (every 5 years) to ensure this policy continues to drive best practice sustainability outcomes.
- Promote higher building performance standards (such as BASIX, NABERS and Green Star) through, for example, Design Excellence provisions.
- Consider whether the Bankstown LEP Clause (or equivalent) is suitable for inclusion in the Standard Instrument template as a mandatory or voluntary provision.
- Explore the potential for incentives to offset the cost of designing and constructing a sustainable building and provide for meaningful environmental outcomes. VPAs are one such mechanism to secure planning benefits and/or development outcomes. These can be easily integrated into the planning framework (LEP, DCP and/or council’s VPA policy). However, further investigation is required to examine the potential implications of larger developments and the extent of private and public benefits.

[8] http://sydneyyoursay.com.au/residential-apartments-sustainability-plan-draft/faqs

3. DRIVE THE ADOPTION OF ELECTRIC VEHICLES

WHY?

While adoption of electric vehicles would only contribute a 1% reduction in overall emissions (assuming a 20% adoption rate), there are particular characteristics of this opportunity that suggest it could result in wider benefits that make it a comparatively 'easy win' for the 3-Councils. These benefits include comparatively low infrastructure costs, high visibility, PR benefits as well as a short implementation timeframe.

Widespread adoption of electric vehicles could act as a 'catalyst' in facilitating wider behaviour change. For the past 20 years electric vehicles have remained one of the key 'icons' of the low carbon movement. More than a means of lowering an individual's emissions, they have come to represent a 'badge of commitment' to the environmental cause. Communities that have shown an early adoption of electric vehicle technology, such as parts of Scandinavia and California, have tended to continue to explore other emissions reduction opportunities.

The day to day benefits of electric vehicles are clear. They represent an opportunity to deliver both emission savings to the region, and cost savings to residents. **The average household in the Eastern Suburbs region drives 29 km/day. A household that switches to an electric vehicle could save over $1,200 in fuel costs, and 800 kg in emissions per year[9].** Electricity demand from electric vehicle charging may also increase the viability of solar PV and cogeneration systems, providing further opportunity for emissions reductions and cost savings.

Despite significant fuel cost savings, the marginal abatement or social cost of electric vehicles is currently high compared to other emissions reduction strategies. This is due to a significantly higher capital cost relative to a combustion engine, reflecting the relative immaturity in the technology. Other factors differentiating car models also make it difficult to isolate the marginal capital cost of an electric engine alone. However, it is widely acknowledged that as battery technology advances and production increases, the cost of electric vehicles will continue to drop.

HOW IT WORKS

Electric vehicles require charging infrastructure in order to make them practical for day to day use. This includes fast charging stations in the public domain and convenient access to power outlets from residential parking spaces. Therefore, in order to encourage the uptake of electric vehicles across the region, there needs to be a regional network of charging stations to make them viable.

ROLE OF COUNCIL

Council has an important role to play in providing supporting infrastructure and incentives for this emerging technology in order to enable and encourage electric vehicle take-up across the region for both residents and businesses. In particular, a collective approach by the 3-Councils can ensure that infrastructure is appropriately coordinated and located across the region.

This involves an assessment of appropriate locations in residential, commercial and retail areas where electric vehicle parking and charging stations can be installed. Combined with similar programs by the City of Sydney and other inner city suburbs, such a strategy would complete a charging network that would allow electric vehicle owners to travel unimpeded around a large portion of metropolitan Sydney.

Similarly, the 3-Councils have the ability to more directly incentivise the uptake of electric vehicles through parking and registration concessions. For example, Randwick Council has installed parking spaces for electric hybrid vehicles at five Council car parking locations across in Randwick, Clovelly, Coogee and Maroubra. In addition to decreased emissions, this will enhance the resilience of the region in adapting to emerging technologies.

This strategy will also require coordination with the private sector electric car manufacturers, who are currently looking for locations to install charging stations. For example, Tesla is currently undertaking a process of establishing a network of 'supercharge' stations between Brisbane and Melbourne which will allow customers to charge their cars to a range of around 250 kilometres in 20 minutes at no cost.

RECOMMENDED ACTIONS

Increase the number of available electric vehicle parking and charging stations: Increase the number of dedicated electric vehicle parking stations in the private and public domain by exploring:

- DA conditions for new builds/developments
- DCP Controls regarding access to power
- Council owned car parks
- On-street charging facilities

Encourage the uptake of EVs through direct 'low cost' incentives such as:

- Removal of the application/admin fee for parking permits
- Free parking in all council owned car parks
- Free charging at all council owned charging stations.

[9] Based on: Household Travel Survey data from BTS; fuel efficiency of 11L/100km; $1.50/L fuel price, and 25c/kWh electricity tariff.

4. ESTABLISH A TARGETED APPROACH TO ADDRESS APARTMENTS

WHY?

Apartment emissions can be difficult to address due to the need to reach agreement between multiple owners, as well as split incentives for landlords and renters. This issue is particularly prevalent in the Eastern Suburbs region where over half of existing dwellings are apartments, and the proportion increasing with new dwelling growth. Furthermore, almost 2 in 3 of these apartments are rented. It is estimated that emissions reductions of over 3% can be achieved through clean energy projects in apartments across the region.

While performance standards exist for new apartment buildings, it is critical to ensure clean energy retrofits and upgrades are also implemented in existing apartments through specific targeted projects to address this sector.

HOW IT WORKS

A number of local and national schemes exist to promote emissions reductions in apartments, including:

- **Smart Green Apartments** - City of Sydney worked closely with 30 apartments to improve their emissions, water use and waste. Learnings and data from this work will be shared to enable other apartments to benefit from insight gained. Grants are also available for apartment buildings within the City of Sydney LGA.
- **Smart Blocks** - a national program helping with energy efficiency and renewables on common property in apartment buildings. Smart Blocks provides toolkits, online support and case studies to assist apartment owners and managers save money and energy.
- **Green Strata** - a Sydney-based non-profit incorporated association website helping owners and occupiers of apartments improve the sustainability of their common property via information on their website and workshop participation.

These schemes provide valuable resources and demonstrate both the environmental and financial benefits of improving the performance of apartment common areas. However, the remaining challenge is to get engagement from time-poor apartment owners and strata committees to access the available information and to empower than to make the decision to implement sustainability projects.

To further catalyse this, the 3-Councils could establish a rates-based finance facility, such as an EUA, for residential clean energy measures. Upfront funding would be provided to the building owner, to be repaid over time though an additional charge on the property (e.g. Council rates). EUA facility and service provider to enable the funding and implementation of a mass-retrofit of apartments across the region. This allows capital repayments and savings to be more aligned, hence apartment owners need less long term commitment in order to recoup the financial benefits of sustainability projects. Currently, EUAs are limited to larger apartment blocks (20 units or more).

ROLE OF COUNCIL

Council has the ability to work collaboratively with strata managers, building owners, executive committees, and installers to identify apartment buildings in greatest need of clean energy upgrades and retrofits. A taskforce could be established which actively approaches strata committees to communicate the benefits of environmental upgrades, assist with feasibility studies and initiate projects.

RECOMMENDED ACTIONS

- **Sign up to existing strata engagement programs:** Become signatories to existing strata engagement programs such as Smart Blocks and Smart Green Apartments Program.
- **Work with the NSW Government to investigate options to leverage rates-based finance and other innovative finance solutions** for small to medium sized multi-unit developments (2-3 storey MUDs), and smaller scale retrofits (< $1 million).
- **Identify apartments with the greatest potential:** Criteria for identifying apartments include those with large common area demands, such as:
  - Significant underground parking
  - Significant common areas and facilities, including HVAC, central hot water and gyms
  - Buildings with swimming pools

  This process should involve understanding the potential technology and investment potential for the identified pool of apartment buildings, their location and typology.
- Partner with energy efficiency and solar providers to install key upgrades to identified apartment buildings. This could involve going to tender to find a service provider to fund and install key upgrades to identified apartment buildings. This is supported by the establishment of Rate Based Finance for apartments and identifying the location and potential investment, return and emission reductions across the region.
- Work with individual apartment blocks, Strata Managers and Strata Community Australia to identify and encourage building tune ups and retrofits.
- **Development incentives for new MUDS:** Addressed under *Regional Performance Standards for New Developments.*

5. TRANSITION TO LOW CARBON PRECINCTS

WHY?

While non-residential buildings are only responsible for 31% of total emissions, they are made up of considerably less buildings (1200 total non-residential buildings, as opposed to over 10,000 residential buildings), making this sector much easier to identify and target.

The implementation of clean energy strategies in commercial and retail buildings represents over 10% of the total emission reduction potential. Much of this commercial and retail activity is concentrated in major centres across the region, including the suburbs of Bondi Junction, Bondi Beach, Double Bay, Randwick and Maroubra.

The concentration of these buildings, coupled with new development in these centres, provides a unique opportunity to focus Council's efforts to achieve significant emission reductions both through building level strategies and precinct level infrastructure solutions. For example, the implementation of trigeneration at Bondi Junction Westfield alone has the potential to reduce Waverley's total regional emissions by over 10%.

With this in mind, this Plan identifies three key precincts to target, which represent approximately 20% to 30% of commercial and retail floorspace across the region:

- Bondi Beach
- Maroubra Junction
- Double Bay

In addition to these precincts, Waverley Council is currently developing a Green Infrastructure Master Plan for Bondi Junction (see Case Study right).

WHAT IS IT

This strategy seeks to integrate energy efficiency, low carbon solutions (such as trigeneration) and renewable energy technology to deliver low carbon, resilient and more affordable outcomes for both business and the community.

This involves identifying trial sites for low carbon energy and integrated waste and recycling systems, which may include major existing developments, Council owned assets or major new developments. These trial sites build the case for innovative technologies and can catalyse broader precinct level solutions.

As with Strategy 4, engagement with building owners in key precincts can be coupled with an EUA facility and service provider to enable the funding and implementation of a mass-retrofit of buildings in the precinct.

While much attention has been given to the potential for district or precinct scale trigeneration systems, this Plan does not rely on district level systems to achieve the emission reductions outlined above. Building level cogeneration, trigeneration or mini-CHP for apartment hot water have the potential to provide effective low carbon solutions to deliver equivalent emissions reductions and financial returns.

LINKS TO RECYCLED WATER SOLUTIONS

In addition, emission reductions should not be considered in isolation from district level solutions for water. The establishing of recycled water networks could provide the initial catalyst for low carbon energy hubs in high density precincts. This will be further explored through the Eastern Suburbs Water Plan (to be developed).

CASE STUDY – BONDI JUNCTION'S BUILDING FUTURES PARTNERSHIP

In 2009, Waverley's Community Greenhouse Gas Emission Reduction Analysis undertaken by Kinesis first identified Bondi Junction as a key focus of emissions and emission reduction potential for Waverley Council and estimated that if trigeneration was implemented at Westfield alone (131,000m2) it would reduce Waverley's community greenhouse gas emissions by approximately 78,000 tonnes or 13% of the LGA's total emissions.

In 2011, a further study by Kinesis explored the costs, benefits and emission reduction savings from a suite of strategies in Bondi Junction and Westfield including building energy efficiency upgrades, trigeneration and solar PV.

Since that time, Council has worked closely with Westfield as a key stakeholder in the delivery of low carbon energy solutions in Bondi Junction. Most recently, Waverley Council was selected to participate in 'Delivering a Future Sustainable City' hosted by the United States Studies Centre at University of Sydney. In collaboration with Westfield, Waverley Council further developed strategies and solutions for a more sustainable, low carbon Bondi Junction.

The outcomes of this work led Waverley Council to establish the Council-initiated Building Futures Partnership to improve the energy, water and waste efficiency of existing and new buildings in Bondi Junction. The aim of this program is to:

- Improve building efficiency and value through energy, water and waste improvements.
- Establish Bondi Junction as an urban centre of environmental innovation.
- Direct the development of 4 studies (energy, water, waste and building capability).
- Develop business cases for energy, water and waste initiatives at key buildings.
- Provide support to initiate and manage change to buildings, their owners, tenants and users.

This program will work in partnership with Better Buildings Bondi Junction to identify and deliver project components via 4 important studies - on energy, water, waste and building capability and facilitated by 2 key stakeholder groups:

- The Building Futures Partnership - Comprising property owners and managers who are identifying energy, water and waste issues affecting their building users.
- The Building Futures Technical Working Group - A group of independent, industry and government experts which is directing the research into solutions.

ROLE OF COUNCIL

Council is in the unique position to establish the vision for innovative precincts and bring key stakeholders together to collaborate in the delivery and implementation of low carbon solutions both at the building and precinct level.

This can be approached in three key ways:

- **Policy and development controls (top-down solutions):** planning controls and incentives, including voluntary planning agreements can be established for the low carbon precincts to drive innovation in new development. See Case Study outlined in Strategy 2.
- **Business and stakeholder engagement (bottom-up solutions):** working with building owners to address the challenges of building retrofits, including split incentives and disruptions to building operations.
- **Lead the process:** Council can lead on the delivery and implementation of precinct level solutions for the low carbon precincts by facilitating a service provider to deliver energy, water and waste solutions for the precinct (see Case Study right). This process could be facilitated through a building by building retrofit program (as outlined in Strategy 4) and/or through a broader precinct level infrastructure strategy which would include:
  1. Understand and analyse existing and future floorspace and associated energy demands for the precinct.
  2. Establish performance targets for each precinct, including resource consumption, carbon reductions and financial or affordability outcomes.
  3. Seek expressions of interest from third party providers to deliver the solutions identified by Council. This could be initiated with key catalyst sites for low carbon energy and integrated waste and recycling systems, including major existing developments, Council owned assets or major new developments.
  4. Determine Council's role in the delivery of the solution, including engagement with stakeholders, funding or development controls/ incentives required to enable the transition to a low carbon precinct.

CASE STUDY – PARRAMATTA NORTH URBAN TRANSFORMATION

Parramatta North Urban Transformation project is a 31 ha UrbanGrowth NSW project delivering approximately 4,100 new homes 2 km north of Parramatta.

Through the development of the master plan for this project area, UrbanGrowth NSW identified an ambition to deliver sustainable infrastructure in order to achieve:

1. Improve cap ex and op ex for development and building services associated with the development.
2. Reduce infrastructure supply requirements (electricity, water, sewer and car related infrastructure).
3. Improved environmental performance.
4. Increase household affordability.
5. Support high quality and resilient public domain.

To achieve this, initial analysis was undertaken be to forecast consumption profiles and identify the performance opportunities for a suite of innovative solutions.

In April this year, UrbanGrowth NSW went to the market to find a private sector partner to deliver sustainable water and energy infrastructure to the site. Submissions are currently being reviewed.

This project is considered a best practice example that balances the time and efforts required to undertake initial studies before going to the market to find private a sector partner and funding. This process was undertaken within a 9 month period.

RECOMMENDED ACTIONS

- **Launch the Low Carbon Precincts** to other town centres such as Edgecliff, Double Bay, Maroubra Junction, Randwick Junction or Bondi Beach, based on the expansion of the Bondi Junction Building Futures Partnership model.
- **Establish partnerships** with major landowners, government agencies, local community and other strategic partners in each precinct to investigate opportunities for efficient buildings, low carbon energy, recycled water and integrated waste and recycled systems.
- **Establish EUA Facility:** The 3 Councils can offer and promote EUAs as a mechanism to finance energy upgrades.
- **Sign up to existing business engagement programs:** Become signatories to existing business collaboration programs such as *CitySwitch* and *Smart Green Business*.
  - *CitySwitch* is a program run by City of Sydney that supports commercial office tenants to improve office energy and waste efficiency through the provision of a range of services, with the ultimate aim of achieving a 4 star or higher NABERS Energy rating.
  - The *Smart Green Business* Program is an education and engagement program designed to help small and medium enterprises save money and improve their environmental performance.
  - Better Business Partnership provides businesses with a program and process to reduce energy and water consumption and bills, including an energy and water assessment, action plan and assistance in implementation.
- **Test the Market:** once initial analysis have been undertaken, Council should test the market early to find private sector partners and funding to deliver low carbon precinct solutions (see Case Study below)
- **Future Proof Buildings in Low Carbon Precincts:** Given the 30-100 year life of new buildings, consider requiring new buildings in low carbon precincts to be designed to accommodate future precinct energy, water and waste services (such as dual reticulation and appropriate services and plant space) for future connection.

6. IMPLEMENT INNOVATIVE WASTE STRATEGIES

WHY?

While emissions from waste currently represent only a small portion of the overall regional emissions at 7%, this is expected to grow to 9% of total emissions without further intervention. Furthermore, it is the only major emissions source where significant reductions are possible using a combination of existing waste recovery strategies (3.9% reduction in overall emissions) and introducing energy from waste technology (4.5% reduction in overall emissions).

Waste strategies also remain one of the key technologies where Council has direct control. While an increasing number of private organisations are now seeing the financial benefit of waste recovery, the management of residential waste is still a function of Council.

However, waste strategies require a large and consistent feedstock of waste as well as significant capital to financially justify investment into energy from waste technology. In order to achieve the level of emissions reductions outlined here will require a collaborative approach by all Councils in the region.

HOW IT WORKS

The greenhouse gas benefits of waste strategies can be broken down into avoided landfill greenhouse gas emissions, and the conversion of non-recyclable waste into renewable energy.

Waste Diversion:

Waste diversion is the process of separating out organic or recyclable waste out of the main waste stream and ultimately minimise the amount of waste going to landfill. This can be done through a combination of social programs which encourage residents to sort their waste prior to collection and waste separation facilities that sort waste after collection.

As outlined earlier in this report, should the 3-Councils achieve a 75% diversion rate (the current average for the SSROC group is 43% diversion rate as of 2011-12 levels[10]) and convert the remaining waste to energy, it would **reduce greenhouse gas emissions across the region by 165,000 tonnes.**

Energy From Waste:

Energy from Waste is the process of generating energy (electricity, heat or biogas) from waste. There are two main methods of extracting energy from waste:

- Biological treatment through anaerobic digestion
- Thermal treatment through gasification

Anaerobic digestion involves the decomposing of organic material to create biogas that can be converted into electricity or gas for the grid. Anaerobic digestion is for garden, household and commercial organic waste and even sewage sludge. This process results in a diversion from landfill of 40-70% of waste[11]. Anaerobic digestion is the most simple and cost effective form of energy from waste and could begin implementation in the near future.

Most major waste contractors in Australia are already undertaking some form of anaerobic digestion. SITA Australia currently has an anaerobic digestion established at the Kemps Creek facility and Veolia have a similar site at Woodlawn. The Malabar Wastewater Treatment Plant includes an anaerobic digestion facility operating on sewage sludge. The energy produced is used on-site by a 2,975 kW-effective cogeneration system, producing both heat and electricity.

Gasification is a more advanced energy from waste technology that involves gasifying waste at extremely high temperatures (upwards of 300 to 3,000 degrees Celsius). In recent years it has matured as a technology and has proven to be suitable for a wide variety of waste streams including municipal solid waste and some commercial waste streams. Combining waste separation and resource recovery with gasification it is possible to divert 90-100% of waste from landfill, recover valuable materials and produce energy. While energy from waste does present significant opportunities, there are also some inherent challenges.

Most waste providers will require an organic waste stream in order for anaerobic digestion to remain financially feasible. Ensuring a clean and consistent feedstock of organic waste can be a costly and time-consuming process for council due to issues relating to contamination, household participation and contractual arrangements with existing waste providers.

Due to the high capital costs of energy from waste projects, facility developers usually require quite a long-term commitment of feedstock supply (typically 20-25 years) in order to fund the capital expenditure.

Furthermore, establishing local waste to energy facilities can also require significant capital expenditure. Gasification plants can cost upwards of $100 million and therefore it is unreasonable to expect a single Council to fund the procurement of these facilities. Instead, a regional approach is required in order to ensure both the capital and the delivery of a constant organic feedstock.

Existing studies undertaken by Randwick City Council suggest that, taking into consideration existing recovery of recyclable materials, combining both available technologies could result in 90-100% of existing waste being diverted from landfill.

ROLE OF COUNCIL

Most Councils have been extremely proactive in establishing waste diversion programs, and many have already started pursuing energy from waste opportunities.

The major role of Council in relation to waste revolves around the procurement of waste services and the associated requirements for resource recovery and energy generation as part of the contract. Given the length of these contractual arrangements, these can only be re-addressed once every 5-10 years and hence regional alignment can take time.

At this time, Randwick Council is pursuing a different strategy to Waverley and Woollahra. Waverley and Woollahra have entered into a contract with Veolia for processing of their residual waste through a new MBT (Mechanical Biological Treatment) facility to be constructed at the Veolia Woodlawn site, commencing operations in 2016 (though subject to planning approvals and construction of the new facilities).

Randwick Council is not currently contracted to the Veolia MBT, but has instead established a separated food and organics collection and recycling program, which sends organic waste to Earth Power at Camilla. Randwick is currently investigating expanding their organic waste separation program and the feasibility of facilities to treat their residual waste.

It is expected that through the use of the Woodlawn MBT alone, Woollahra and Waverley can be expected to achieve a diversion rate of 67% by 2016. Each of the 3-Councils are currently signed up to the NSW Waste Avoidance and Resource Recovery Strategy, which has set a resource recovery target of 70% by 2021-22. The scenarios and strategies used to help achieve this under existing waste provider contracts have been outlined in the SSROC Regional Waste Avoidance and Resource Recovery Strategy. Given this short-term target, a long-term diversion rate of 75% by 2031 as assumed in this report is both realistic and achievable.

RECOMMENDED ACTIONS

In order to have the biggest impact over the long term, alignment between all three councils in the region through a collective regional contract will be required. However, in the absence of this in the short term, the following next steps should be investigated:

- **Work with Veolia to** advocate for improved waste diversion from the new MBT Facility at Woodlawn through the addition of additional energy from waste technologies including gasification.
- **Monitor the expansion of Randwick Councils** food waste collection program to all dwellings within the LGA to evaluate its applicability to other areas within the region.
- **Investigate the potential** to establish a commercial organics waste collection and recycling service across the region
- **Continue to work** as part of the SSROC regional waste program to undertake feasibility assessments on Energy from Waste.

[10] Hyder Consulting (2014) SSROC Regional Waste Avoidance and Resource Recovery Strategy

[11] City of Sydney Advanced Waste Treatment Master Plan

TIMELINE TO A LOW CARBON FUTURE

Figure 24 outlines an anticipated timeline for the delivery of the key regional strategies outlined above. While indicative in nature, this timeline has been informed by the predicted adoption and delivery of various strategies outlined in Table 3 of this report and provides a visual representation of the scale and effort required to achieve the outcomes laid out in this plan.

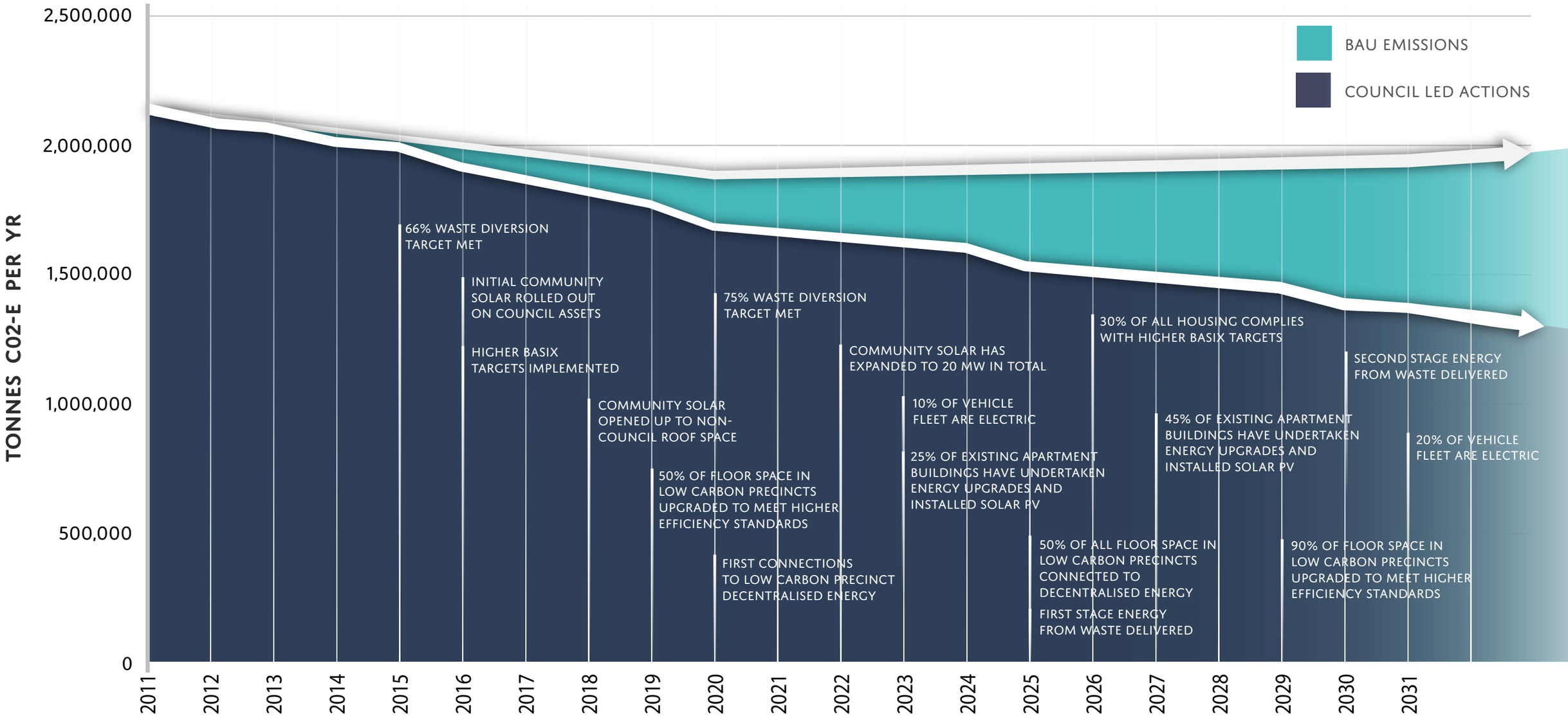


Figure 24: Indicative timeline for the implementation for low carbon strategies across the Eastern suburbs.

ESTABLISHING A REGIONAL EMISSION TARGET

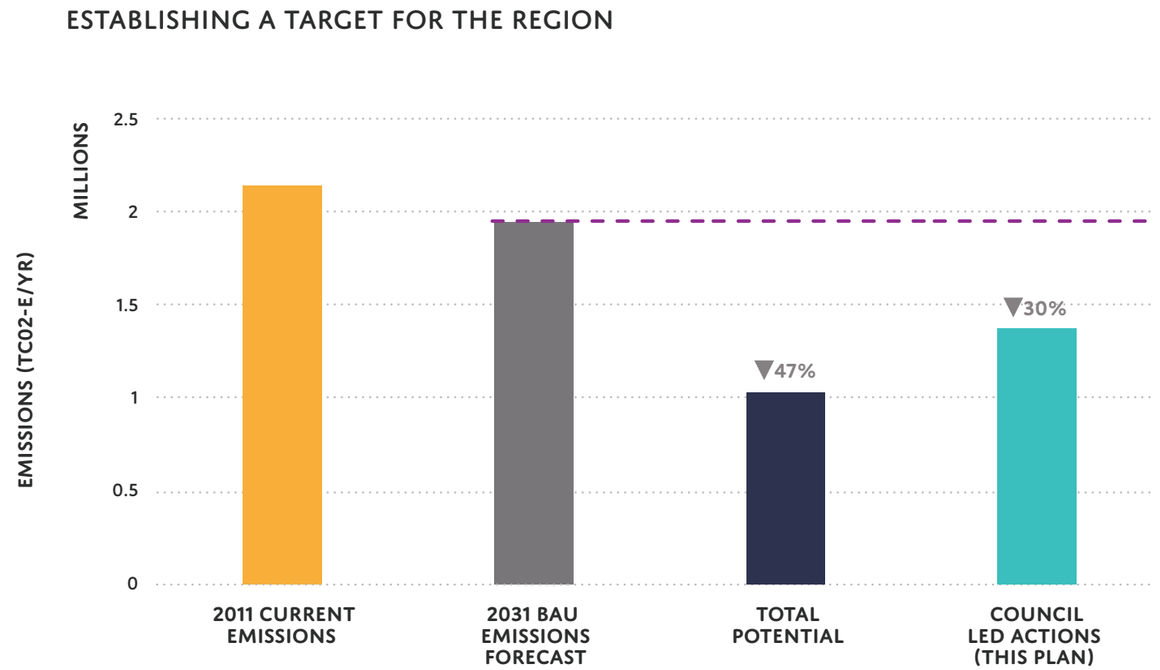


Figure 25: Defining an emissions target.

Establishing a clear and achievable regional emission target will play a vital role in cementing alignment between Council, business and the wider community and help drive momentum for the six regional strategies identified in the Plan. It is also central to:

- Creating great places for our residents and businesses to live and work
- Attracting innovative high-tech businesses and jobs to our town centres
- Helping build resilience in our community and change the way our residents think about, and use, energy

Equally, the establishment of a regional emission target will show leadership and demonstrate Council's commitment for change. Reaching this target will require significant collaboration between Council, residents and business and all levels of government.

Given the long term significance of these targets, it is important that they are informed and framed appropriately. There are a several key considerations that must be taken into account when framing effective, actionable and balanced targets:

- **It should align with the reporting milestones other strategic plans:** All three of the councils currently report against key strategic planning milestones to 2031.
- **It should be visionary and achievable:** Given the realities of implementation and adoption, it would be unrealistic to establish a target that is equivalent to, or above the full potential. It is equally fair to assume that council led actions will not be the only factors supporting the reduction in regional emissions (as outlined below). Therefore, a target that is both achievable and ambitious should lie somewhere in between the total available potential and the potential resulting from Council led action.
- **It should be transparent:** One of the main purposes of a target to be able to benchmark current performance with future performance. Therefore, in order to accurately track progress, future emissions calculations should adhere to consistent scope and assumptions. This report and the associated technical appendix outline the scope of the data and the assumptions used to inform this process.

Considering the above principles and informed by the analysis undertaken in this report, the recommended regional emissions target for the Eastern Suburbs is:

30% reduction in greenhouse gas emission by 2031 against business as usual levels.

LONG TERM TRENDS SUPPORTING THIS TARGET

While a target of 30% may appear ambitious, it is important to remember that the strategies adopted by the 3-Councils will not be the only contributing factors in helping to achieve it.

While Council will play a vital role in addressing existing barriers and demonstrating the business case for emissions reducing strategies in the short term, there are a also a range of external trends that are likely to further multiply the impact of these strategies in the long term. These trends include:

- **Renewable energy technology is getting cheaper, more efficient and more diverse:** The production cost of solar PV panels has dropped significantly in the last 5 years and is expected to drop by a further 40% by the end of 2017[13]. This will increase the financial return on investing solar and further enhance take-up across the region. Furthermore, emerging renewable technologies, such as wave technology and urban wind turbines are likely to become increasingly more feasible in our urban environments over the coming 5-10 years.
- **Increasing cost of electricity generated from fossil fuel:** Forecasts show that the cost of energy obtained from the fossil fuels are likely to gradually increase in the long term. There are various reasons for this including the implementation of price on carbon, increased per unit cost of sourcing remaining available fossil fuels and the requirement to replace aging coal fire power plants. This will further encourage the uptake of renewable energy throughout the community.
- **Battery Storage:** The increase in available and affordable battery technology will overcome many of the existing barriers to the uptake of solar PV in relation to the requirement for immediate use of the power generated in order to be financially feasible. This will open up the possibility of small to medium scale solar for buildings that may not be used on weekends or mostly used in the evening.
- **Federal Government Actions:** The Federal Government is in the process of determining their post 2020 emissions targets and the subsequent impacts on Federal Climate Policy including the Renewable Energy Target.
- **State Government Actions** – The State Government is currently exploring new mechanisms to facilitate building retrofits and upgrades such as EUAs as well as frameworks for electricity to be traded across property boundaries (Virtual Net Metering) to encourage the decentralised generation.
- **Telecommunications –** e.g. working from home, video conferencing

Figure 26: Tesla powerwall.

[13] https://www.db.com/cr/en/concrete-deutsche-bank-report-solar-grid-parity-in-a-low-oil-price-era.htm

MONITORING OUR SUCCESS

This report represents only the first step in a long journey to realising a low carbon Eastern Suburbs. While the strategies outlined in the document are a good starting point, this strategy should not be considered a static document but instead continually monitored and reviewed as we learn from the success and failures of various projects.

In order to do this, the 3-Councils will be utilising a strategic city performance monitoring tool (Figure 27) to optimise strategies and policies over time.

Through this process, the region will be able to better:

1. **Understand the effects urban development on citywide greenhouse gas emissions**
2. **Understand the effects of implemented greenhouse gas emission reduction actions**
3. **Communicate the success or failure of implemented actions to the community**
4. **Adapt and modify actions and policies to ensure continual reductions in citywide greenhouse gas emissions**
5. **Provide stakeholders with information that can inform their own strategies and policies.**

REGIONAL PERFORMANCE MONITORING THROUGH CCAP CITY

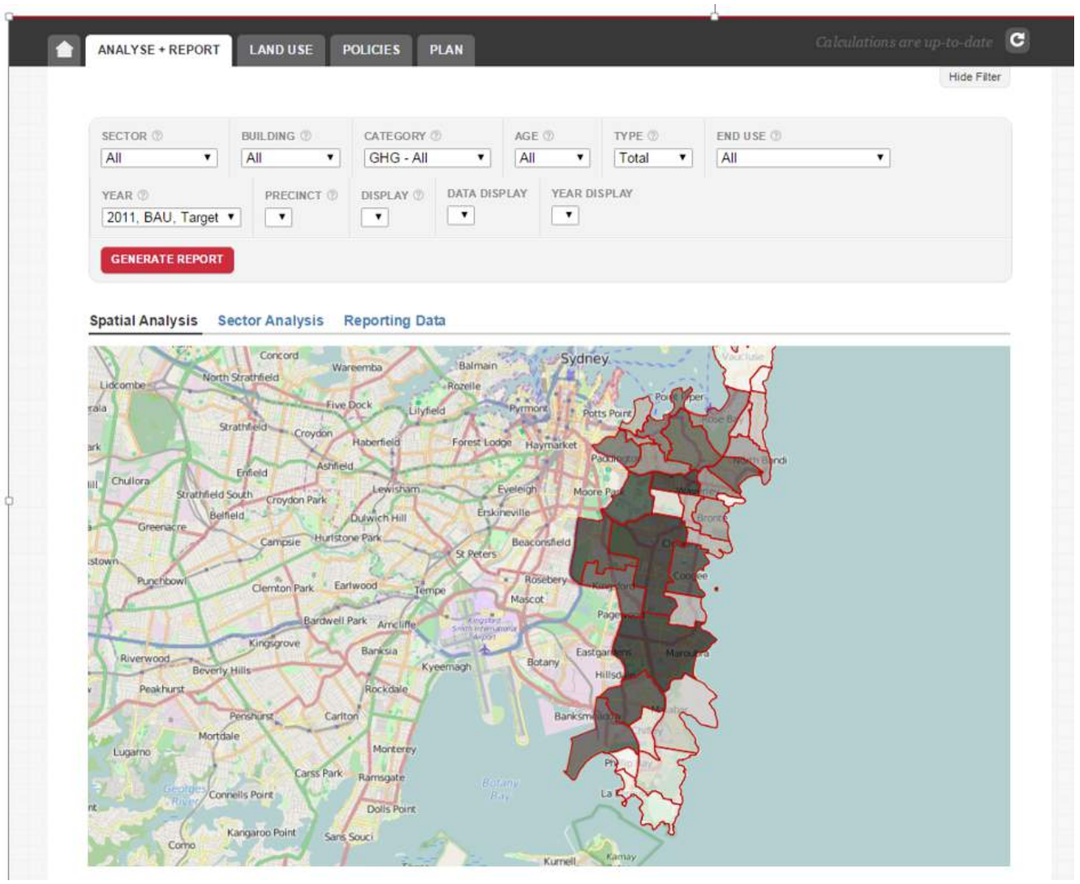


Figure 27: Tracking, analysing and responding to the regions emissions over time using CCAP City.

TECHNICAL APPENDIX
DATA AND METHODOLOGY

OVERVIEW

Analysis in this report is derived from datasets contained, used and analysed by Kinesis in CCAP City. These datasets are sourced from best available utility, government and Council datasets. An overview of CCAP City datasets and calculations are provided in the figure and discussed in detail below.

LAND USE DATA

2011 RESIDENTIAL DWELLINGS

The number of dwellings per suburb were determined by extracting the number of occupied private dwellings from Profile. Id (source:http://profile.id.com.au/waverley/dwellings?WebID=10) and categorising this data into dwelling types (detached, attached, multi-unit) using breakdown of dwelling structures provided by the ABS Quickstats (http://www.censusdata.abs.gov.au/census_services/getproduct/census/2011/quickstat/SSC12444?opendocument&navpos=220).

Where suburbs crossed LGA boundaries, the breakdown provided by Profile.Id was used in preference to that of the ABS as it was judged to be a more accurate reflection of the proportion of dwelling types in those suburbs (http://profile.id.com.au/waverley/dwellings?WebID=190).

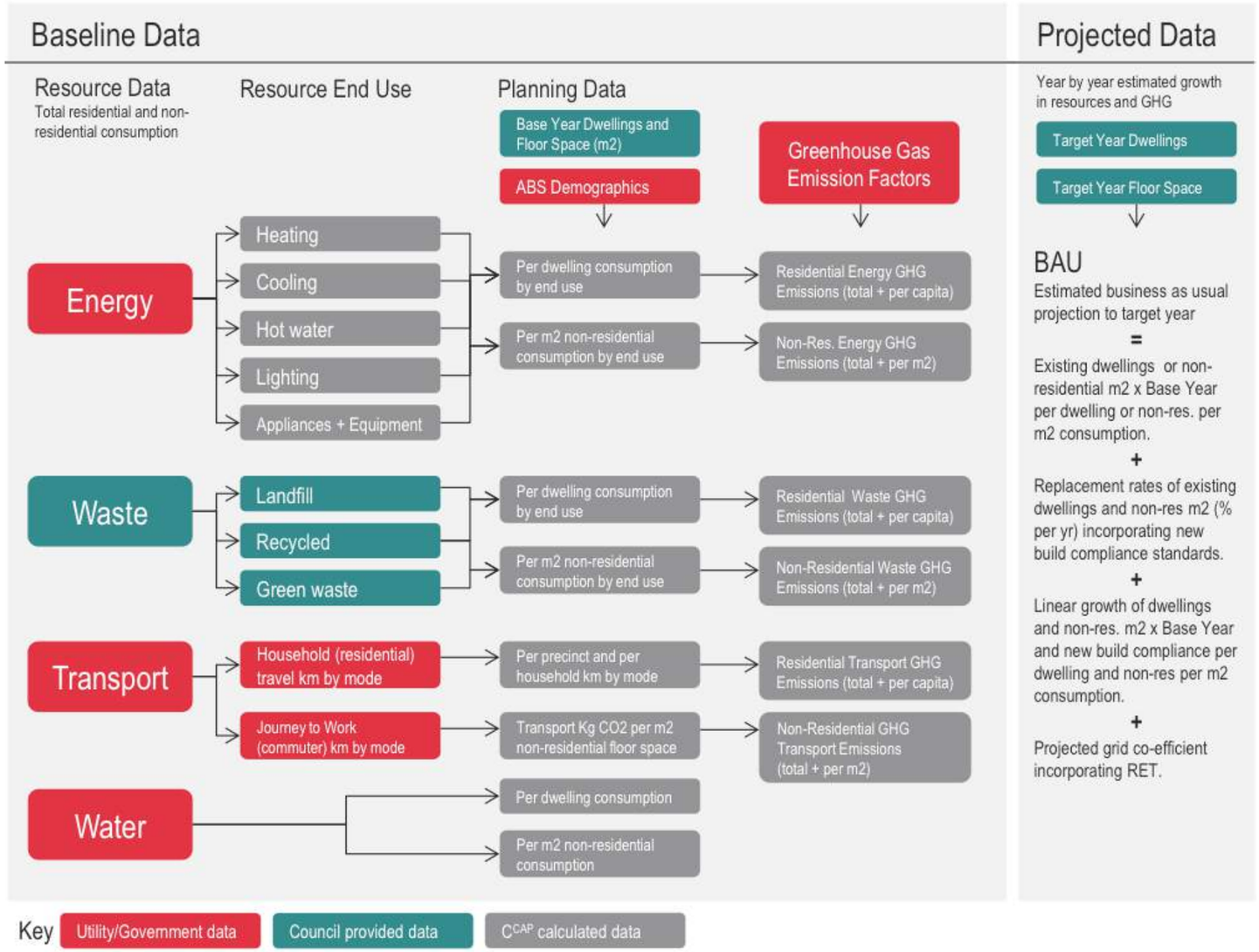
2031 RESIDENTIAL DWELLINGS

2031 dwelling forecasts for each suburb were determined using a combination of data from three sources:

- The net increase in dwelling numbers from 2011 to 2031 was derived from the NSW Department of Planning and Environment Population, Household and Dwelling Projections, 2014 (http://www.planning.nsw.gov.au/en-au/deliveringhomes/populationandhouseholdprojections/data.aspx).
- Dwelling types were derived from historic data on net additional dwellings from 2000/01 to 2009/10 published by the NSW Department of Planning (http://www.planning.nsw.gov.au/Portals/0/HousingDelivery/5_2010-2011_East_Subregion.pdf).
- Locations were derived from historic data on dwelling completions by suburb from 2003/04 to 2012/13 published by the NSW Department of Planning (http://data.nsw.gov.au/data/dataset/sydney-region-dwelling-completions/resource/8d1fd706-2c4c-4a79-8a0a-288006068290).

The net dwelling completions by suburbs were then adjusted using the expert knowledge of Council Planning staff to more accurately predict areas where future dwelling growth is planned.

CCAP CITY METHODOLOGY OVERVIEW



- Dwellings denotes residential data and m2 denotes non-residential data
- Energy End Use are estimated based on available studies and reports reconciled to total metered data
- BAU projections are estimated based on multiplying Base Year consumption by growth in dwellings and non-residential floorspace (incorporating replacement rates, i.e. knock-down/rebuild, and compliance requirements for new dwellings e.g. BASIX in NSW).
- PROJECTED data is estimated based on calculations of demand and supply side policies set by a user across energy, waste and transport.

CALCULATION OF NON-RESIDENTIAL FLOORSPACE

NON-RESIDENTIAL FLOORSPACE

Baseline (2011) and predicted (2031) non-residential floorspace was compiled from available data contained in local economic development reports. The accuracy and reliability of each dataset was assessed in consultation with planning staff from each Council to determine which datasets to use. The following datasets were used in each LGA:

WAVERLEY

- SGS, Eastern Suburbs Economic Profile (2013)
- HillPDA, Waverley Local Village Centres Economic Assessment (2006)
- BTS, Bureau of Transport Statistics Employment Forecasts (2014), which were converted to floorspace area
- Land use area calculations from Waverley LEP, undertaken by Sam McGuiness (2011)

WOOLLAHRA

- SGS, Eastern Suburbs Economic Profile (2013)
- Floorspace estimates undertaken by Anthony Weinberg based on gross land areas in town centres (excluding roads) provided by Council
- Calculations undertaken by Council's GIS team to separate the portion of non-residential floorspace in Paddington located within Woollahra LGA
- Estimates undertaken by Anthony Weinberg to determine the area of non-residential floorspace in Edgecliff Centre.

RANDWICK

- SGS, Randwick Economic Study (2008)
- Randwick Education and Health Specialised Centre Discussion Paper (2010)

Kinesis compiled a list of enrolments per educational facility (preschools /primary + secondary school) per suburb across the region (sources: myschool.edu.au, childcarensw.com.au) and determined floorspace per child benchmarks for preschools using the Waverley, Woollahra and Randwick DCPs, and for primary and secondary schools using the NSW Infrastructure: Education Baseline Report 2012 (source: http://www.infrastructure.nsw.gov.au/state-infrastructure-strategy/2012-state-infrastructure-strategy/expert-reports.aspx). These benchmarks were used to determine floorspace per educational facility by applying it to number of enrolments per facility.

For full details on the sources and methodology used to derive land use data, refer to data input spreadsheets for each LGA emailed by Kinesis, 26th September, 2014.

SUMMARY OF DWELLING DATA AND SOURCES USED IN ANALYSIS

COUNCIL	NET DWELLING INCREASE 2011-2031	SOURCE	LINK
RANDWICK	6,222 dwellings	East Subregional Strategy (2007)	http://www.planning.nsw.gov.au/PlanningyourRegion/Subregions/SydneyCitySubregion/tabid/474/ctl/Login/language/en-US/Default.aspx?returnurl=%2fen-au%2fplanningyourregion%2fsubregions.aspx
WAVERLEY	2,609 dwellings	Waverley LEP Metropolitan Strategy Compliance (2011)	http://www.waverley.nsw.gov.au/__data/assets/pdf_file/0014/27500/Metropolitan_Strategy_Cover_Page_191011.pdf
WOOLLAHRA	2,675 dwellings	50% of target contained in NSW Department of Planning and Environment Population, Household and Dwelling Projections, 2014	http://www.planning.nsw.gov.au/en-au/deliveringhomes/populationandhouseholdprojections/data.aspx

SUMMARY OF FINAL LAND USE DATA USED IN ANALYSIS

	WAVERLEY	WOOLLAHRA	RANDWICK	SPECIAL USE
Commercial 2011	265,066	195,539	276,729	
Commercial 2031	306,905	215,093	308,411	
Retail 2011	250,728	164,851	226,691	
Retail 2031	272,715	181,810	242,624	
Industrial 2011	8,196	-	1,281,761	
Industrial 2031	8,196	-	1,391,761	
Special Use 2011			803,214	803,214
Special Use 2031			1,014,323	1,014,323

RESOURCE CONSUMPTION DATA

Resource consumption for electricity, gas, transport and waste was sourced from the following datasets:

ELECTRICITY CONSUMPTION

- Ausgrid suburb level electricity consumption for 2010/11 and 2011/12
- Residential General Supply
- Residential Off Peak Hot Water
- Non-Residential Small Sites (<160,000 kWh pa)
- Non-Residential Medium-Large Sites (>160,000 kWh pa)

Source: Requested directly by Waverley, Woollahra and Randwick Councils.

GAS CONSUMPTION

- Jemena LGA level gas consumption for 2011
- Source: http://jemena.com.au/what-we-do/assets/jemena-gas-network/average-gas-consumption.aspx

TRANSPORT DATA

- Bureau of Transport Statistics Household Travel Survey
- ABS Census Journey to Work Data (2011)

WASTE DATA

- Recycled, green waste and waste to landfill tonnes for residential and non-residential provided by Waverley, Woollahra and Randwick Councils.

GREENHOUSE GAS EMISSION FACTORS

- Australian Greenhouse Office National GHG Accounts Workbook.
- Electricity projections incorporate the 20% RET target to 2020, no change has been predicted beyond 2020.
- Car driver factor reflects approximately 11 L/100km average vehicle based on ABS Vehicle Survey.
- Public transport emission factors estimated by Kinesis from a number of sources.

END USE DATA

End Use breakdowns include estimates for electricity and gas consumption of individual end uses including lighting, appliances, heating, cooling and hot water. Utility data is not available at this granularity. CCAP City estimates end use to allow cities to understand how and why resources are used across the city and provide inputs into the policy calculations included in CCAP City. Importantly, all end use data is reconciled to the available metered data at the suburb or LGA level to ensure that high level reporting is accurate.

End use Resource consumption estimates are based on the following key datasets:

- Energy Use in the Australian Residential Sector, 1986 – 2020, Australian Government Department of the Environment, Water, Heritage and the Arts (DEHWA), 2008.
- Building Code of Australia, Energy Efficiency Requirements in Commercial Buildings
- Department of Resources, Energy and Tourism, Energy in Australia, ABARE, Canberra
- Energy Efficient Strategies (2009), Appliance Energy Consumption in Australia: Equations for Appliance Star Ratings
- ACADS-BSG Australian Climatic Data for hourly temperature, insulation and humidity.
- Kinesis CCAP Tool (on-going) metered data of individual building performance in metropolitan cities and states across Australia. Over 2,000 assets at July 2013.
- Scientific analysis of primary resource consumptions using manufacturer's data and scientific principles.

SUBURB LEVEL DATA

Data presented in this report is shown at a suburb level. In cases where suburb level data is not available, it is estimated from LGA level data using various techniques:

Electricity/Gas/Water: Per dwelling energy and water consumption benchmarks are calibrated to overall LGA consumption data, and then multiplied by dwelling figures to estimate suburb level data. For this project, Ausgrid electricity consumption data was sourced at a suburb level for both residential and non-residential uses.

Waste: per dwelling and per m2 waste intensity figures are determined based on benchmarks and LGA totals. These intensity figures are then multiplied by the dwelling and floorspace figures for each suburb. This method differentiates between the different dwelling types, while all non-residential floorspace is assumed to have the same waste intensity.

Residential VKT (Vehicle Kilometres Travelled): A transport model is used to combine LGA level transport data (kilometres travelled by mode) with suburb-specific public transport accessibility, distance to centres, employment and vehicle ownership to calculate suburb level VKT.

PROJECTED RESOURCE CONSUMPTION

CCAP City projects energy, waste and transport consumption at the suburb and region under a business as usual or BAU scenario. This projection is estimated based on multiplying current consumption by growth in dwellings and non-residential floorspace (incorporating replacement rates, i.e. knock-down/rebuild, and BASIX compliance requirements for new dwellings).