



Renewable Energy Roadmap

Randwick City Council

January 2020



Contents

ABBREVIATIONS	5
EXECUTIVE SUMMARY	6
BACKGROUND	6
COUNCIL'S 2017-18 CARBON FOOTPRINT	8
EMISSIONS REDUCTION POTENTIAL & PATHWAYS	9
<i>Slow scenario</i>	11
<i>Medium scenario (Council target)</i>	12
<i>Fast scenario</i>	13
1 INTRODUCTION AND CONTEXT FOR ACTION ON CLIMATE	15
1.1 THE RANDWICK CITY PLAN: A 20-YEAR PLAN	15
1.2 RANDWICK CITY COUNCIL RENEWABLE ENERGY MASTER PLAN	16
1.3 RANDWICK CITY COUNCIL DECLARATION OF CLIMATE EMERGENCY	16
1.4 RANDWICK CITY COUNCIL CARBON AND RENEWABLE ENERGY TARGETS	16
1.5 LEGISLATIVE INFLUENCES ON CLIMATE AND SUSTAINABILITY ACTION BY RANDWICK CITY COUNCIL	16
1.6 PAST AND CURRENT ACTIONS BY RANDWICK CITY COUNCIL	17
1.6.1 <i>IT actions to improve performance</i>	20
1.7 RENEWABLE ENERGY INITIATIVES IN RANDWICK CITY	21
1.7.1 <i>Australian Energy Foundation / Our Energy Future</i>	21
1.7.2 <i>Solar my School</i>	21
1.7.3 <i>Solar uptake in Randwick LGA</i>	21
2 BROADER CONTEXT FOR ACTION ON CLIMATE	24
2.1 GLOBAL RESPONSE TO CLIMATE CHANGE	24
2.2 NATIONAL, STATES AND TERRITORIES RESPONSE TO CLIMATE CHANGE	25
2.2.1 <i>NSW State targets</i>	27
2.3 NSW LOCAL GOVERNMENTS RESPONSE TO CLIMATE CHANGE	28
3 ENERGY USE AND GREENHOUSE GAS EMISSIONS	31
3.1 ENERGY AND EMISSIONS BOUNDARY	31
3.2 RANDWICK CITY COUNCIL'S 2017-18 ENERGY AND CARBON FOOTPRINT	31
3.3 ENERGY END-USE IN COUNCIL OPERATIONS	33
3.4 RANDWICK CITY COUNCIL'S HISTORICAL CONSUMPTION	34
3.5 RANDWICK CITY COUNCIL FORECAST BUSINESS-AS-USUAL CARBON FOOTPRINT	36
3.5.1 <i>Population</i>	36
3.5.2 <i>Asset changes</i>	37
3.5.3 <i>Grid decarbonisation</i>	37
3.5.4 <i>Net projected energy demand and carbon emissions for Randwick City Council</i>	37
4 RANDWICK CITY COUNCIL SITE VISITS & STAKEHOLDER ENGAGEMENT	40
5 RECOMMENDED ACTIONS AT MAJOR SITES	46
5.1 DES RENFORD LEISURE CENTRE	46
5.1.1 <i>Load profile of Des Renford Leisure Centre</i>	46
5.1.2 <i>Energy management & renewable energy opportunities</i>	46
5.2 COUNCIL ADMINISTRATION CENTRE AND TOWN HALL	49
5.2.1 <i>Load profile of administration centre & Town Hall</i>	49
5.2.2 <i>Energy management & renewable energy opportunities</i>	50
5.3 LIONEL BOWEN LIBRARY	52
5.3.1 <i>Load profile of Lionel Bowen Library</i>	52
5.3.2 <i>Energy management & renewable energy opportunities</i>	53
5.4 RANDWICK COUNCIL DEPOT	55
5.4.1 <i>Load profile of Council depot</i>	55

5.4.2	Energy management & renewable energy opportunities	55
5.5	STREETLIGHTING.....	57
5.5.1	Load profile of streetlighting.....	57
5.5.2	Energy management & renewable energy opportunities	57
6	RANDWICK CITY COUNCIL RENEWABLE ENERGY PROJECT IMPLEMENTATION PLAN	59
6.1	PROJECTS IMPLEMENTED IN FY2019.....	60
6.2	PROJECTS IMPLEMENTED OVER MULTIPLE YEARS	60
6.3	PROJECTS RECOMMENDED FOR IMPLEMENTATION IN FY2020	62
6.4	PROJECTS RECOMMENDED FOR IMPLEMENTATION IN FY2021	64
6.5	PROJECTS RECOMMENDED FOR IMPLEMENTATION IN FY2022-23	65
6.6	PROJECTS RECOMMENDED FOR IMPLEMENTATION FROM FY2024 ONWARDS.....	66
7	RENEWABLE ENERGY ROADMAP SCENARIOS.....	70
7.1	SLOW SCENARIO.....	71
7.2	MEDIUM SCENARIO (COUNCIL TARGET)	72
7.3	FAST SCENARIO	73
8	INVESTMENT REQUIRED BY RANDWICK CITY COUNCIL	75
8.1	STREETLIGHTING.....	75
8.2	ONSITE ENERGY EFFICIENCY AND SOLAR.....	75
8.3	SPORTING FIELD LIGHTING	75
8.4	MAJOR CAPITAL PROJECTS	76
8.5	SUSTAINABLE PROCUREMENT	76
8.6	FLEET	76

Table of Figures

Figure 1: Renewable energy & carbon targets by NSW Councils.....	7
Figure 2: Randwick City Council's carbon footprint 2017-18.....	8
Figure 3: Randwick City Council electricity end-use estimate.....	9
Figure 4: Slow Scenario: Carbon emissions pathway for Randwick City Council	11
Figure 5: Slow scenario: Renewable Energy Roadmap for Randwick City Council	11
Figure 6: Medium Scenario: Carbon emissions pathway for Randwick City Council	12
Figure 7: Medium scenario: Renewable Energy Roadmap for Randwick City Council	12
Figure 8: Fast scenario: Carbon emissions pathway for Randwick City Council	13
Figure 9: Fast scenario: Renewable Energy Roadmap for Randwick City Council	13
Figure 10: Randwick City Plan – 6 Strategic Themes.....	15
Figure 11: Randwick City Council renewable actions roadmap	18
Figure 12: Solar PV uptake by Randwick City Council (APVI 2019)	22
Figure 13: Uptake of solar PV in the Randwick LGA compared with other NSW LGAs.....	22
Figure 14: Global context for action on climate.....	24
Figure 15: Global risks report – likelihood & impact of climate, other risks to global economy	25
Figure 16: Australia's renewable energy and carbon goals – National level	26
Figure 17: Australia's renewable energy and carbon goals – State & Territory level	26
Figure 18: Renewable energy & carbon targets by NSW Councils.....	29
Figure 19: Renewable energy & carbon targets by NSW towns and communities	29
Figure 20: Randwick City Council's energy use 2017-18 by major energy type.....	32
Figure 21: Randwick City Council's carbon footprint 2017-18.....	32
Figure 22: Randwick City Council grid electricity use by top 10 accounts	33
Figure 23: Randwick City Council electricity end-use estimate.....	34
Figure 24: Randwick City Council historical fuel consumption	35

Figure 25: Randwick City Council historical electricity consumption.....	35
Figure 26: Randwick City Council historical natural gas consumption.....	36
Figure 27: Population growth in Randwick City Council over from 2011-2036	37
Figure 28: Randwick City Council BAU energy projection 2017-18 to 2029-30	38
Figure 29: Randwick City Council BAU emissions projection 2017-18 to 2029-30	38
Figure 30: Load profiles during 2017-18 – Des Renford Leisure Centre	46
Figure 31: Possible solar PV locations (subject to structural analysis) – Des Renford Leisure Centre..	48
Figure 32: Load profiles during 2017-18 – Administration Centre & Town Hall.....	49
Figure 33: Possible solar PV location (subject to structural analysis) – town Hall	51
Figure 34: Load profiles during 2017-18 – Lionel Bowen Library.....	52
Figure 35: Possible solar PV location (subject to structural analysis) – Bowen Library	54
Figure 36: Load profiles during 2017-18 – Council Depot.....	55
Figure 37: Possible solar PV locations (subject to structural analysis) – Council Depot	56
Figure 38: Load profiles during 2017-18 – Streetlighting.....	57
Figure 39: Slow Scenario: Carbon emissions pathway for Randwick City Council	71
Figure 40: Slow scenario: Renewable Energy Roadmap for Randwick City Council	71
Figure 41: Medium Scenario: Carbon emissions pathway for Randwick City Council	72
Figure 42: Medium scenario: Renewable Energy Roadmap for Randwick City Council	72
Figure 43: Fast scenario: Carbon emissions pathway for Randwick City Council	73
Figure 44: Fast scenario: Renewable Energy Roadmap for Randwick City Council	73

Table Summary

Table 1: Randwick City Council energy & carbon footprint 2017-18	8
Table 2: Randwick City Council previous renewable energy installations	19
Table 3: Randwick City Council energy & carbon footprint 2017-18	31
Table 4: Randwick City Council sites which were visited for the renewable energy roadmap.....	40
Table 5: Randwick City Council stakeholder meetings.....	42
Table 6: Energy management & renewable energy opportunities - DRLC	47
Table 7: Energy management & renewable energy opportunities – Admin & Town Hall.....	50
Table 8: Energy management & renewable energy opportunities - Lionel Bowen Library	53
Table 9: Energy management & renewable energy opportunities – Council Depot	55
Table 10: Randwick City Council streetlighting inventory and energy use	58
Table 11: Randwick City Council emission reduction projects in FY2019	60
Table 12: Randwick City Council multi-year emission reduction projects	60
Table 13: Randwick City Council emission reduction projects in FY2020	62
Table 14: Randwick City Council emission reduction projects in FY2021	64
Table 15: Randwick City Council emission reduction projects in FY2022-23	65
Table 16: Randwick City Council emission reduction projects from FY2024	66
Table 17: Estimated efficiency & onsite solar investment	75

Abbreviations

AEF	Australian Energy Foundation
APVI	Australian Photovoltaic Institute
B5, B20	Biodiesel, numbers refer to % renewable biodiesel in regular diesel
BMS	Building Management System
CCF	(NSW) Climate Change Fund
CO	Carbon monoxide
COP	Conference of Parties (e.g. COP21 Paris Agreement)
CPP	Cities Power Partnership is an initiative of the Climate Council
CSP	Community Strategic Plan
DPIE	(NSW) Department of Planning, Industry and Environment
EUA	Environmental Upgrade Agreements
EV	Electric Vehicles
GHG	Greenhouse Gas Emissions
HVAC	Heating, Ventilation and Air Conditioning
IPCC	Intergovernmental Panel on Climate Change
IT / ICT	Information Technology / Information and Communications Technology
kW, kWh, GWh, GJ, etc	Units of energy and power
LCV	Light Commercial Vehicles
LED, T8, T5, HID, CFL	Types of lighting
LGA	Local Government Area
LPG	Liquefied Petroleum Gas
O&M	Operation and Maintenance
PPA	(Renewable Energy) Power Purchase Agreement
PV	Solar Photovoltaic technology
R22	Refrigerant gas in HVAC systems (banned under Montreal Protocol and being phased out)
RET	Renewable Energy Target
SDG	Sustainable Development Goals
SLIP	Street Lighting Improvement Program
SSD	Solid State Devices
SSROC	Southern Sydney Regional Organisation of Councils
STC	(Renewable Energy) Small-scale Technology Certificate
t CO ₂ -e	tonnes of carbon dioxide equivalent
UV	Ultraviolet technology (also UV-LED)
VNM	Virtual net metering
VO	Voltage Optimisation
VSD	Variable Speed Drive
WEF	World Economic Forum

Executive summary

Background

Randwick City Council is committed to reducing its carbon footprint and demonstrating via its leadership that a step change in energy demand and renewable energy is feasible and cost effective.

This renewable energy roadmap builds on previous programs and achievements by Council to reduce its environmental impact, and responds to a number of Council's strategic plans, corporate policies, and action plans, including:

- The Randwick City Plan: A 20-year plan
- Randwick's Renewable Energy Master Plan (2015)
- Randwick's Energy and Greenhouse Management Action Plan (2015)
- Low Carbon Future Plan (Regional Environment Program with Waverley and Woollahra Councils 2016)
- Carbon Neutral accreditation under the Federal Government's Climate Active program (2018)
- Establishment of net zero carbon emissions and 100% renewable energy goals by 2030 (2018), joining nearly 20 councils across NSW who have similar targets as illustrated below
- Declaration of a state of climate emergency (2019)

In particular, this roadmap study responds to Council's net zero carbon and renewable energy target and sets out pathways that Council can take in the coming decade to meet them. The targets set out in Council's March 2018 resolution and addressed within this roadmap include:

- *Greenhouse gas emissions from Council's operations – net zero greenhouse gas emissions by 2030, including but not limited to the following measures:*
 - *Council's total energy consumption – 100% replacement by renewable sources (generated on site or off-site for Council's purposes) by 2030.*
 - *Council's vehicle fleet – net zero greenhouse gas emissions by 2030.*

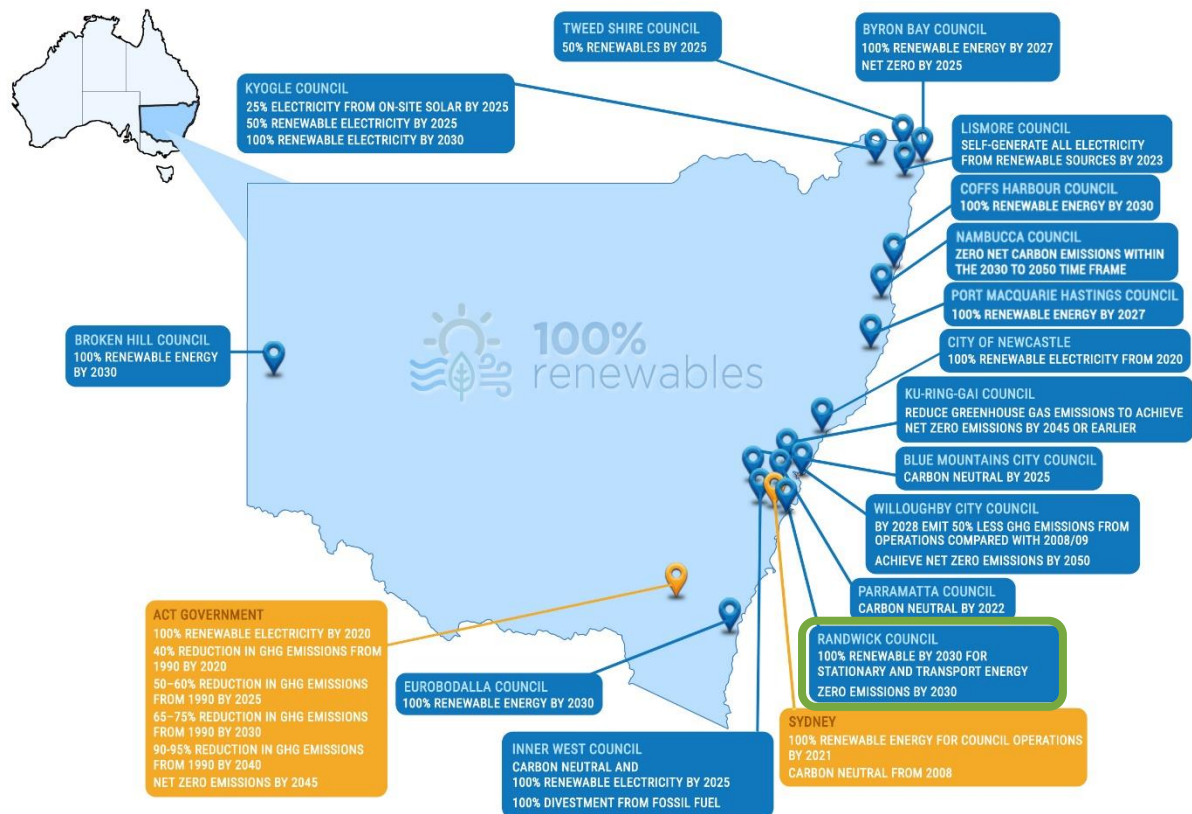


FIGURE 1: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS

These operational actions by Council also complement more recent initiatives that are driving the wider Randwick community carbon footprint down, including:

- Engagement of residents and business via Council's participation in the Australian Energy Foundation program facilitating the implementation of solar energy systems and other energy-saving measures across Randwick homes and businesses
- Council's participation as a co-founder of the Solar my School program conducted with Waverley and Woollahra Councils as a key element of our 3-Council Regional Environment Program, and
- Additional programs such as the Apartment Solar Program and the Pool Efficiency Program run in partnership with UNSW.

Council's 2017-18 carbon footprint

Data supplied by Council was used to develop Randwick City Council's energy and carbon footprint for the 2017-18 financial year (tabulated below).

TABLE 1: RANDWICK CITY COUNCIL ENERGY & CARBON FOOTPRINT 2017-18

Emission Source	Energy (GJ)	Activity Data	Units	Total GHG emissions t CO ₂ -e
Diesel for fleet	19,343	501	kL	1,433
Petrol for fleet	8,662	253	kL	617
Ethanol for fleet	153	7	kL	0.06
Biodiesel	189	5	kL	0.5
LPG	137	5	kL	0.5
Natural Gas	11,706	11,706	GJ	762
Electricity used in Council facilities	18,306	5,084,996	kWh	4,831
Electricity Streetlighting	19,236	5,343,240	kWh	5,076
Electricity from Solar PV	861	239,300	kWh	0
TOTAL	78,593 GJ			12,721 t CO₂-e

Emissions from Council's operations are dominated by electricity from the grid, used to supply Council's assets/facilities as well as streetlights. This is illustrated below.

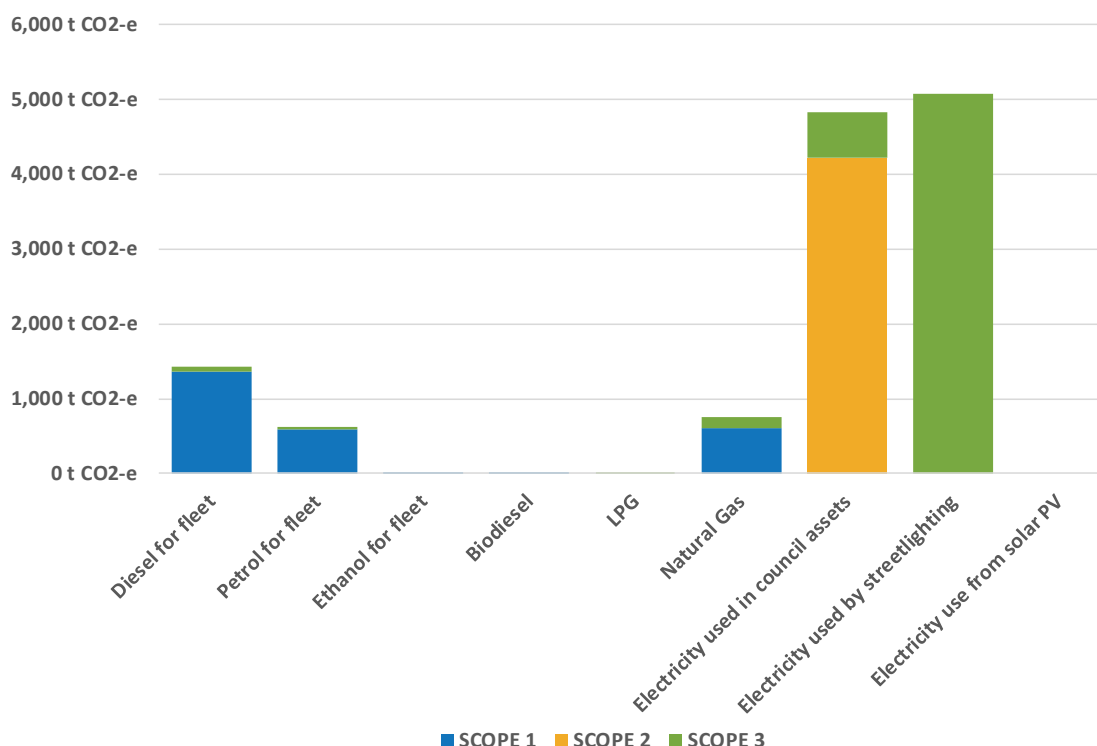


FIGURE 2: RANDWICK CITY COUNCIL'S CARBON FOOTPRINT 2017-18

It is useful to develop an understanding of the end-use of energy in order to inform the identification and development of opportunities to increase renewable energy and reduce emissions.

- Diesel and petrol are used for heavy/light commercial vehicles and for passenger vehicles respectively.

- Natural gas is used for water heating, with 94.5% consumed for pool heating at the Des Renford Leisure Centre, 5% consumed at the Council Administration Centre for space heating and the remaining very small volumes of natural gas consumed at Coogee Oval, Prince Henry Centre and Randwick Community Centre for hot water and space heating.
- Electricity demand for Council is summarised in the chart below. An analysis of electricity use drawing on experience from previous audits and other Councils indicates that lighting (for streets, buildings, parks) is the dominant use of electricity.

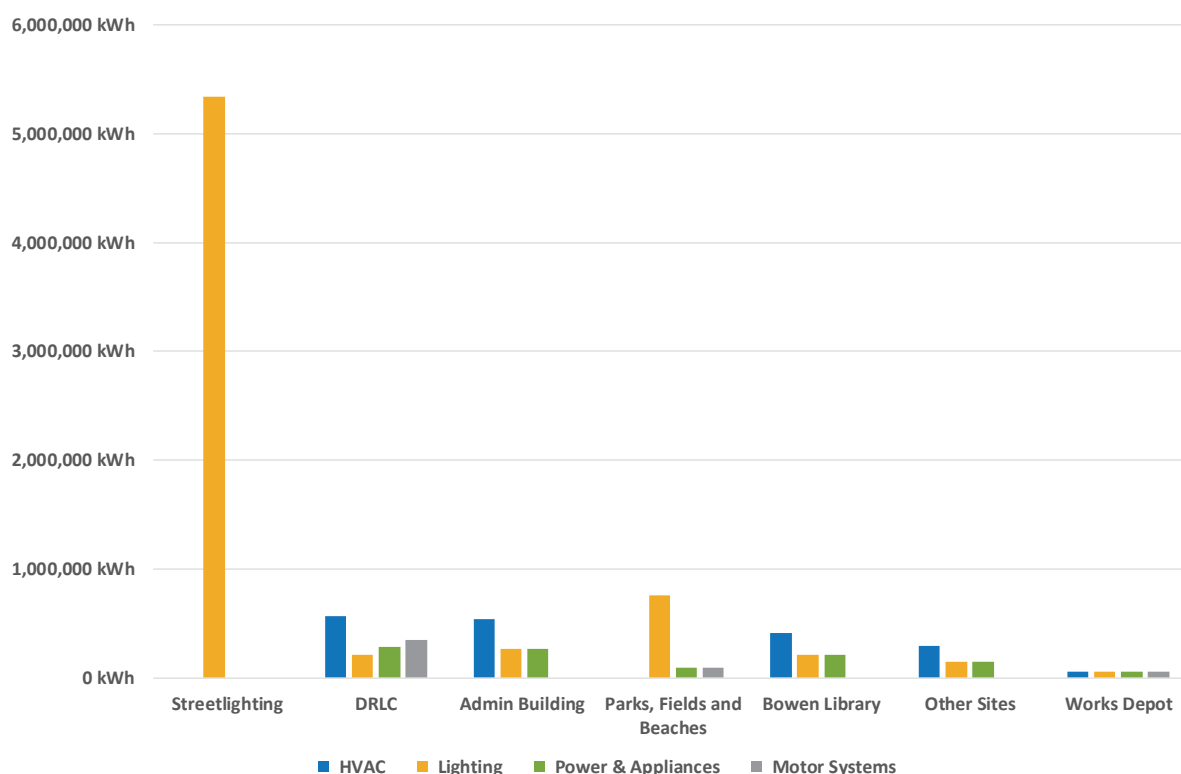


FIGURE 3: RANDWICK CITY COUNCIL ELECTRICITY END-USE ESTIMATE

Emissions reduction potential & pathways

Approximately 125 energy and emission reduction opportunities have been identified from consultations with key Council personnel and site visits, with 105 of these selected to be included in this roadmap of measures that can see Randwick City Council's electricity demand decrease and renewable energy supply increase to meet Council's targets. Actions are categorised as follows:

- Energy efficiency including upgrading building and sports field lighting to LED, air conditioning systems and hot water, for example.
- Street lighting upgrades to LED technology via accelerated bulk replacement programs.
- Solar PV onsite – this includes recently installed systems that will yield emissions savings from FY2020.
- Operation and maintenance (O&M) – typically procedures or simple controls that can reduce unnecessary energy waste, such as high night-time demand.
- Fleet emissions reduction measures such as incentives to increase the number of hybrid vehicles, trialling electric vehicles and developing future fleet transition plans.
- Fuel switching, in particular from gas to electric heat pumps for water heating.

- All energy – such as sustainable procurement policies that apply to all purchases of equipment that impact on energy use.
- Renewable energy power purchase agreements (PPA).

Council's potential renewable energy roadmap is developed by 'implementing' these 105 initiatives over time, from the FY2020 financial year through to FY2030. Suggested timing is based on discussions with Council, though it is indicative and may be changed to reflect organisation requirements during the development of each subsequent Operational Plan and 4-year Delivery Program.

Three scenarios were modelled based on the timing of identified actions and are illustrated below.

- **Slow scenario** – this sees all of the onsite measures including street lighting implemented over time. The purchase of renewables via a PPA is assumed to increase to 100% by FY2025, as committed to by Council. In addition, uptake of electric vehicles for Council fleet purposes will be gradual.
- **Medium scenario** – the same as the slow scenario, however with a more rapid transition to EVs and Hybrids.
- **Fast scenario** – this scenario sees Council continue to increase its level of renewable energy purchased via PPAs to 100% by FY2022. It also sees 100% of petrol and diesel vehicles switch to electric by FY2025.

The investments required by Randwick City Council to achieve the levels of carbon abatement estimated in this Roadmap are summarised below.

- Streetlighting
 - Capital investment for the first bulk upgrade by Council of \$1,838,274 with annual savings of \$385,034, giving a simple payback of 4.77 years (Ausgrid estimates).
 - By extrapolation costs to upgrade the balance of streetlights to LED could be \$2,124,877 with annual cost savings of \$445,065 for the same simple payback.
- Onsite energy efficiency and solar
 - A series of projects over several years are estimated to cost \$3,678,507 and will save Council an estimated \$536,566 per year.
- Sporting field lighting
 - The pathway reflects the potential for most of Council's field lighting to be upgraded by 2030 as part of routine field upgrades over this period.
- Major capital projects
 - Heffron Centre. It is assumed that Council's requirements for projects such as the Heffron Centre include achieving low carbon emissions within the approved funding.
- Sustainable procurement
 - Updating Council's sustainable procurement policies will help to ensure that new projects, major equipment upgrades and appliance purchases are energy efficient.
- Fleet
 - Council plans to change its fleet to be fully electric by 2030, and to reduce the size of passenger fleet to 50 by 2022.

Slow scenario

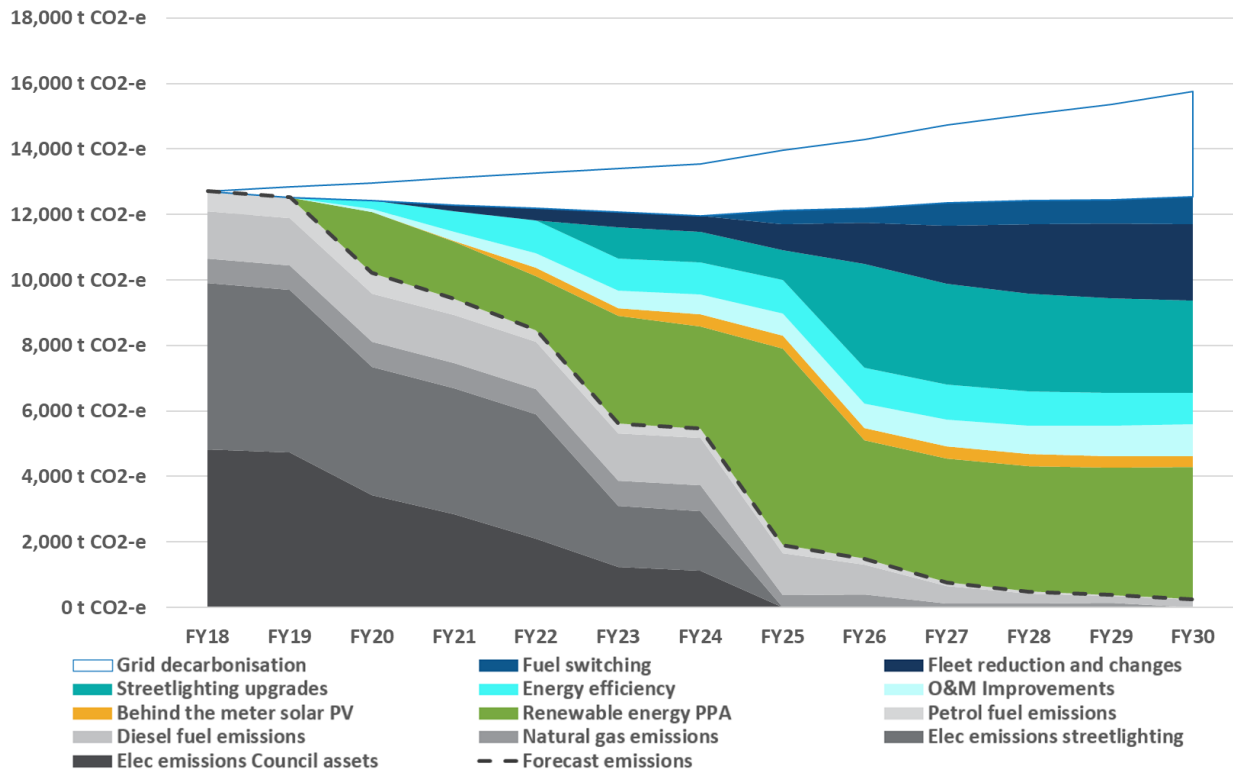


FIGURE 4: SLOW SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

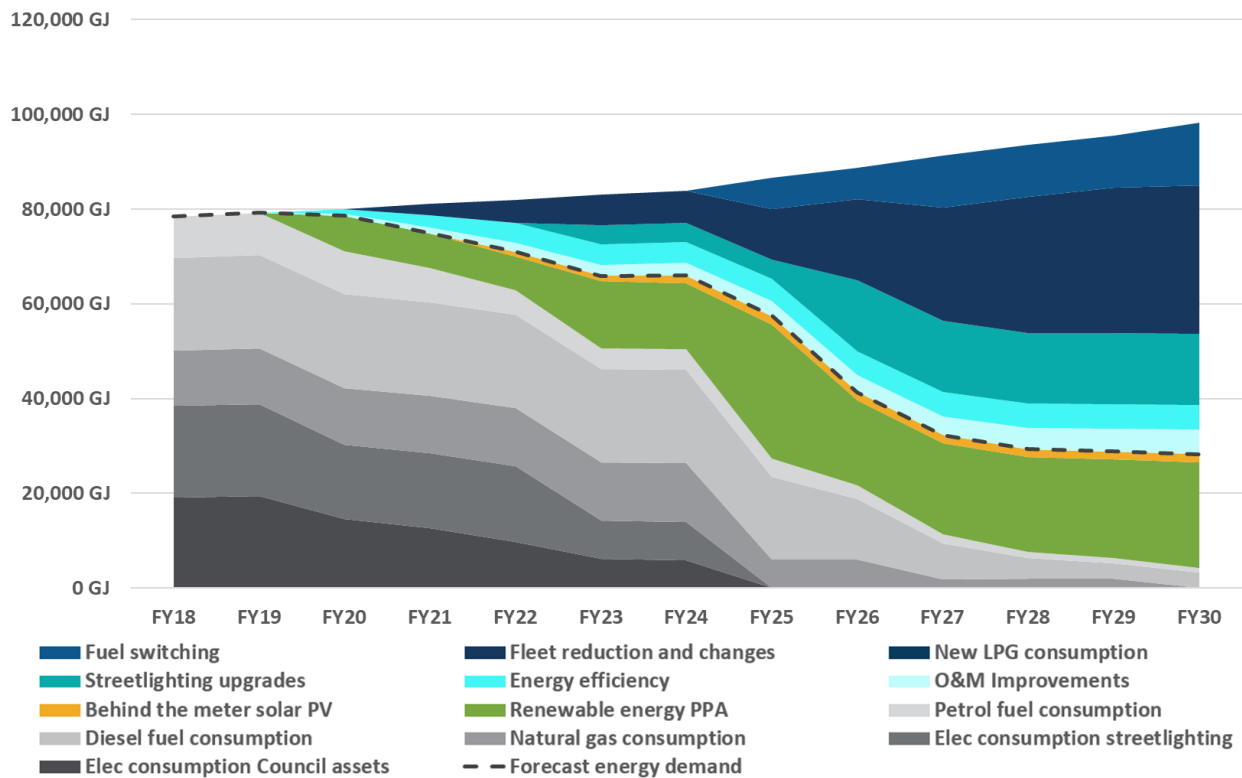


FIGURE 5: SLOW SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

Medium scenario (Council target)

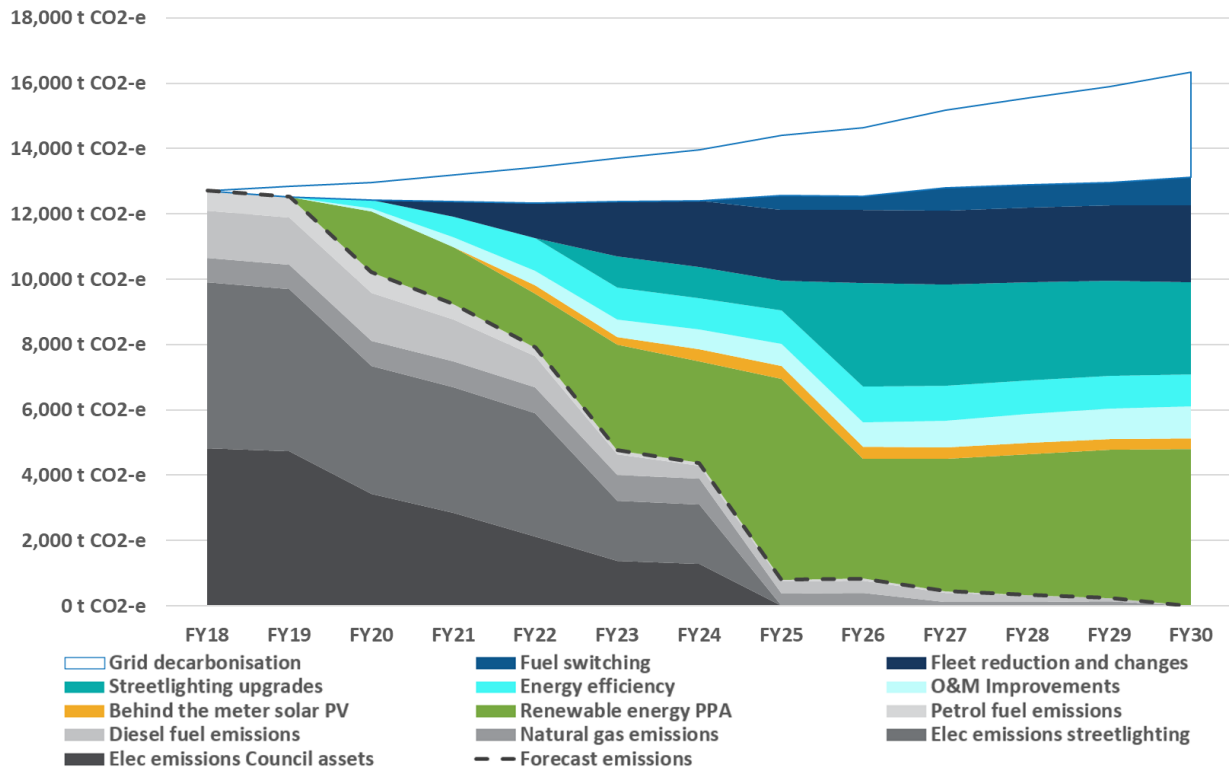


FIGURE 6: MEDIUM SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

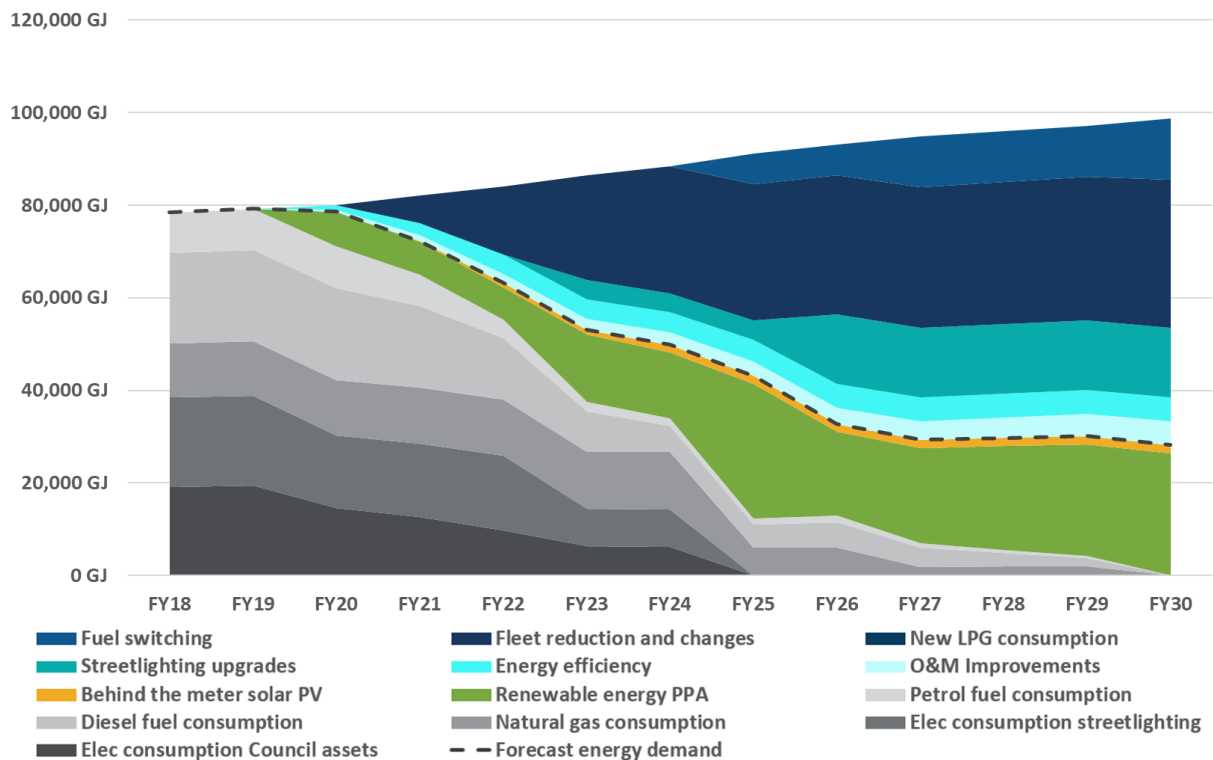


FIGURE 7: MEDIUM SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

Fast scenario

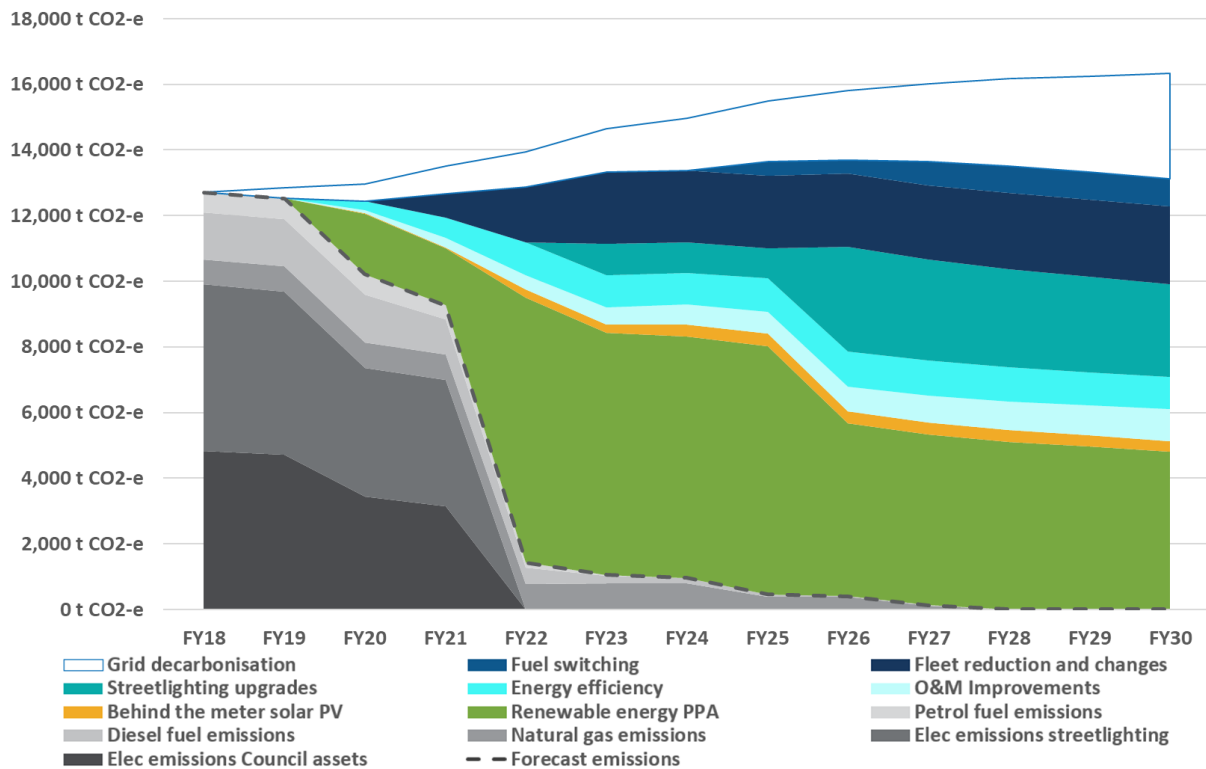


FIGURE 8: FAST SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

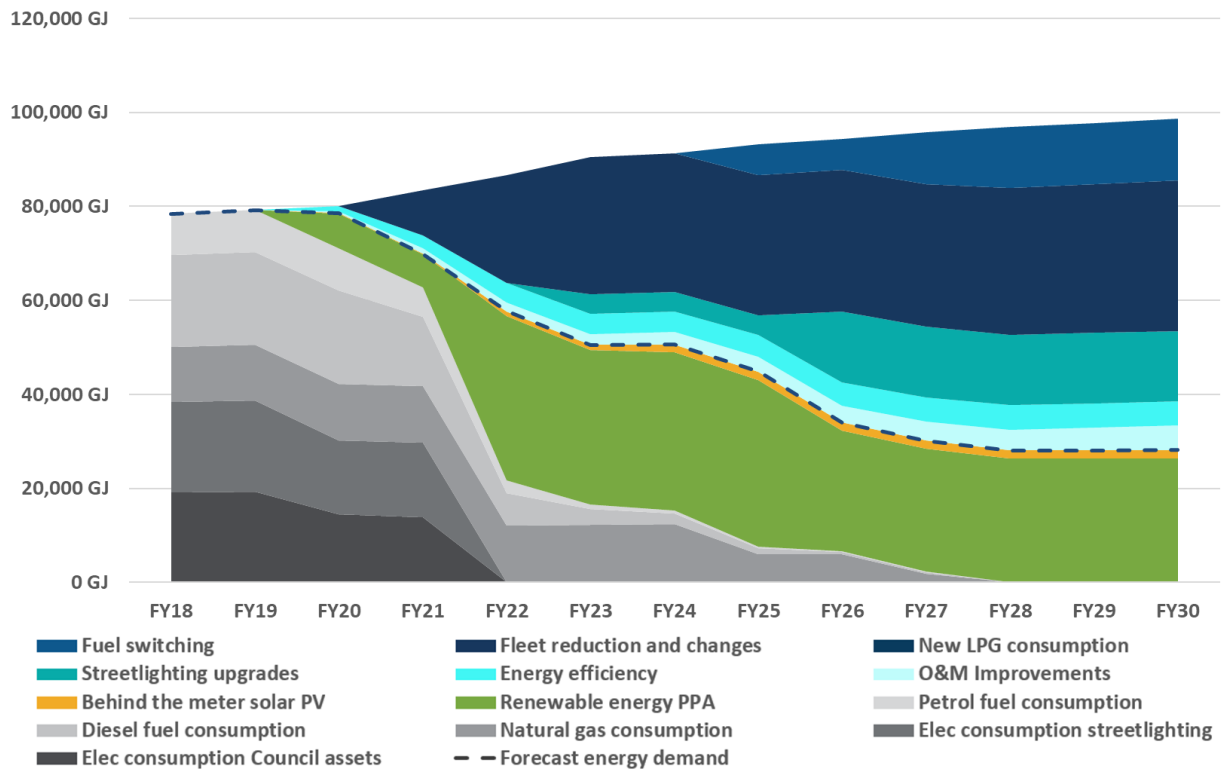


FIGURE 9: FAST SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

Part 1

Introduction & Randwick City Council context for action on climate

1 Introduction and context for action on climate

Randwick City Council is committed to reducing its carbon footprint and demonstrating via its leadership that a step-change in energy demand and renewable energy is feasible and cost-effective. This renewable energy roadmap was developed via an assessment of opportunities available to Council to decrease energy use and increase renewables in its operations, and via engagement with Council staff to ensure a broad range of views and ideas were input to the process. The roadmap builds on actions that Council has been implementing for many years, and continues to implement across various programs and partnerships with the community and local government sector.

As a leader in environmental sustainability, Randwick City Council developed this renewable energy roadmap as part of its long-term strategic vision to continue to take action on climate change. The Council has developed a range to strategic plans, policies and actions in the recent past which include:

- The Randwick City Plan: A 20-year plan
- Randwick's Renewable Energy Master Plan (2015)
- Randwick's Energy and Greenhouse Management Action Plan (2015)
- Low Carbon Future Plan (Regional Environment Program with Waverley and Woollahra Councils 2016)
- Carbon Neutral accreditation under the Federal Government's Climate Active program (2018)
- Establishment of net-zero carbon emissions and 100% renewable energy goals by 2030 (2018)
- Declaration of a state of climate emergency (2019)

1.1 The Randwick City Plan: A 20-year plan

The Randwick City Plan was initially developed in 2006 (revised in 2009 and 2012), and sets out the long-term ambitions of the community in terms of where it wants to see Randwick develop over a 20-year period. In 2017 an updated publication of the 20-year plan highlighted six strategic themes which the Plan is built around, and intended outcomes over the Delivery Program period 2018-2021, with a prominent focus on actions that will lead to more sustainable outcomes and lower greenhouse gas emissions. In particular, the intended outcomes of the major themes – *Responsible management*, *Places for people*, *Moving around*, and *Looking after our environment* – are highly relevant in the context of climate change mitigation across council operations and the broader community context.



FIGURE 10: RANDWICK CITY PLAN – 6 STRATEGIC THEMES

1.2 Randwick City Council renewable energy master plan

In 2015, a renewable energy master plan was developed for Randwick City Council to recognise the most economically viable renewable energy technologies for the Randwick LGA. The aim of the plan was to identify innovative technologies in addition to those (energy efficiency, solar PV and behavioural actions) which were being implemented from the 2015 energy and greenhouse management and action plan.

The renewable energy masterplan explored ambitious financing strategies such as environmental upgrade agreements (EUA), virtual net metering (VNM) and power purchase agreements (PPAs) as possible financial methods for community solar PV. The plan highlighted the role of Council as a leader, facilitating a relationship between residents and renewable energy suppliers.

1.3 Randwick City Council declaration of climate emergency

In May of 2019, Randwick City Council declared a state of climate emergency. The Resolution states that Randwick City Council:

- *1. publicly acknowledges that we are in a state of climate emergency that requires urgent action by all levels of government; that human induced climate change represents one of the greatest threats to humanity, civilisation, and other species; and that it is still possible to prevent the most catastrophic outcomes if societies take emergency action, including local councils; and*
- *2. bring back a report to Council to examine how council plans, policies and works programs can address the climate emergency, and ensure this is embedded into future council strategic plans¹.*

1.4 Randwick City Council carbon and renewable energy targets

A Notice of Motion was carried in March of 2018 which defined targets for reductions to greenhouse gas emissions, energy and water sustainability and tree canopy coverage. Greenhouse gas emission and energy targets are the most relevant to this renewable energy roadmap and are outlined below:

- *Greenhouse gas emissions from Council's operations – net zero greenhouse gas emissions by 2030, including but not limited to the following measures:*
 - *Council's total energy consumption – 100% replacement by renewable sources (generated on site or off-site for Council's purposes) by 2030.*
 - *Council's vehicle fleet – net zero greenhouse gas emissions by 2030.*

1.5 Legislative influences on climate and sustainability action by Randwick City Council

Several policies provide a legislative basis for Randwick's ongoing action on sustainability and climate change. For example:

- **Local Government Act 1993** - the following principles apply to decision-making by Councils (subject to any other applicable law).

¹ This Renewable Energy Roadmap report provides a key response to this requirement.

- Section 8(2c) “Council’s should consider the long term and cumulative effects of actions on future generations”.
- Section 8(2d) “Council’s should consider the principles of ecologically sustainable development”.
- **Environmental Planning and Assessment Act 1979** - the objects of this Act, which are reflected in Council’s environmental planning instruments that council development activities often must comply with, include:
 - Section 1.3(b) “to facilitate ecologically sustainable development in decision-making about environmental planning and assessment”;
 - Section 1.3(e) “to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats”; and
 - Section 1.3(f) “to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage)”.
- **Protection of the Environment Operations Act 1997**
 - The objects of the Act include to protect, restore and enhance the quality of the environment having regard to ecologically sustainable development, such as through compliance with EPA licence requirements for scheduled activities and avoiding activities being carried out in an environmentally unsatisfactory manner that is likely to cause pollution.
- **Randwick Procurement Policy 2017**
 - The policy outlines Council’s commitments to adopting procurement practices which promote “economic, social and environmental sustainability”.
 - Section 4.4: “maintaining and enhancing our quality of life, for both current and future generations, through a balance of economic viability, environmental conservation and restoration and community wellbeing. Council will assess proposals to determine commitment to environmental sustainability through whole of life considerations”.
 - The policy is being reviewed from August 2019. Council should consider implementing sustainable procurement practices based on the 2017 Sustainable Procurement Guide for NSW local governments, in particular adopting a quadruple bottom line approach that encompasses economic, environmental, social and good governance principles.
(<https://www.lgnsw.org.au/files/imce-uploads/127/esstam-sustainable-procurement-guide-30.05.17.pdf>)
- **Waste Avoidance and Resource Recovery Act 2001**
 - Council is expected to contribute to meeting the targets in the NSW Waste Avoidance and Resource Recovery Strategy.

1.6 Past and current actions by Randwick City Council

Randwick City Council has undertaken actions to reduce energy consumption over many years, primarily in response to earlier energy and greenhouse gas reduction targets established from 2007 onwards. These were summarised in Randwick’s initial Local Greenhouse Action Plan prepared over a number of stages to satisfy NSW Government reporting requirements at the time. In conjunction with

these steps, Randwick Council undertook its own Climate Change Mitigation and Adaptation Roadmap with funding and template preparation provided by the Commonwealth Government at the time.

Earlier programs included:

- rebates for energy and water-saving measures for residents (Randwick's Home Energy Makeover program) funded originally via a NSW Government demand management grant and then extended via Randwick's innovative environmental levy initiative;
- development and implementation of the 3-Council regional ecological footprint program with a 3-year \$1.8 million external grant aimed at responding to resource consumption across the eastern suburbs; and
- leading development and implementation of the 5-year Local Government Emissions Trading Scheme (LGETS) trial with 9 metropolitan and 3 regional NSW local Councils.

Since those years, implementation of energy-saving measures has broadened across Council operations and the community. Council's measures since 2008-09 are illustrated in the following graph.

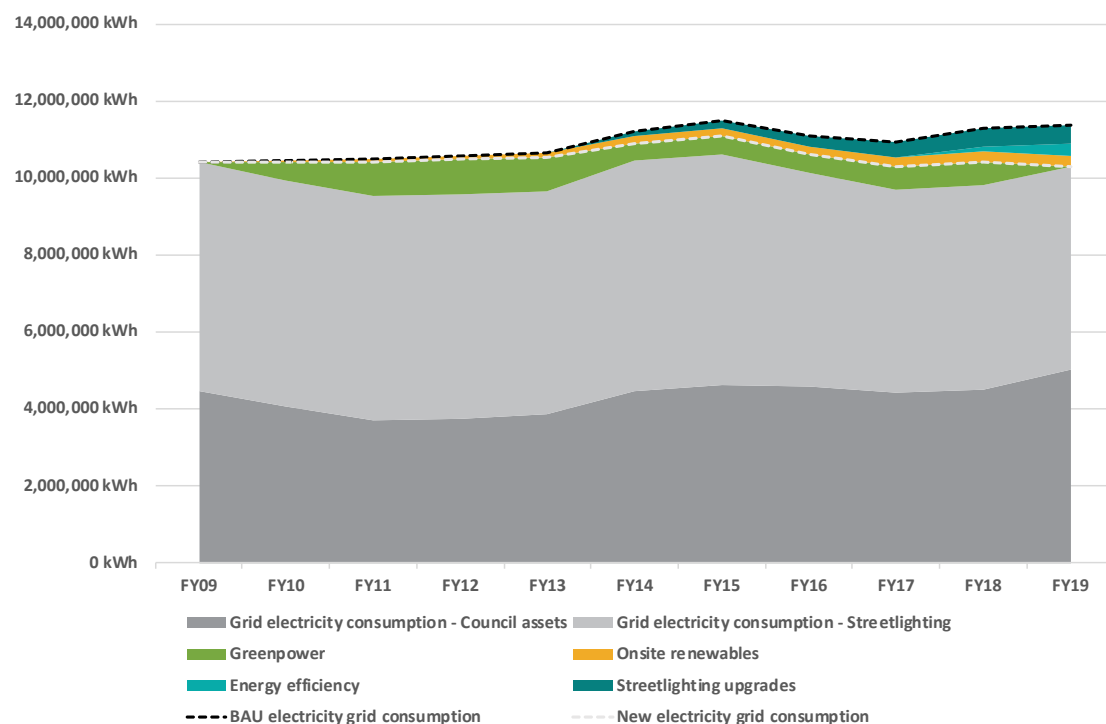


FIGURE 11: RANDWICK CITY COUNCIL RENEWABLE ACTIONS ROADMAP

A detailed list of more recent actions includes:

- Purchasing renewable energy
 - Since 2010 Council purchased accredited GreenPower® to meet some of the energy demand for its facilities. In total 5,712 MWh of electricity has been sourced in this way.
 - From 1 July 2019 in an agreement negotiated via SSROC (South Sydney Regional Organisation of Councils), Randwick is purchasing 20% of its electricity from the Moree Solar Farm, until 2030. Options enable increases to this level of renewable energy over this timeframe.
- Undertaking energy efficiency measures in major buildings:

- Implementation of LED lighting at large and small energy-consuming Council buildings, including Works Depot and Bowen and Malabar libraries.
- Installing sub-metering at large sites, to provide valuable information regarding the energy performance of large sites.
- Motion sensor lighting has been installed at various sites to reduce electricity consumption from lighting.
- Energy-efficient heat pumps, pool blankets and gas-boosted solar hot water have been implemented at Des Renford Leisure Centre.
- Voltage Optimisation technology was installed at the Des Renford Leisure Centre and at the Bowen Library.
- Installing energy-efficient streetlights
 - The Council is a part of the Street Lighting Improvement (SLI) Program, an initiative between SSROC and Sydney Councils to work with Ausgrid for accelerated replacement and upgrades to approximately 3900 lamps for Randwick City.
- Implementing onsite renewable energy projects:
 - The Council has now installed solar PV and a wind turbine at 14 of its own sites, which collectively have 194 kW capacity.

TABLE 2: RANDWICK CITY COUNCIL PREVIOUS RENEWABLE ENERGY INSTALLATIONS

Year	Project	Site	Potential RE Generation pa (kWh) ²
2009-2010	2 kW Solar	Moverley Children's Centre	2,920
2009-2010	49 kW Solar	Works Depot	71,540
2010-2011	2.4 kW Wind	Randwick Community Centre	3,200
2010-2011	3 kW Solar	Maroubra Senior Citizens Centre	4,380
2011-2012	10 kW Solar	Administration Centre and Town Hall	14,600
2012-2013	2 kW Solar	Barrett House	2,920
2012-2013	6 kW Solar	Randwick Community Centre	8,760
2013-2014	30 kW Solar	Lionel Bowen Library	43,800
2013-2014	31 kW Solar	Des Renford Aquatic Centre	45,260
2014-2015	7 kW Solar	Community Nursery	10,220
2016-2017	10 kW Solar	Kensington Park Community Centre	14,600
2016-2017	30 kW Solar	Prince Henry Centre	43,800
2018-2019	2 kW Solar	Randwick Literary Institute	2,920
2018-2019	10 kW Solar	Malabar Community Library	14,600
Total	194 kW RE		283,520 kWh pa

- Supporting sustainable transport options
 - Electric vehicle charging stations have been installed as a part of a jointly funded program with Waverley and Woollahra Councils. Charging stations within Randwick

² Actual generation will vary from year to year as measured via Council's Solar Analytics platform. Generation includes solar that is self-consumed and solar energy that is exported to the grid. Council's energy use footprint only includes self-consumed solar energy generation.

Council can be found at Coogee Beach, Randwick Community Centre, Des Renford Leisure Centre and Silver Street Car Park. In 2019, two older charging stations which were installed at the Administration Centre and Prince Henry Centre in 2012 were also upgraded, and an innovative school environmental grant enabled Council to install two additional public electric vehicle charging stations into the public domain at The Spot.

- Randwick City Council's Bicycle Plan has been designed to improve links to key locations in Randwick City and its neighbouring councils.
- Council has six electric bikes, two electric cars and several hybrid vehicles for staff use.

1.6.1 IT actions to improve performance

IT have also implemented numerous actions to improve energy efficiency performance of IT systems, including:

- Replacement of the last remaining desktop computers with small NUC computers, and reduced the number of iPads from 130 to 10 to provide an overall saving in energy usage.
- Replacement of Council's monitor fleet (approximately 1,000 monitors) with the Dell P2419H monitors which consume 18W operational energy demand, which is much more efficient than the older monitors (HP EliteDisplay E221) which used 36W.
- Reduction in electricity consumed in the datacentres at Bowen Library and the Administration building by moving the data centre offsite, resulting in at least a 19kW 24/7 demand reduction.
- All phones, computers, laptops etc. have power management settings as per the relevant corporate policy.
- Devices per person was rationalised from up to 5 to 4 (Surface Pro, phone and two monitors).
- Continual reduction and consolidation of printers across all Council buildings as Council operations become digital.

1.7 Renewable energy initiatives in Randwick City

Policies and actions by Council complement initiatives to increase the uptake of renewables in the community.

1.7.1 Australian Energy Foundation / Our Energy Future

The Australian Energy Foundation (formerly, in conjunction with the SSROC, the Our Energy Future program) is now delivering Council's renewable and energy-saving initiative for residents and businesses, aiming to facilitate increased understanding of their energy consumption, energy bills and improving environmental performance.

1.7.2 Solar my School³

Randwick City Council jointly founded Solar my School with Waverley and Woollahra Councils to provide free independent support to schools who are looking to reduce their energy bills. As at late 2019, the program has resulted in the generation of more than 300,000 MWh of renewable energy, with participation from almost every government and non-government, public and private school across Sydney's eastern suburbs. Brigidine College Randwick, Randwick Boys High School and Maroubra Junction Public School are a few of the schools within Randwick City Council which have installed solar PV as a result of this program. In late 2019 the program was announced as a winner in the 2019 Green Globe Awards and a winner of the Keep Australia Beautiful Award in the Renewable Energy category.

1.7.3 Solar uptake in Randwick LGA

Some 10.5% of dwellings (APVI⁴ <http://pv-map.apvi.org.au/>) in Randwick LGA have installed solar PV as of November 2019. This places Randwick LGA in the lower end of NSW Council's in terms of the number of residents taking up solar panels. In addition to 2,573 residential systems, there have been 121 installations of 10-100 kW capacity, which tend to be commercial-scale systems, plus 6 systems greater than 100 kW in scale. Local governments near Randwick have comparable levels of solar PV uptake. Councils in the north of the state, including Tweed, Moree Plains and Narrabri, have reached solar uptake levels of 35% to 40% and lead the way for NSW councils. The graphics below display the current (November 2019) status of the Randwick LGA with respect to its neighbouring councils and also all councils in NSW.

³ Sourced from <https://www.solarmyschool.org.au/>

⁴ APVI data (number of registered solar PV systems) from the Clean Energy Regulator and other sources

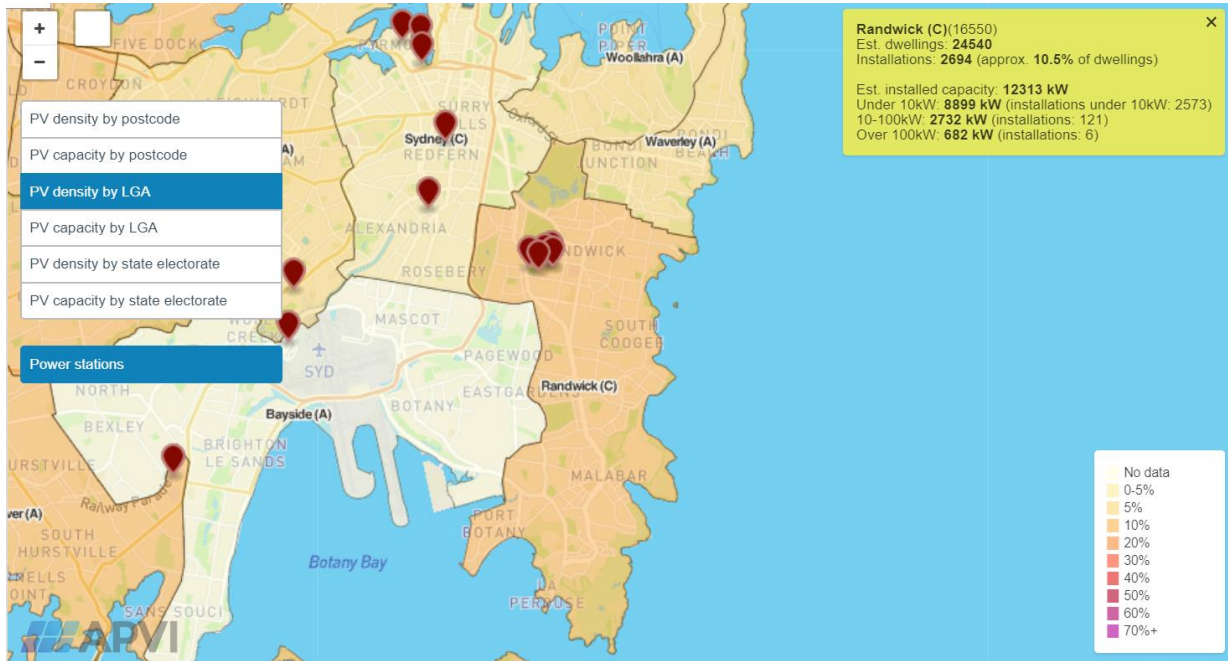


FIGURE 12: SOLAR PV UPTAKE BY RANDWICK CITY COUNCIL (APVI 2019)

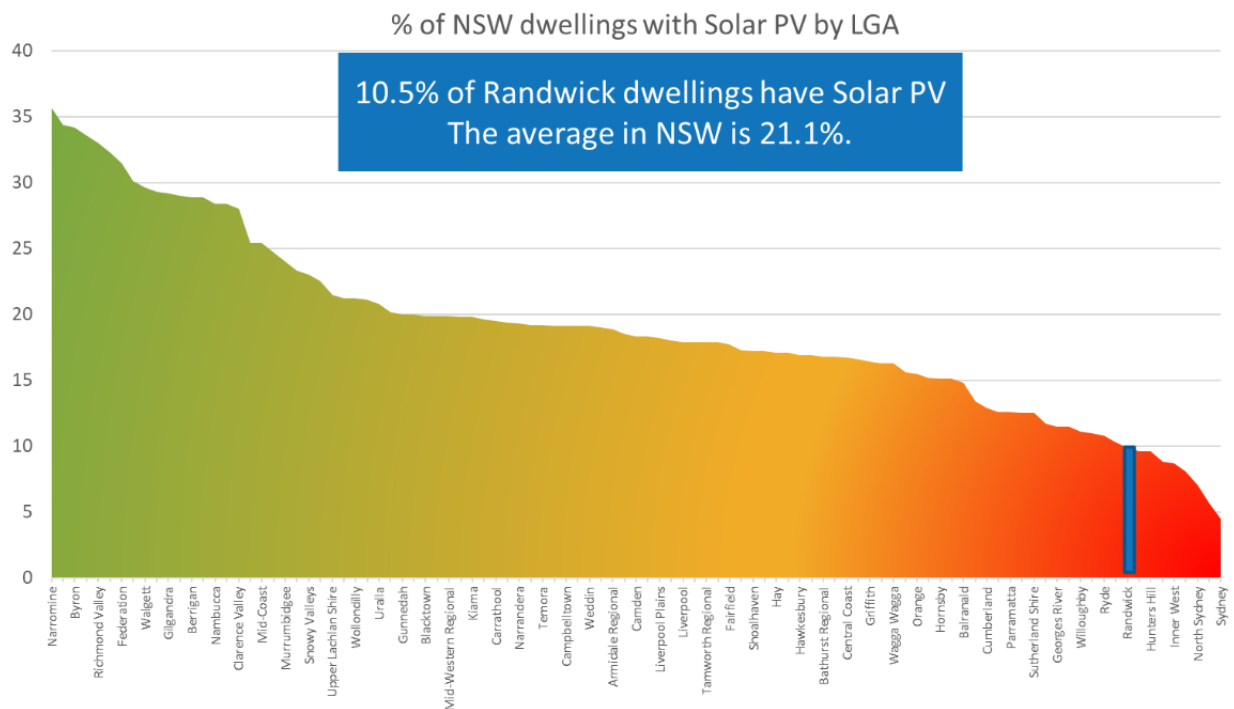


FIGURE 13: UPTAKE OF SOLAR PV IN THE RANDWICK LGA COMPARED WITH OTHER NSW LGAS

Part 2

Broader context for climate action

2 Broader context for action on climate

2.1 Global response to climate change

Internationally, there are three primary drivers for urgent action on climate, additional to the second commitment period of the Kyoto Protocol from 2013 to 2020. These are:

1. Sustainable Development Goals (SDGs)

In 2015, countries adopted the 2030 Agenda for Sustainable Development and its 17 Sustainable Development Goals. Governments, businesses and civil society together with the United Nations are mobilising efforts to achieve the Sustainable Development Agenda by 2030⁵. The SDGs came into force on 1 January 2016 and call on action from all countries to end all poverty and promote prosperity while protecting the planet.

2. Paris Agreement

To address climate change, building on the IPCC's 5th Assessment Report (2014), countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015. The Agreement entered into force less than a year later. In the agreement, signatory countries agreed to work to limit global temperature rise to well below 2°C, and given the grave risks, to strive for 1.5°C⁶.

3. Special IPCC report on 1.5°C warming

In October 2018 in Korea, governments approved the wording of a special report on limiting global warming to 1.5°C. The report indicates that achieving this would require rapid, far-reaching and unprecedented changes in all aspects of society. With clear benefits to people and natural ecosystems, limiting global warming to 1.5°C compared to 2°C could go hand in hand with ensuring a more sustainable and equitable society⁷.



FIGURE 14: GLOBAL CONTEXT FOR ACTION ON CLIMATE

A first draft of the IPCC's 6th Assessment Report will be available in early 2020, with the report expected to be finalised in 2021.

⁵ Sourced from <https://www.un.org/sustainabledevelopment/development-agenda/>

⁶ Sourced from <https://www.un.org/sustainabledevelopment/climatechange/>

⁷ Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

In addition, the World Economic Forum's Global Risks Report 2020⁸ highlights adverse climate change-related outcomes as among the most likely to occur with the highest impacts to the global economy.

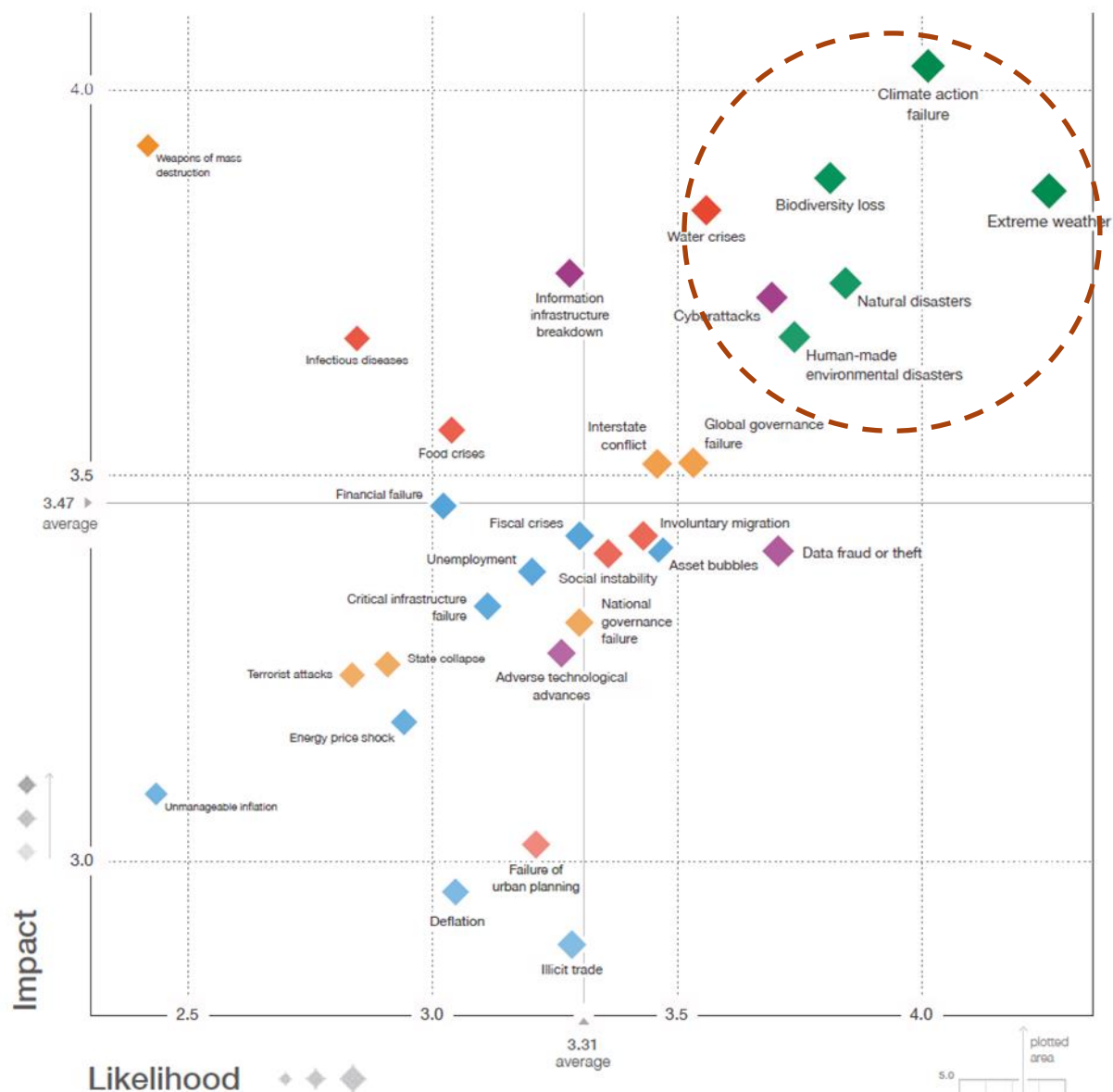


FIGURE 15: GLOBAL RISKS REPORT – LIKELIHOOD & IMPACT OF CLIMATE, OTHER RISKS TO GLOBAL ECONOMY

2.2 National, states and territories response to climate change

At a national level, Australia's response to the Paris Agreement has been to set a goal for greenhouse gas (GHG) emissions of 5% below 2000 levels by 2020 and GHG emissions that are 26% to 28% below 2005 levels by 2030.

A major policy that currently underpins this is the Renewable Energy Target (RET). This commits Australia to source 20% of its electricity (33,000 GWh p.a., estimated to equate to a real 23% of

⁸ <http://reports.weforum.org/global-risks-report-2020/>

electricity) from eligible renewable energy sources by 2020. The scheme runs to 2030. These two key targets are illustrated below.



FIGURE 16: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – NATIONAL LEVEL

According to the Clean Energy Regulator⁹, “with the capacity of new build commencing generation in 2018 combined with the expected accreditations in 2019 and 2020, we expect (renewable energy) generation to step up from around 22,000 gigawatt hours in 2018 to around 30,000 gigawatt hours in 2019 and 40,000 gigawatt hours in 2020”. This exceeds the RET 20% target by some 7,000 GWh.

At a sub-national level, all states and territories have established aspirational emissions targets as well as some legislated targets for renewable energy, as seen below.

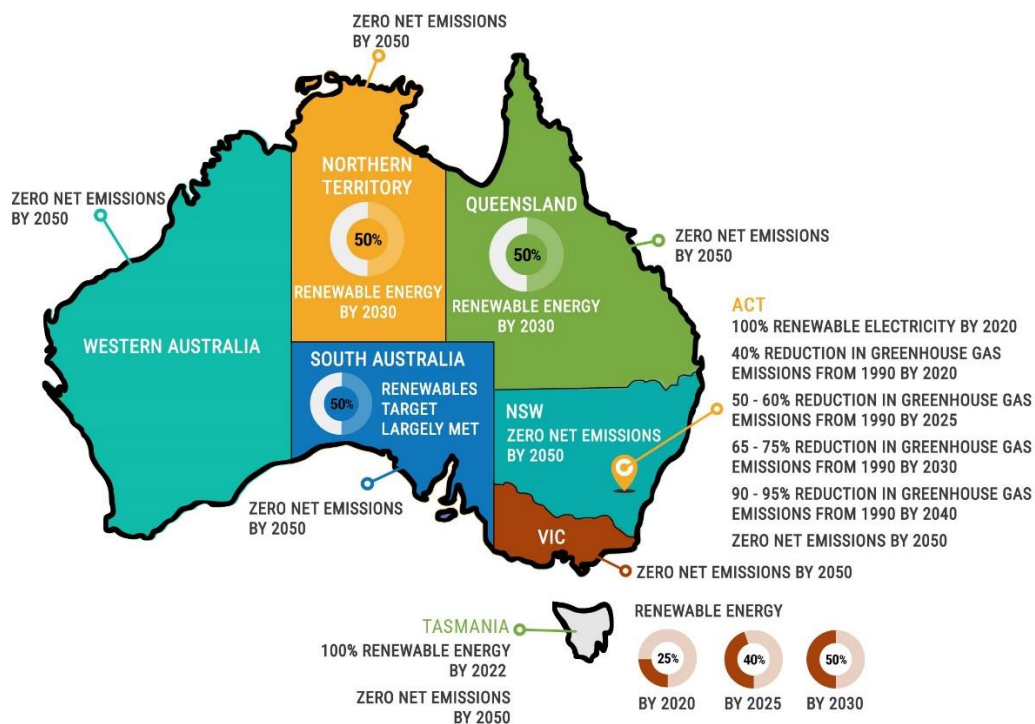


FIGURE 17: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

⁹ March 2018, Australian Government – Clean Energy Regulator. 2018 Annual Statement to the Parliament on the progress towards the 2020 Large-scale Renewable Energy Target.

2.2.1 NSW State targets

The NSW Climate Change Policy Framework¹⁰ outlines the State's target of reaching net-zero emissions by 2050. This is an aspirational objective and helps to set expectations about future GHG emissions pathways to help others to plan and act. The policy framework will be reviewed in 2020.

Through the Government's Climate Change Fund (CCF) 2018-2022 Strategic Plan a number of initiatives will be progressed in the next four-year period with a total funding allocation of \$170 million. The five major initiatives being developed include:

1. Supporting regional community energy projects and community energy hubs to give communities more control, avoid costly infrastructure upgrades and reduce rural energy costs.
2. Supporting feasibility studies and commercialisation of emerging energy projects including pumped hydro generation and utility-scale batteries, with potential co-funding from the Australian Renewable Energy Agency, to bring forward private sector investment to support the next generation of energy and storage projects in NSW.
3. Providing small incentives to coordinate assets such as home and electric vehicle storage to beat energy peaks and provide household demand response to the grid, as highlighted by AEMO and the NSW Energy Security Taskforce as a key priority for system security.
4. Supporting energy storage in state-owned sites, such as schools, to lower peak demand and potentially attract investment in local manufacturing.
5. Increasing the energy savings for eligible recipients of the Low-Income Household Rebate by allowing them to opt out of the rebate and install a solar system on their roof. This would add solar capacity to the grid and more than double the energy savings for the households involved (<https://energysaver.nsw.gov.au/households/solar-and-battery-power/solar-low-income-households>).

The NSW Renewable Energy Action plan has helped to drive the growth of renewables in the State through its three key goals:

- Goal 1 – Attract renewable energy investment
- Goal 2 – Build community support, including the establishment of the Renewable Energy Advocate
- Goal 3 – Attract and grow renewable energy expertise

2.2.1.1 Energy management support in NSW

The NSW Government runs a number of initiatives aimed at promoting and increasing the uptake of energy efficiency and sustainable practices. Initiatives that help local governments include:

- Sustainability Advantage program, which helps local governments commit to, plan, implement and be recognised for sustainability practices in their operations and supply chains.
- Energy Savings Scheme – information and resources that help organisations get access to financial incentives by implementing verifiable energy savings initiatives, such as building retrofits, plant upgrades and lighting upgrades to LED.

¹⁰ <http://www.environment.nsw.gov.au/topics/climate-change/policy-framework>

- In 2018 the government completed a panel of renewable energy Power Purchase Agreement (PPA) providers, which local governments can access to implement onsite solar PV. The advantage of an onsite PPA is that the solar PV can be installed and deliver cost savings at no upfront cost. However, cost savings are not as great compared to using your own capital. This initiative is useful where access to capital is not available or is limited.
- Community renewable energy guides and resources e.g. <http://c4ce.net.au/>.
- A wide range of tools, guides, case studies, training courses and other materials is available to businesses through DPIE, covering a wide range of sectors, technology types and energy forms, including information on savings measures, incentives and rebates for households and business under the Energy Saver Program.
- Environmental Upgrade Agreements (EUA), which can help organisations and participating Councils overcome barriers to implementing environmental upgrades.
- Clean Energy for Business – a program that ran in 2017 and helped businesses and local governments plan for a net-zero / 100% renewable energy future. Case studies from this program will help other organisations plan similar clean energy pathways.

2.3 NSW local governments response to climate change

Much of the leadership on renewable energy and climate in Australia comes from local government. Prominent examples of how local governments are demonstrating leadership are highlighted below.

1. The Southern Sydney Regional Organisation of Councils (SSROC) is an association of 11 councils, including Randwick City Council. SSROC provides a forum through which member councils can work collaboratively to solve regional issues and contribute to the future sustainability of the region. Some major initiatives that are highly relevant to the emissions pathway project include a Regional Waste and Resource Recovery Strategy, Street Lighting Improvement Program, Renewable Energy Master Plan, Our Energy Future, and the Woodlawn Mechanical Biological Technology waste facility¹¹. SSROC also led a major renewable energy procurement initiative through which many of the Sydney region's councils are now sourcing 20-35% of their electricity from renewable energy, including Randwick City Council.
2. Cities Power Partnership or CPP is an initiative of the Climate Council and it represents Australia's largest local government climate action network with over 100 councils, including Randwick City Council. While this doesn't involve setting specific targets per se, the commitment to key actions can either serve as a set of de facto targets or can provide a basis from which to set targets in future.
3. Adoption and publication of ambitious targets for renewable energy and/or carbon emissions for Council operations. The chart below shows the status of target-setting by local councils in NSW (as at June 2019). A total of 17 councils in NSW, plus the ACT have set ambitious goals for renewable energy and/or carbon emissions – typically 50-100% renewable energy or renewable electricity, and some net zero emissions targets are seen. As a sustainability leader, Randwick City Council has also set targets to source 100% of its stationary energy from renewables by 2030 and to attain net-zero emission by 2030. Most local councils have energy and/or sustainability plans in place for their operations.

¹¹ <http://ssroc.nsw.gov.au/projects/>

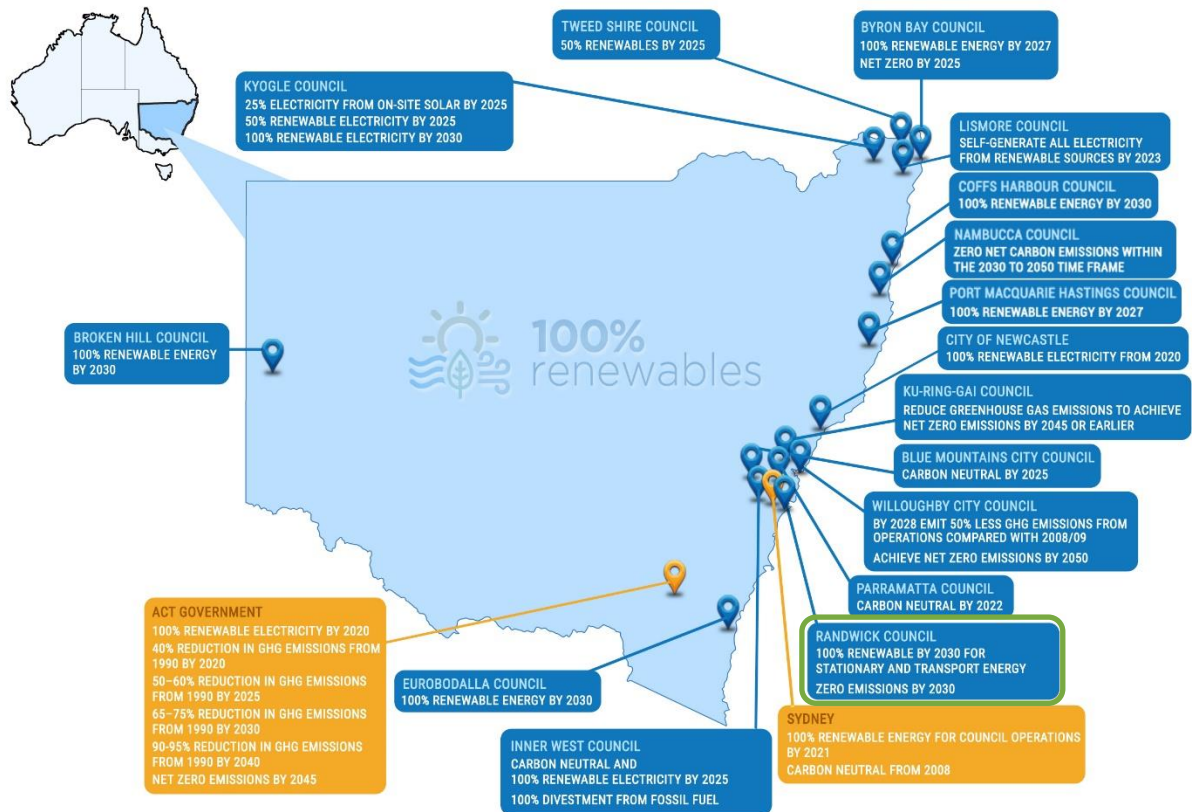


FIGURE 18: RENEWABLE ENERGY & CARBON TARGETS BY NSW COUNCILS

There has also been an increasing trend of local communities setting their own targets, and Councils developing plans and targets to help their communities increase the uptake of renewables and reduce their emissions.

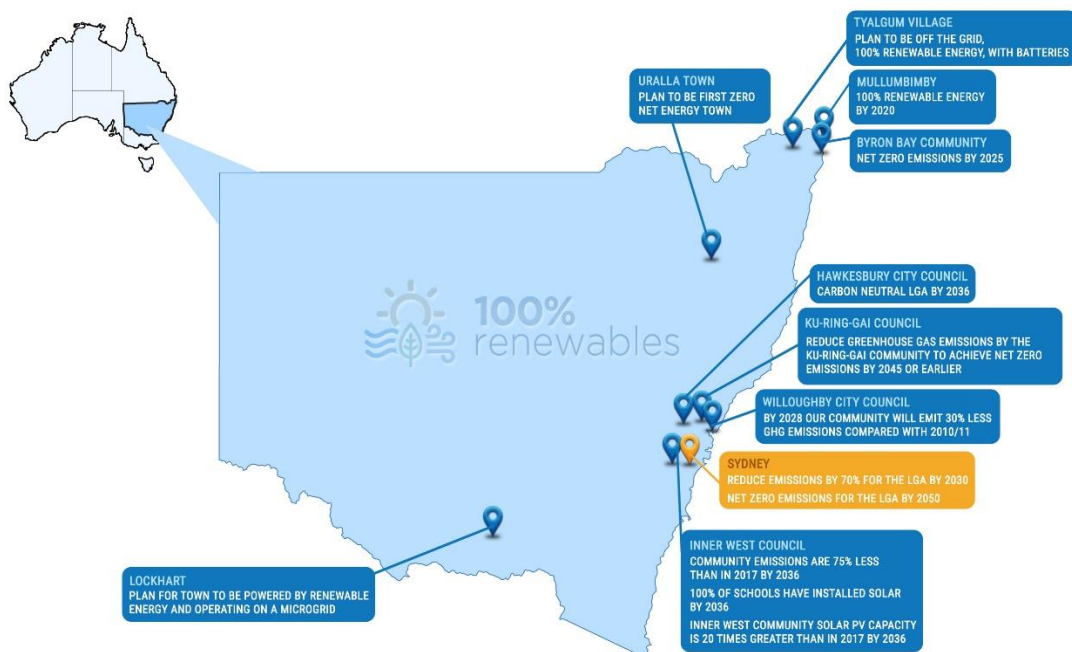


FIGURE 19: RENEWABLE ENERGY & CARBON TARGETS BY NSW TOWNS AND COMMUNITIES

Part 3

Council's energy use, carbon footprint and forecast emissions

3 Energy use and greenhouse gas emissions

3.1 Energy and emissions boundary

The focus of this Council Roadmap is energy-related, including electricity, natural gas and vehicle fuel used by Council in its operations. Emissions from these sources are included across all “scopes” – that is:

- Scope 1: direct combustion of fuel on Council sites or in Council vehicles,
- Scope 2: electricity supplied to Council’s sites from the grid, and
- Scope 3: upstream emissions associated with the provision of energy and streetlighting services to Council.

3.2 Randwick City Council’s 2017-18 energy and carbon footprint

Data supplied by Council was used to develop Randwick City Council’s energy and carbon footprint for the 2017-18 financial year (tabulated below). Overall this shows that Council operations consumed 75,845¹² gigajoules (GJ) of energy, resulting in greenhouse gas emissions of 12,295 tonnes of carbon dioxide equivalent (t CO₂-e).

This equates to 1% of the total estimated GHG emissions by the Randwick LGA.

TABLE 3: RANDWICK CITY COUNCIL ENERGY & CARBON FOOTPRINT 2017-18

Emission Source	Energy (GJ)	Activity Data	Units	Scope 1 t CO ₂ -e	Scope 2 t CO ₂ -e	Scope 3 t CO ₂ -e	Total t CO ₂ -e
Diesel for fleet	19,343	501	kL	1,364		70	1,433
Petrol for fleet	8,662	253	kL	586		31	617
Ethanol for fleet	153	7	kL	0		0	0.06
Biodiesel	189	5	kL	0		0	0.5
LPG	137	5	kL	0		0	0.5
Natural Gas	11,706	11,706	GJ	603		159	762
Electricity used in Council facilities	18,306	5,084,996	kWh		4,221	610	4,831
Electricity Streetlighting	19,236	5,343,240	kWh			5,076	5,076
Electricity from Solar PV ¹³	861	239,300	kWh				0
TOTAL	78,593 GJ			2,553 t CO₂-e	4,221 t CO₂-e	5,947 t CO₂-e	12,721 t CO₂-e

Energy use and emissions from Council’s operations are dominated by electricity from the grid, used to supply Council’s assets/facilities as well as streetlights. This is illustrated in the charts below.

¹² Council also consumed 137GJ of LPG in 2017-18 which is not included in this assessment as it is not material.

¹³ Inclusive of the 11 sites on the Solar Analytics portal at time of reporting

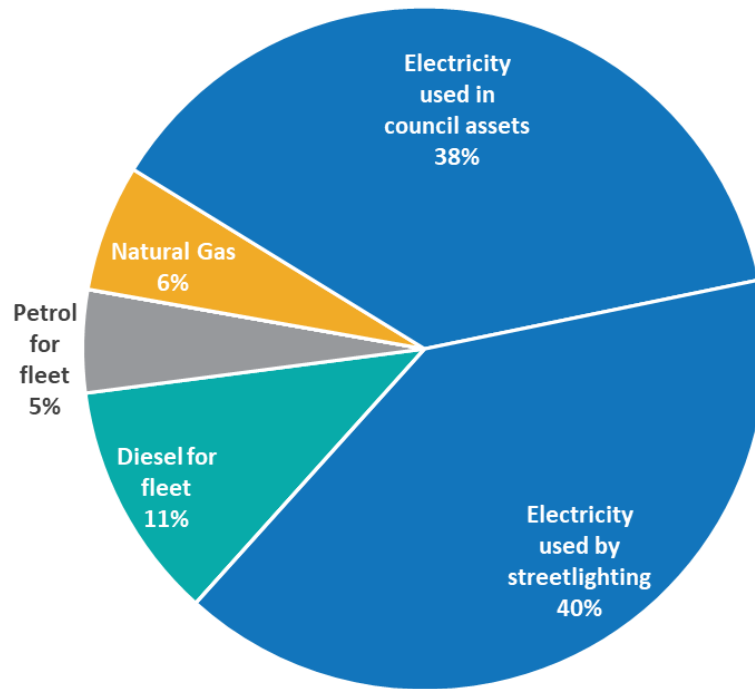


FIGURE 20: RANDWICK CITY COUNCIL'S ENERGY USE 2017-18 BY MAJOR ENERGY TYPE

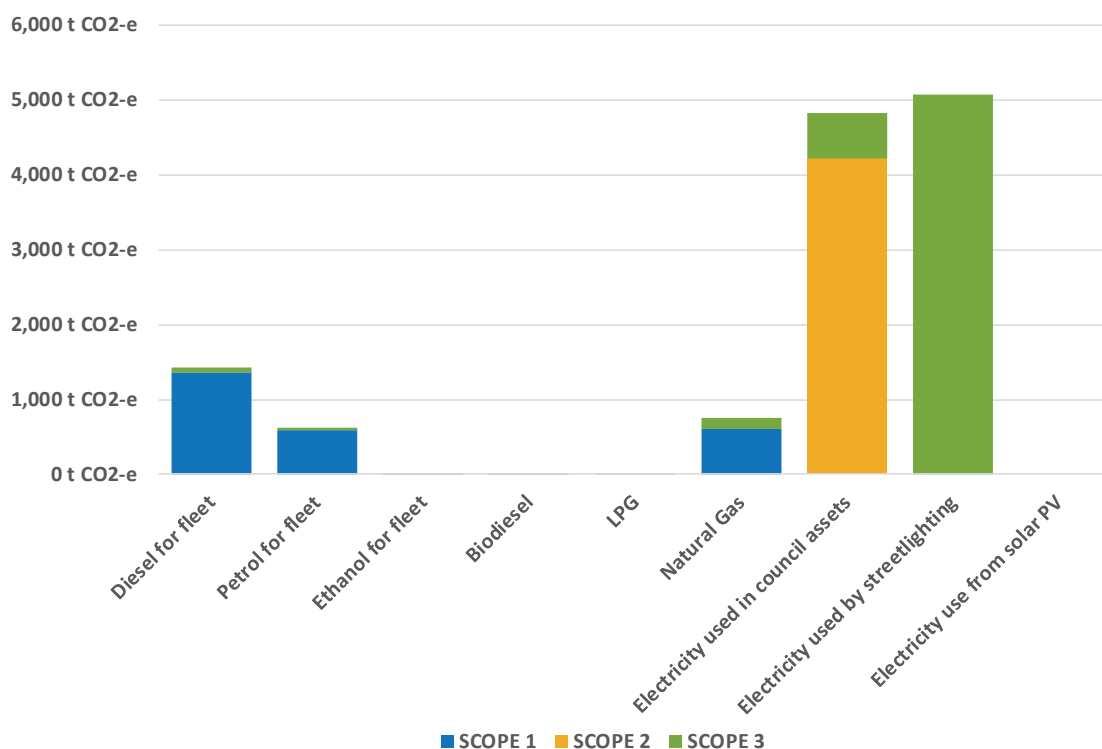


FIGURE 21: RANDWICK CITY COUNCIL'S CARBON FOOTPRINT 2017-18

The carbon footprint chart above shows that 78% of Council's emissions are related to electricity consumption, with 12% due to diesel fuel consumption by Council's road plant and trucks. Just 6% of emissions result from the consumption of natural gas, largely for pool heating at Des Renford Leisure Centre.

3.3 Energy end-use in Council operations

It is useful to develop an understanding of the end-use of energy in order to inform the identification and development of opportunities to increase renewable energy and reduce emissions.

- Diesel and petrol are used for heavy/light commercial and for passenger vehicles respectively.
- Natural gas is used for water heating, with 94.5% consumed for pool heating at the Des Renford Leisure Centre, 5% consumed at the Council Administration Centre for space heating and the remaining natural gas consumed at Coogee Oval, the Prince Henry Centre, and Randwick Community Centre.
- Electricity demand for Council is summarised in the charts below, highlight the following:
 - The top 10 grid-electricity consuming sites (including streetlighting) account for 94% of grid electricity demand. Of these streetlighting (53%), Des Renford Leisure Centre (14%), the Administration Centre (11%) and Bowen Library (8%) are the major energy-using accounts.
 - Understanding end-use of electricity is important as it can help to target areas for identification and evaluation of abatement opportunities. An analysis of electricity use drawing on experience from previous audits and other Councils indicates that lighting (for streets, buildings, parks) is the dominant use of electricity.

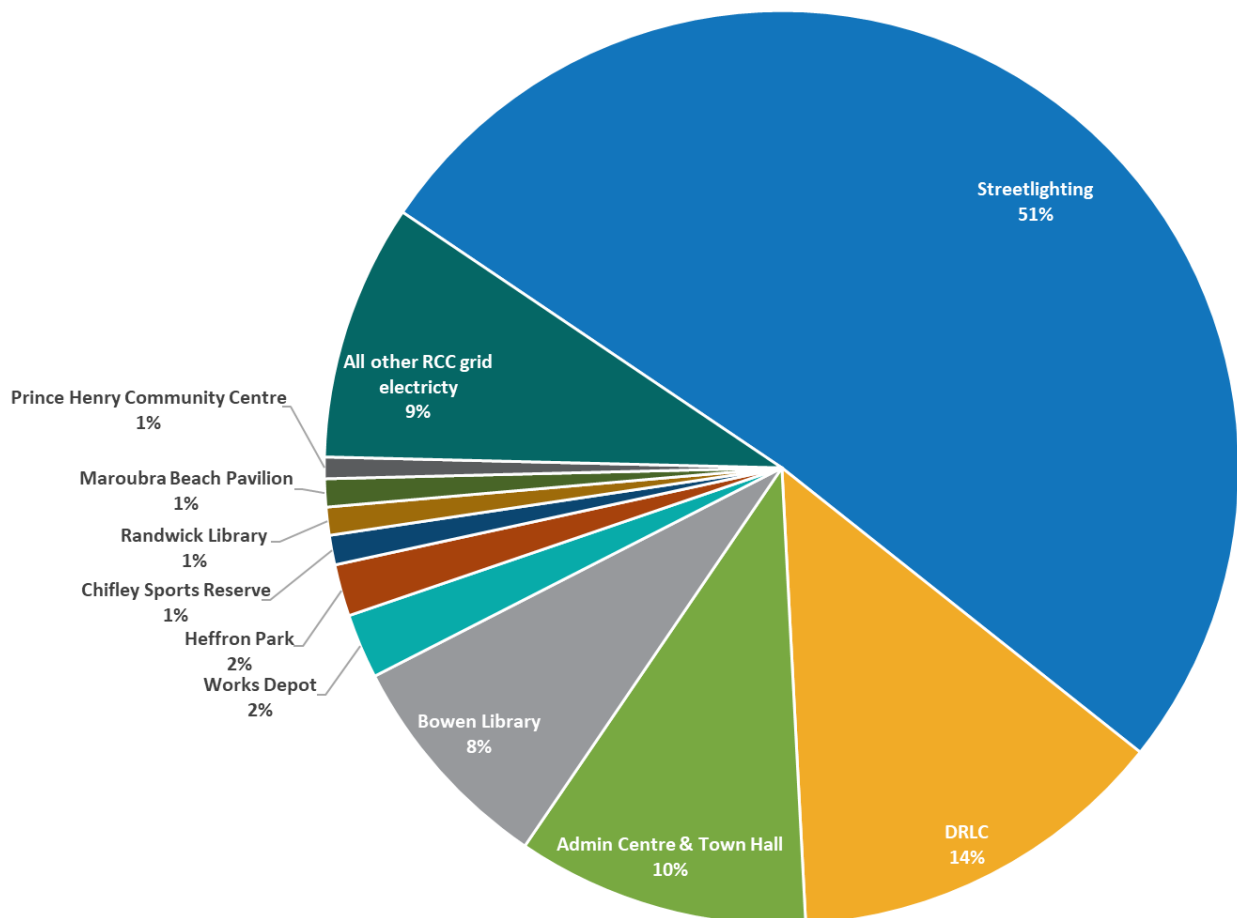


FIGURE 22: RANDWICK CITY COUNCIL GRID ELECTRICITY USE BY TOP 10 ACCOUNTS

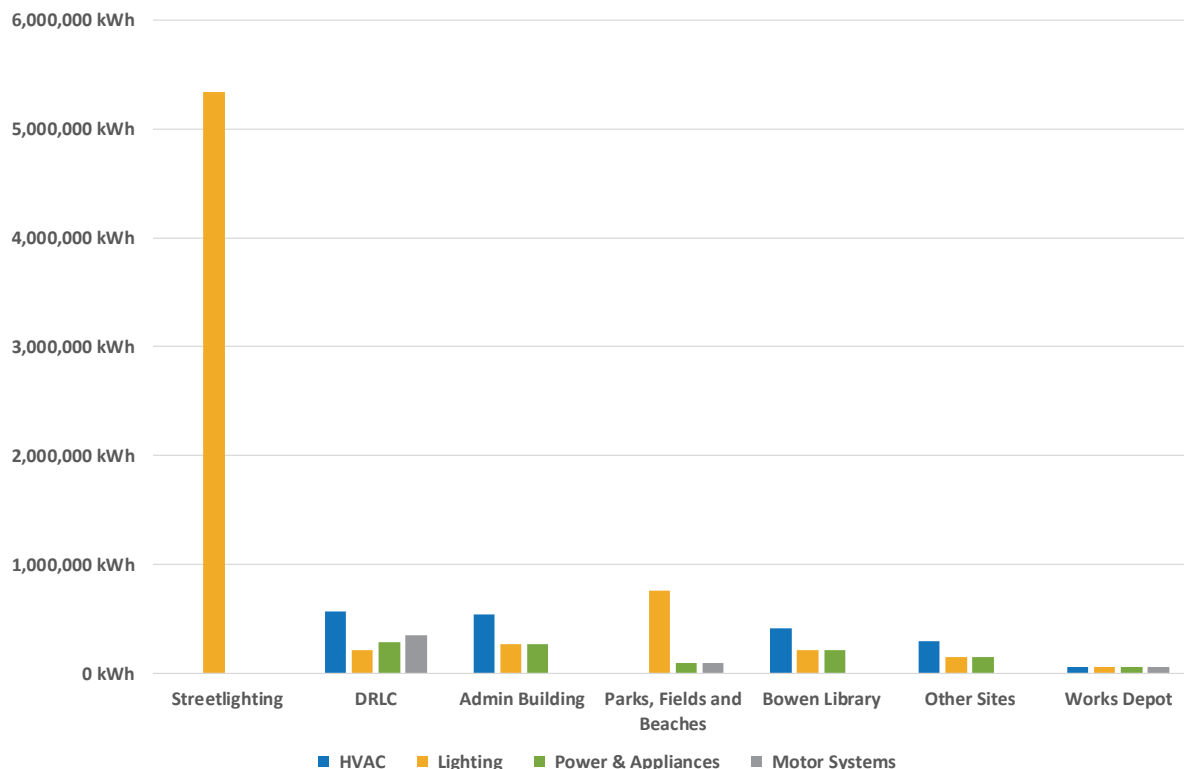


FIGURE 23: RANDWICK CITY COUNCIL ELECTRICITY END-USE ESTIMATE

3.4 Randwick City Council's historical consumption

Randwick City Council has been tracking its energy consumption for many years. Data provided by Council and extracted from the Azility platform allows for an analysis of energy use and greenhouse gas emissions from fleet and facilities, covering petrol, diesel, LPG, natural gas and electricity.

The four charts below highlight the following overall trends:

- Vehicle fuel use has remained steady over the period 2011-12 to 2017-18, with the three main changes including:
 - Reduction in biodiesel volumes as B20 supplies have fallen and been replaced by a B5 blend at Council's depot
 - A trend towards diesel vehicles and away from petrol, and
 - A phasing out of LPG consumption by Council's fleet
- Electricity use has seen little overall change since 2005—06, with savings made as a result of actions by Council serving to limit growth in energy demand as Council's services have increased.
- High apparent growth in natural gas demand in recent years is the result of both extended opening times of the 50m outdoor pool and more complete data sets for the Des Renford Leisure Centre

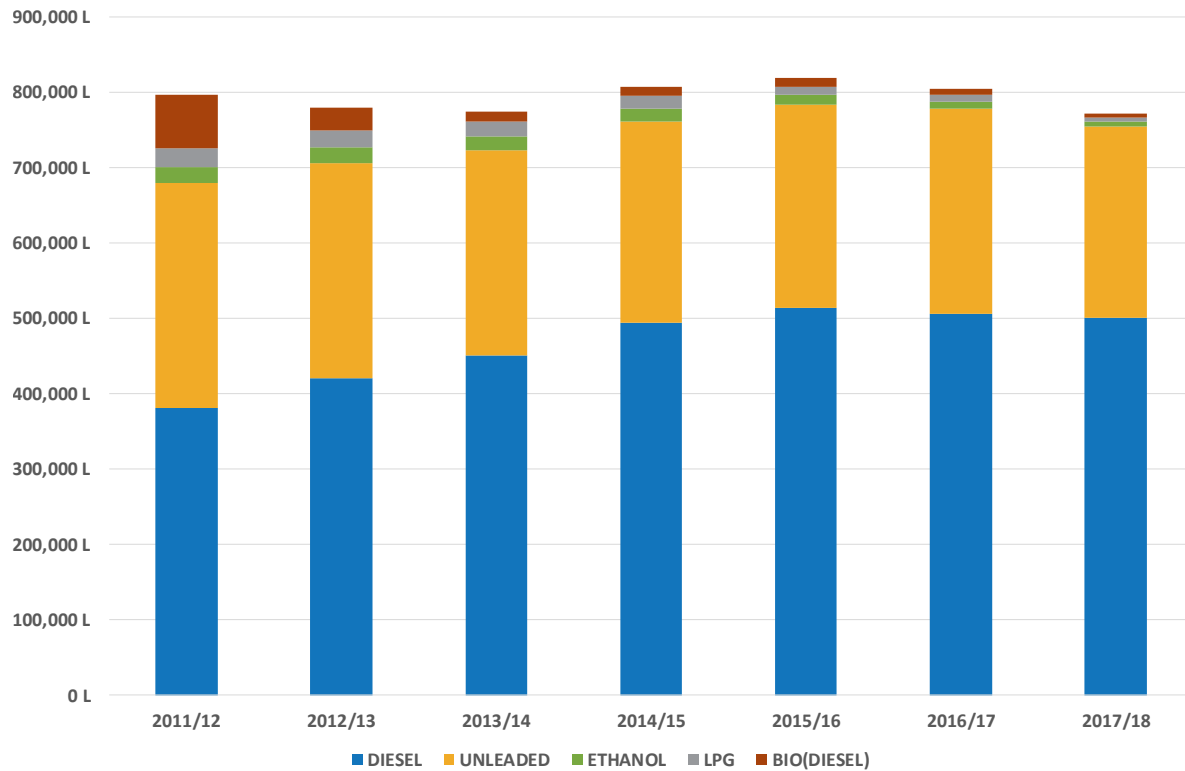


FIGURE 24: RANDWICK CITY COUNCIL HISTORICAL FUEL CONSUMPTION

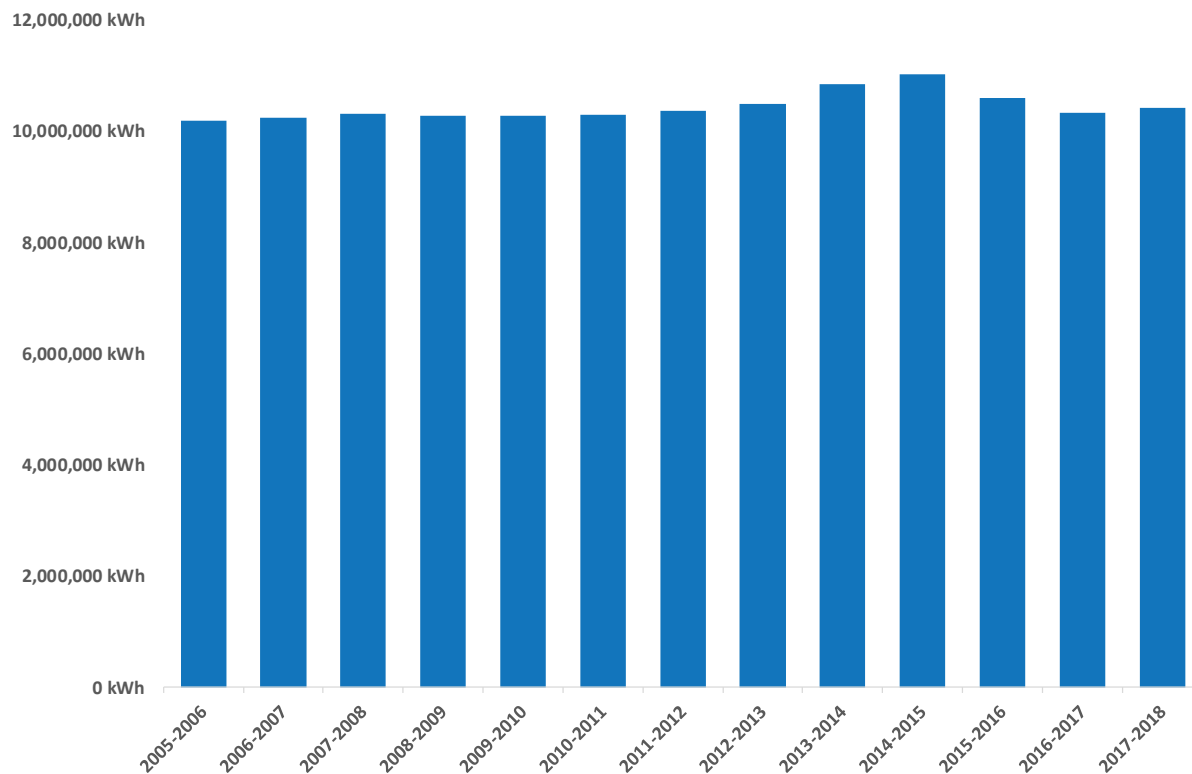


FIGURE 25: RANDWICK CITY COUNCIL HISTORICAL ELECTRICITY CONSUMPTION

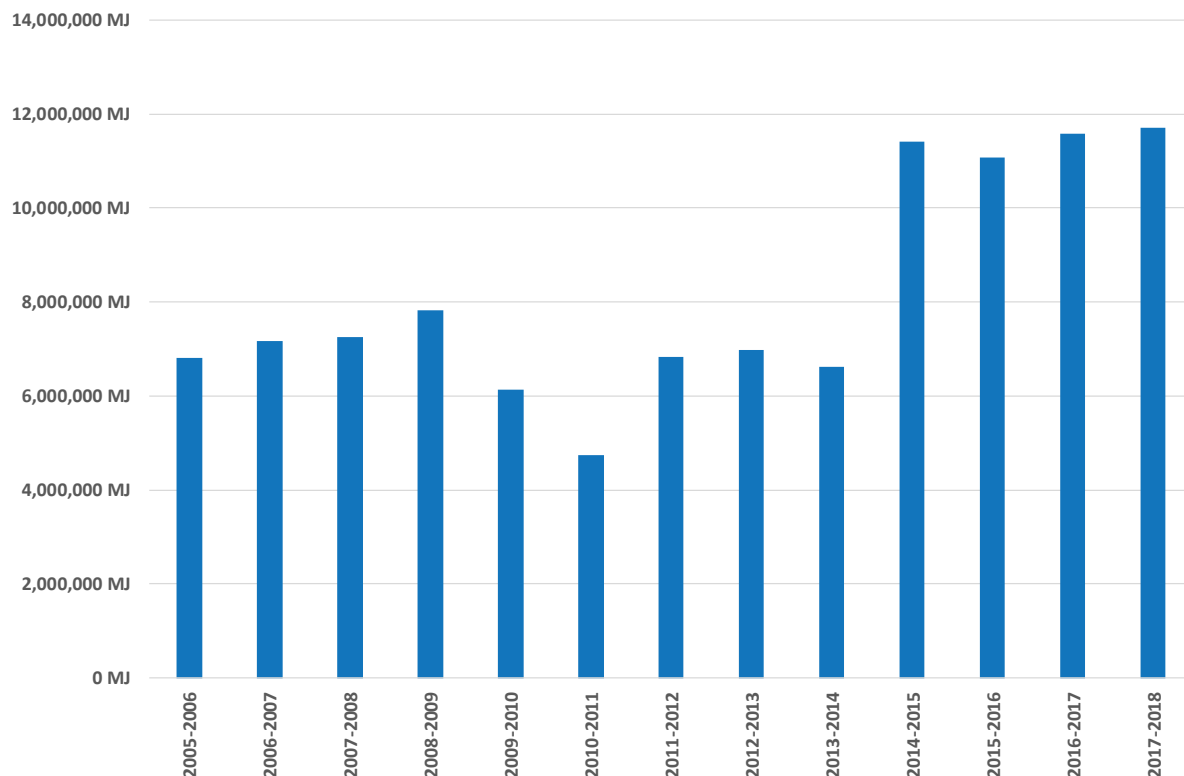


FIGURE 26: RANDWICK CITY COUNCIL HISTORICAL NATURAL GAS CONSUMPTION

3.5 Randwick City Council forecast business-as-usual carbon footprint

The Randwick region is a growth area, and as such energy demand and emissions in Council's operations to service the LGA will not remain static. Three factors will most likely influence Council's future demand for fossil-fuel energy and associated emissions in the absence of further abatement action by Council. These include:

- Population growth as estimated by the Department of Planning and Environment, from 2011 out to 2036.
- Asset changes to occur within Council's portfolio – including major new-build and expansion projects that may have an impact on Council's energy demand, and 'smart city' initiatives that may see more and more devices connected to assets such as streetlights.
- Grid decarbonisation – both the Renewable Energy Target (RET) and most forecasts of long term (2050) carbon intensity of the electricity grid show a pathway towards a grid that is largely supplied by renewables.

3.5.1 Population

The estimated resident population of Randwick City Council in 2016 was over 146,000 and is expected to grow to over 167,950 by 2031 and 180,150 by 2036 (1.16% pa). This can impact on Council's energy demand in a number of ways – through the increased demand for more road maintenance and parks maintenance, new streetlighting for new sub-divisions, and higher demand for Council's community services facilities, sporting fields and the like.

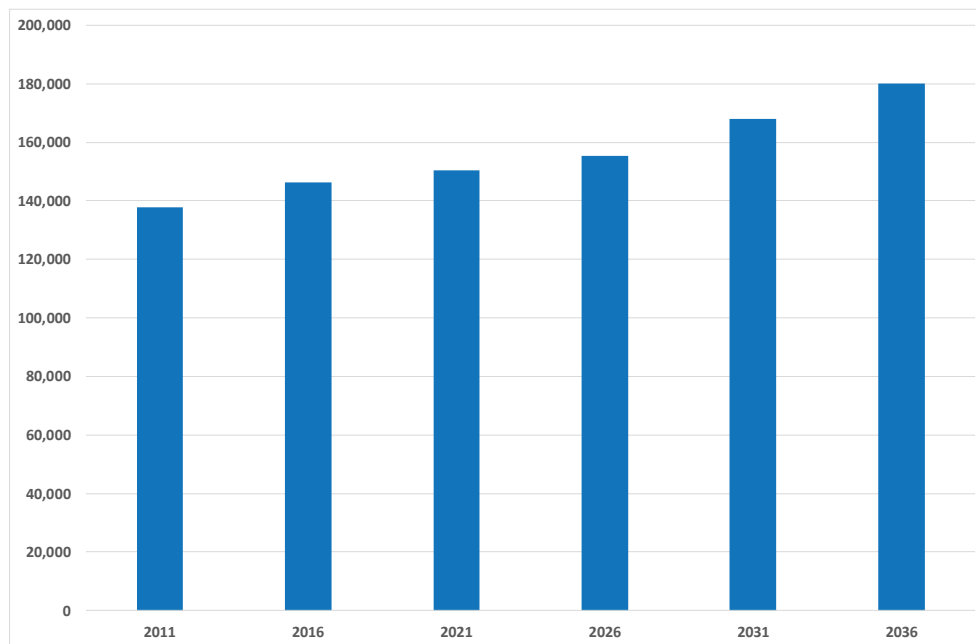


FIGURE 27: POPULATION GROWTH IN RANDWICK CITY COUNCIL OVER FROM 2011-2036¹⁴

3.5.2 Asset changes

Known and expected asset changes include:

- Heffron Park continued re-development,
- Development of the South Sydney Rabbitohs NRL Centre of Excellence,
- Planned refurbishment of Council's admin building, including air conditioning and lighting.
- Smart city infrastructure implemented progressively.

3.5.3 Grid decarbonisation

For NSW, a mid-range forecast is made of grid carbon intensity based on:

- Achievement of the RET of 20% renewables for the state by 2020,
- 80% renewables for NSW by 2050, with a straight-line decrease in emissions from 2020 to 2050 (this is a high-level estimate and actual changes in carbon intensity of the grid in NSW will most likely be characterised by gradual change as more renewables are built and step changes as large fossil-fuel assets are retired over time. The purpose is to illustrate potential contribution to decarbonisation by the grid, and Council may wish to review this from time to time to check grid carbon intensity trends and their impact on Council's task to reach net-zero emissions).

3.5.4 Net projected energy demand and carbon emissions for Randwick City Council

For the purpose of this work the following BAU growth forecasts for energy demand were applied in addition to the above forecast of grid GHG intensity for NSW:

- Council facilities and fleet 1% per annum increase & streetlighting 0.5% per annum increase.

Applying the above changes to the base year energy in 2017-18 sees the following outcome.

- An overall increase in energy demand from 78,593 GJ to 88,246 GJ in 2030, a 12% increase.

¹⁴ Department of Planning and Environment projections to 2036

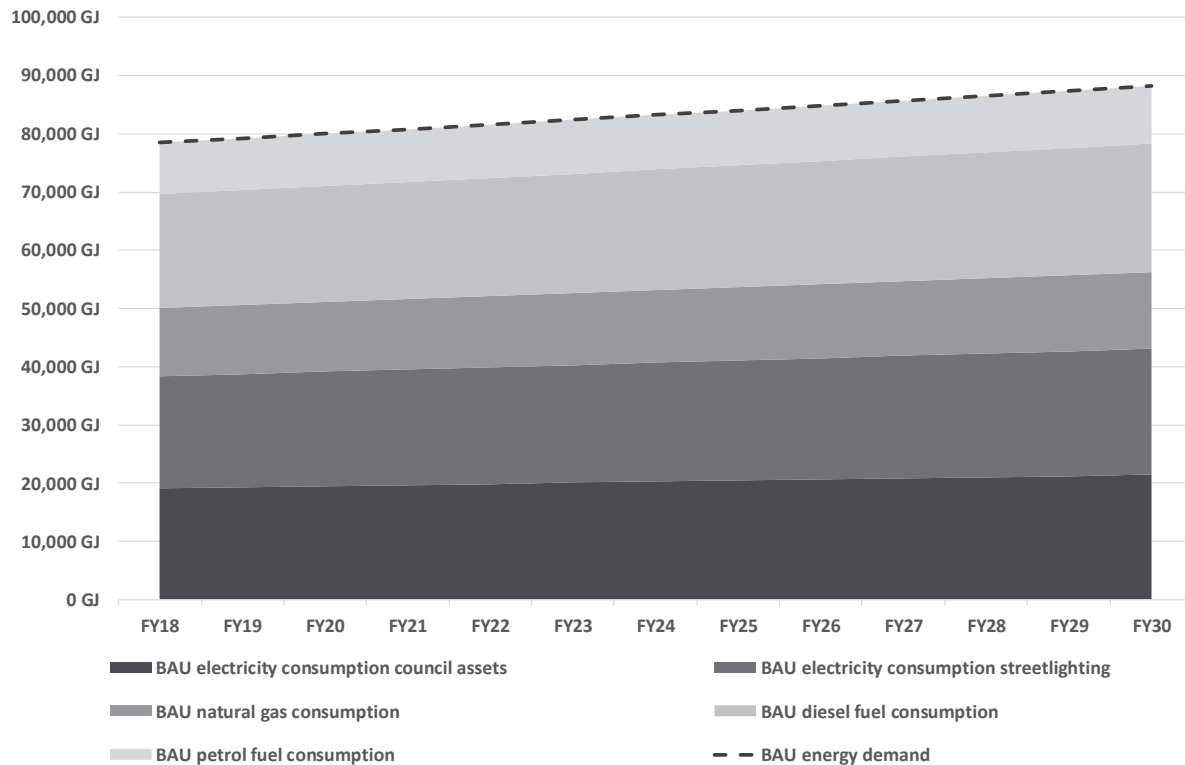


FIGURE 28: RANDWICK CITY COUNCIL BAU ENERGY PROJECTION 2017-18 TO 2029-30

However, owing to the expected changes to the carbon intensity of the electricity grid, Randwick City Council's business-as-usual GHG emissions may decrease by 13% by 2030.

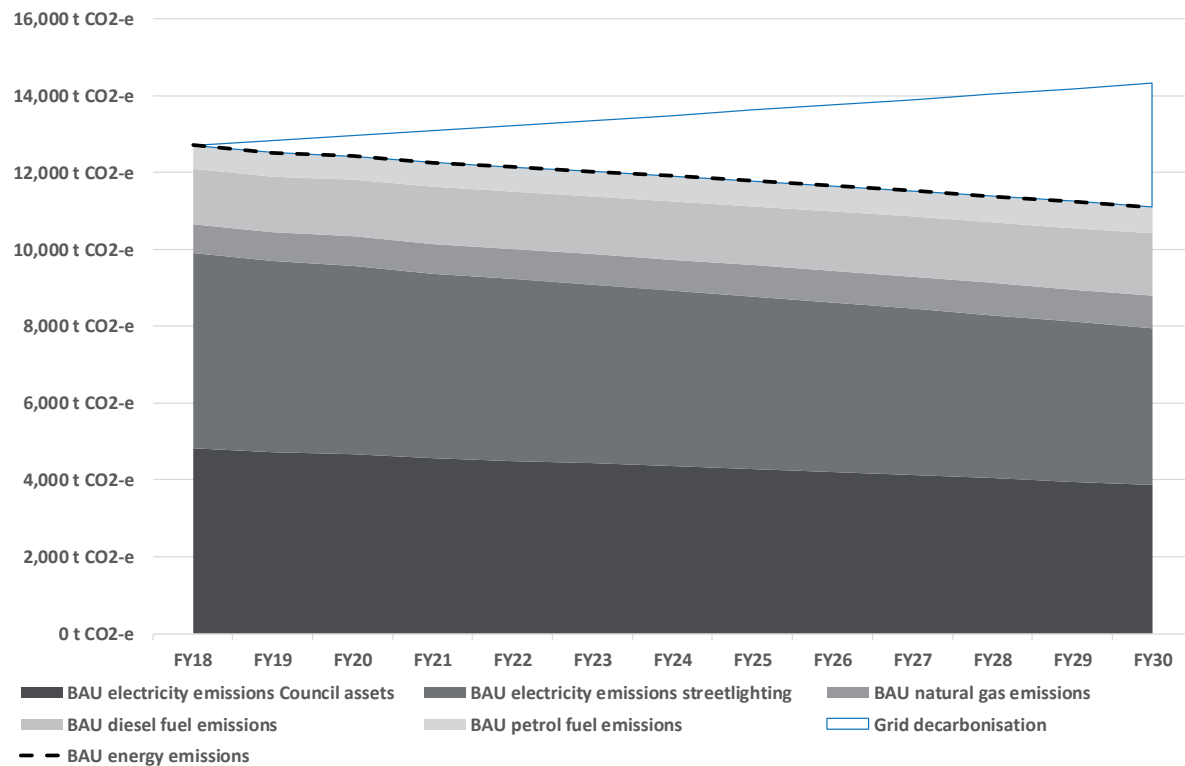


FIGURE 29: RANDWICK CITY COUNCIL BAU EMISSIONS PROJECTION 2017-18 TO 2029-30

Part 4

Assessment of Council's sites

4 Randwick City Council site visits & stakeholder engagement

Randwick City Council's top energy using sites were visited to understand operations and planned works. Site data was reviewed to develop estimates of energy-saving opportunities and renewable energy opportunities that can lower Council's carbon footprint. Other smaller sites such as the Kensington Community Centre and Prince Henry Centre were also inspected for energy-saving and renewable energy opportunities. The following table summarises the sites that were visited as part of this work. The following section is a more detailed summary of the findings for Council's four largest energy-using sites and streetlighting, which account for 89% of electricity use and nearly 100% of gas use, and a suggested schedule for implementation of energy efficiency and renewable energy over the next several years.

TABLE 4: RANDWICK CITY COUNCIL SITES WHICH WERE VISITED FOR THE RENEWABLE ENERGY ROADMAP

Site Name	Consumption FY2017-18	Observations
Des Renford Leisure Centre	1,406,473 kWh 11,007,837 MJ	Gas is used to heat the Training, Competition and Dome pools, with new Evo C200 heat pumps heating the outdoor 50m pool. Filter pumps are all fixed-speed driven, as are indoor ventilation systems. Solar matting on the roof of the facility is no longer operational. A 30 kW solar PV system was installed on the roof of the new gym. Voltage Optimisation was implemented recently.
Council Administration Centre and Town Hall	1,076,980 kWh 604,535 MJ	The central ventilation plant is original and constant volume, and the chillers and auxiliaries are also old and due to be replaced. The majority of lighting is twin 36W linear fluorescents, housed in full-panel luminaires that previously held quadruple fluorescent lamps. Building management controls are basic but effective at limiting out-of-hours energy waste. Significant changes have been made to IT systems following 2017-18, with most of the server infrastructure moved offsite to 3 rd party providers. A 10 kW solar PV system is on the roof of the site.
Lionel Bowen Library	829,020 kWh	High energy demand at Bowen is due to an aging HVAC system with several controls that are faulty leading to excessive out-of-hours energy use, older linear fluorescent lighting, and IT systems. During the course of the Roadmap development lighting has been upgraded to LED, IT systems energy demand has been significantly reduced and quotes have been sought to reduce out-of-hours energy use. A 30 kW solar PV system is on the roof of the site. Several split air conditioning units supplement the main units, and many of these are in poor condition. Voltage Optimisation was implemented recently.

Site Name	Consumption FY2017-18	Observations
Randwick Council Depot	239,086 kWh	A 48 kW solar PV system and LED lighting in the main warehouse were implemented in recent years; however the offices and workshop sections use mostly fluorescent lighting. A water treatment plant recovers and reuses truck washdown water.
Heffron Park	231,047 kWh	Energy use at Heffron Park has increased significantly in recent years through development of new amenities, sporting field lights and parking. There are more than 200 HID lights and 34 LEDs across sporting fields, around 40 carpark lights and several amenities blocks. More sporting fields are being developed alongside the Heffron Centre development on Bunnerong Road.
Randwick Branch Library	95,823 kWh	T5 and compact fluorescent lighting service the site. Council's meter includes lighting, power and ventilation, including electric duct heating. Chilled water is likely to be provided by the shopping centre. A single 7-day time clock controls ventilation from 6:30am to 11pm.
Maroubra Beach Pavilion	89,063 kWh	The Pavilion is a small consumer of energy, mostly for indoor fluorescent lights and appliances. The major energy demand is for carpark and beachfront HID lighting. It is understood that the beachfront lighting poles are old and may be due for replacement, making an upgrade to LED lighting feasible.
Chifley Sports Reserve	87,382 kWh	This sporting facility was developed in recent years. Sporting field and carpark lights are older HID technology and will account for the majority of energy use.
Prince Henry Community Centre	70,819 kWh	A 30 kW solar PV system, T5 lights and relatively new air conditioning systems are installed at the Prince Henry Community Centre. Battery storage is proposed in future to capture export solar, as the centre have intermittent energy demand due to bookings for its function rooms.
Pioneers Park	64,794 kWh	Older HID lighting for the rugby and AFL fields is due to be upgraded in the short term, providing an opportunity to implement an energy-efficient LED lighting solution that could pave the way for this to be adopted across Council's fields.
Coogee Beach lights	28,047 kWh	Beachfront lights are understood to be mercury vapour or metal halide technology.
Macartney Oval	22,996 kWh	This account includes much of the public lighting and street lighting serving the new apartment developments in this area, in addition, to park lighting and irrigation.

Site Name	Consumption FY2017-18	Observations
Nagle Park	20,638 kWh	HID lighting is provided at these fields, representative of sporting fields across the LGA.
Kensington Oval	19,769 kWh	
Coogee Oval	18,244 kWh	Dressing rooms, club offices and medical rooms use lighting and appliances. A small hot water boiler behind the grandstand supplies hot water to showers. An ice making machine is also at the site.
Groundsman Room / Grandstand		
Moverly Child Care Centre	14,875 kWh	An older solar 2 kW solar PV system is installed. Most lights are linear or compact fluorescent.
Coogee Oval	10,844 kWh	HID lighting is provided at these fields, representative of sporting fields across the LGA.
Nursery	8,006 kWh	Council's nursery has a 7 kW solar PV system, its own water treatment plant to use rainwater in the plant nursery, and soil heating.
Randwick Community Centre	6,843 kWh	Most energy use is for lighting and appliances. A 5 kW solar PV system and a small 2.4 kW wind turbine supplement grid power to the site. The site includes a sustainability centre.
La Perouse Museum	4,413 kWh	Most energy use is for lights and some appliances.

In addition to site visits, a number of face-to-face meeting were held with key Council stakeholders across a range of facility types and functional areas, to identify and discuss potential short, medium and long term opportunities for energy saving and emissions reduction in line with Council's goals. The table below is a summary of the key stakeholder meetings.

TABLE 5: RANDWICK CITY COUNCIL STAKEHOLDER MEETINGS

Facility type/s and/or function	Key areas of discussion
Sporting fields	<ul style="list-style-type: none"> LED lighting opportunities for new field activation and refurbishment. Other councils have instituted an LED policy for new sporting fields, and most suppliers can deliver both 'standard' HID as well as LED solutions. As sporting field lights are changed infrequently due to low utilisation, implementing an LED policy is recommended as a way of ensuring consistency in future projects. Pioneers Park upgrade and ongoing works to develop Heffron Park were highlighted as projects where LED lighting can potentially be implemented to better understand the costs and benefits before committing to a policy for all future field upgrades.

Facility type/s and/or function	Key areas of discussion
IT services	<ul style="list-style-type: none"> IT policies and actions are consistent with Council's approach towards reduced energy demand. As highlighted above: <ul style="list-style-type: none"> Replacement of the last remaining desktop computers with small NUC computers, and reduced the number of iPads from 130 to 10 to provide an overall saving in energy usage. Replacement of Council's monitor fleet (approximately 1000 monitors) with the Dell P2419H monitors which consume 18W operational which is much more efficient than the older monitors (HP EliteDisplay E221) which used 36W. Reduction in electricity consumed in the datacentre at Bowen Library and the Administration building by moving the datacentre offsite, resulting in a 19kW demand reduction. All phones, computers, laptops etc. have power management settings as per the Group Policy. Devices per person was rationalised from up to 5 to 4 (Surface Pro, phone and two monitors). Continual reduction and consolidation of printers across all Council buildings as Council operations become digital.
Fleet	<ul style="list-style-type: none"> Council currently has six electric bikes, two electric cars and several hybrid vehicles for staff use. Greater use of biodiesel would result if more vehicles refuel in the depot, though limited space is an issue. Council will adopt a policy to see all new vehicles be hybrid or electric by 2022.
Procurement	<ul style="list-style-type: none"> Updating Council's procurement policy – e.g. to align with 2017 sustainable procurement guidance for NSW councils – is feasible, but influencing staff and teams who develop briefs and specifications for projects and services is as, if not more important. Influencing major projects can help to ensure that best practice energy efficiency and renewables is built into major new projects. Influencing facilities management can help to ensure that replacement of minor equipment (appliances, air conditioners, etc) are energy efficient. Ongoing education internally should be an integral part of efforts to improve Council's sustainable procurement.

Facility type/s and/or function	Key areas of discussion
Streetlighting	<ul style="list-style-type: none"> • An update and clarity on the scope of the proposed bulk lamp replacement was provided. • New LEDs and smart control functionality mean there is ongoing minor changes to the scope and budget for the initial upgrade. • Confirmation was received that ~15% of the lights have been upgraded to LED as part of spot replacements in recent years. • 3,943 streetlights will be replaced with LEDs in the current bulk replacement program (conservatively modelled from FY2023 but this may occur earlier). • It is reasonable to assume that nearly all streetlights will be LED in the medium term, and modelling assumes this occurs in FY2026.

Part 6

Randwick City Council's renewable energy opportunities & proposed implementation plan

5 Recommended actions at major sites

5.1 Des Renford Leisure Centre

5.1.1 Load profile of Des Renford Leisure Centre

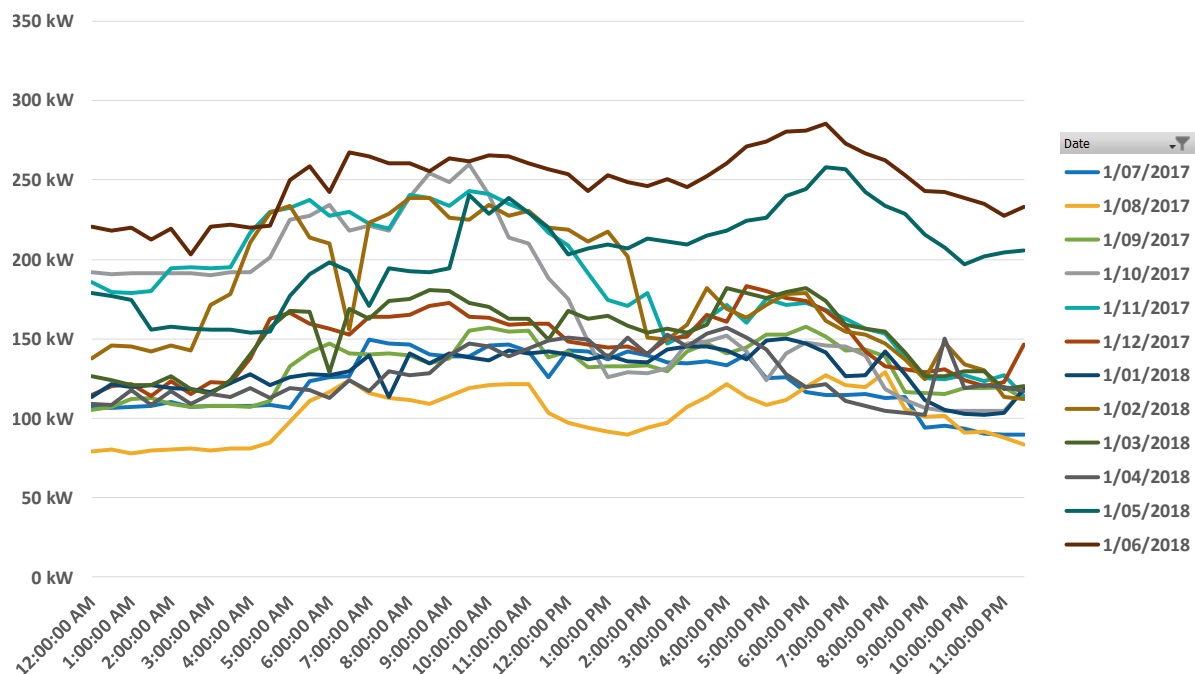


FIGURE 30: LOAD PROFILES DURING 2017-18 – DES RENFORD LEISURE CENTRE

Load profile data for the centre show the following:

- The new electric heat pumps were installed in August 2017. At that time (and in the preceding month) electrical demand at the centre was typically in the range 80-130 kW. In the months of May and June 2018 demand was in the range 200-280 kW, highlighting the impact of the heat pumps in colder months.
- During summer months the change in demand is far more modest since pool heating requirements allied to pool blankets leads to low requirements for supplementary heating of the main pool.
- The base demand prior to the implementation of the heat pumps shows the demand for pool pumps and ventilation systems, UV lighting, as well as base lighting & power demand (e.g. for emergency lights, appliances, server & comms systems, etc).
- Typical warm month profiles show increasing demand from early morning as gym, ground floor studios, café, pool and amenities are opened for use. Heat pumps often have higher demand in the mornings, with low demand in the afternoon. As days get cooler heating is again required until blankets are placed on the main pool at the end of each day. This sees heat pump demand drop as blankets are often sufficient to avoid significant loss of heat at night.

5.1.2 Energy management & renewable energy opportunities

A range of opportunities were identified that Council can assess and develop in coming years to reduce energy use and greenhouse gas emissions. These are tabulated below.

TABLE 6: ENERGY MANAGEMENT & RENEWABLE ENERGY OPPORTUNITIES - DRLC

Project type	Description
Solar PV	Install 70 kW solar PV. Structural assessment of the site has highlighted some limitations to use of roof space and rectification works that will be required so that the roof can be certified with solar PV. An additional 70 kW would bring the total for the site to just under 100 kW, thus allowing the upfront STC discount to be received.
	Install an additional 93 kW solar PV in the medium to long term. This represents the maximum additional solar PV that can be installed following the implementation of the above 70 kW system and would be subject to further structural assessment of other roof areas.
Fuel Switch	Replace the gas heater for the Dome pool with a heat pump. The gas boiler is in good condition and this may be feasible at the end of the boiler's life or if gas v electricity prices and heat pump efficiency make a strong business case earlier.
	Replace the gas heater for the Competition pool and Training pool with heat pumps. The requirement for 4 x C200 kW heat pumps to service the 50m pool can be assessed as part of an evaluation of heat pump options for the main indoor pools. The gas boiler is in good condition and this may be feasible at the end of the boiler's life or if gas v electricity prices and heat pump efficiency make a strong business case earlier.
	Disconnect all gas devices (chipper and amenities hot water) – this would be a last step if the gas boilers are replaced with heat pumps.
VSD Control	Install a VSD on the 50m pool filter pump
	Install a VSD for the Dome pool ventilation fan linked to the Dome opening mechanism and/or relative humidity.
	Install VSDs for the Competition pool and Training pool pump
	Install VSDs for the Competition pool and Training pool ventilation fan linked to relative humidity in these spaces
Power Supply	Reinstall new power factor correction units to correct the main incoming supply to 1.0. This will not save energy demand but would be a cost-effective demand reduction measure.
Lighting	Replace Competition pool deck lighting with LED floodlights
	Replace Training pool deck lighting with LED floodlights
	Upgrade amenities and studio and office T5 lighting with LED
	Replace tower lighting with LED as part of routine maintenance
UV Technology	Replace UV sterilisation for the Dome, Competition and Training pools with new systems. Monitor developments in ultraviolet light-emitting diodes (UV-LEDs) for water disinfection.
Out-of-hours demand	Implement shut down procedures to minimise night demand.

These measures could reduce electricity consumption by more than 400 MWh of electricity as well as all of the site's gas consumption (11,007 GJ per year). Initial estimates developed as part of this project indicate that investment of more than \$1 million could result in cost savings of more than \$180,000

per year. Estimated itemised costing of the Renewable Energy Roadmap can be found in the Implementation Plan in the following section.



FIGURE 31: POSSIBLE SOLAR PV LOCATIONS (SUBJECT TO STRUCTURAL ANALYSIS) – DES RENFORD LEISURE CENTRE

5.2 Council administration centre and Town Hall

5.2.1 Load profile of administration centre & Town Hall

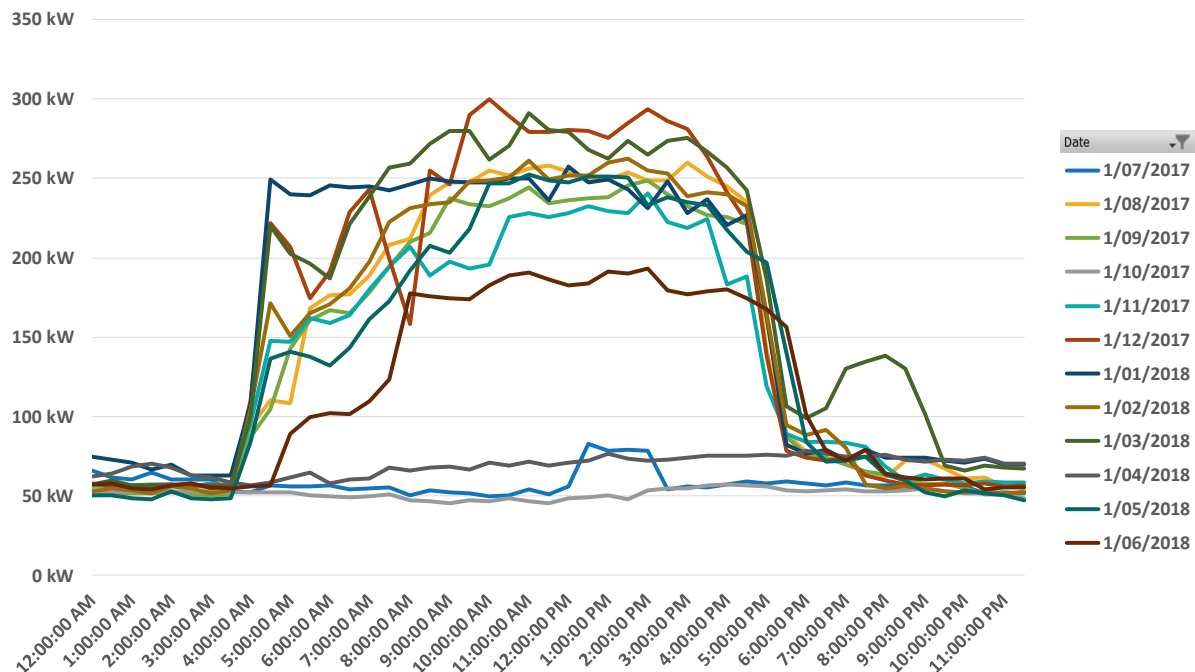


FIGURE 32: LOAD PROFILES DURING 2017-18 – ADMINISTRATION CENTRE & TOWN HALL

Load profile data for the facility show the following:

- Base demand throughout the baseline year was generally at around 50 kW with minor variations from time to time. Shut down procedures and controls appear to be effective. Base demand included the main server system, appliances in both the main building and the Town Hall kitchen, carpark, external and stairwell lights, as well as a high proportion of lights on each floor (based on a night audit).
- Load profiles suggest HVAC systems start operation quite early, at about 5am, and shut down is achieved by 6pm, excepting Council meeting days when late evening demand in Town Hall is evident in the profiles.
- Daytime demand for light, power and HVAC ranges from 230-300 kW, with highest daytime demand in summer as expected. Since space heating is supplied by three gas-fired condensing boilers there is no early morning 'spike' in electrical demand in winter.
- As noted above, HVAC and lighting systems are dated. A major project will be implemented in the short term to upgrade many of the facility's energy services, with the precise scope of work to be determined. This offers a unique opportunity to achieve a step-change in energy demand at the site by upgrading to energy efficiency best practice technologies.

5.2.2 Energy management & renewable energy opportunities

A range of opportunities were identified that Council can assess and develop in coming years to reduce energy use and greenhouse gas emissions. These are tabulated below.

TABLE 7: ENERGY MANAGEMENT & RENEWABLE ENERGY OPPORTUNITIES – ADMIN & TOWN HALL

Project type	Description
HVAC	Upgrade the central HVAC system – this project is committed and will be implemented in the short term. There is an opportunity within this project to implement energy-efficient best practice technology and controls that can significantly reduce the energy demand of the building.
	Upgrade older HVAC plant in Town Hall. The Chambers air conditioning was recently replaced and there will be opportunities to achieve further savings with the replacement of the three old systems serving other sections of Town Hall.
Solar PV	Install 40 kW solar PV on the roof of the Town Hall. This roof is quite new and the system would be fully absorbed on site.
Lighting	Basement level and stairwell lighting can be upgraded to LED technology with controls to minimise energy demand.
	Upgrade all Ground, level 1 and Level 2 lighting to LED technology. There may be an opportunity to implement this as part of planned HVAC upgrades. Current lighting is mostly full ceiling tile luminaires with integrated air conditioning. Hence upgrading to LED may require the ceiling also be replaced and this is under consideration.
	Upgrade all Town Hall lighting to LED technology. This has already been partially implemented in the hallway outside Chambers and in the upstairs foyer.
Out-of-hours demand	Reduce out of hours demand such as upgrade external lights to LEDs
IT	As noted above IT energy demand at the site has been significantly reduced through both outsourcing of servers and through demand control measures. The process of outsourcing IT services is continuing and further minor energy reductions are anticipated.

These measures could reduce electricity consumption by more than 500 MWh of electricity, subject to specifications and final decisions on HVAC plant replacement. The costs to upgrade the site are to be determined by the scope and successful tender bid for the HVAC (and potentially lighting) works. Cost savings of more than \$100,000 per year in energy and maintenance costs would result.

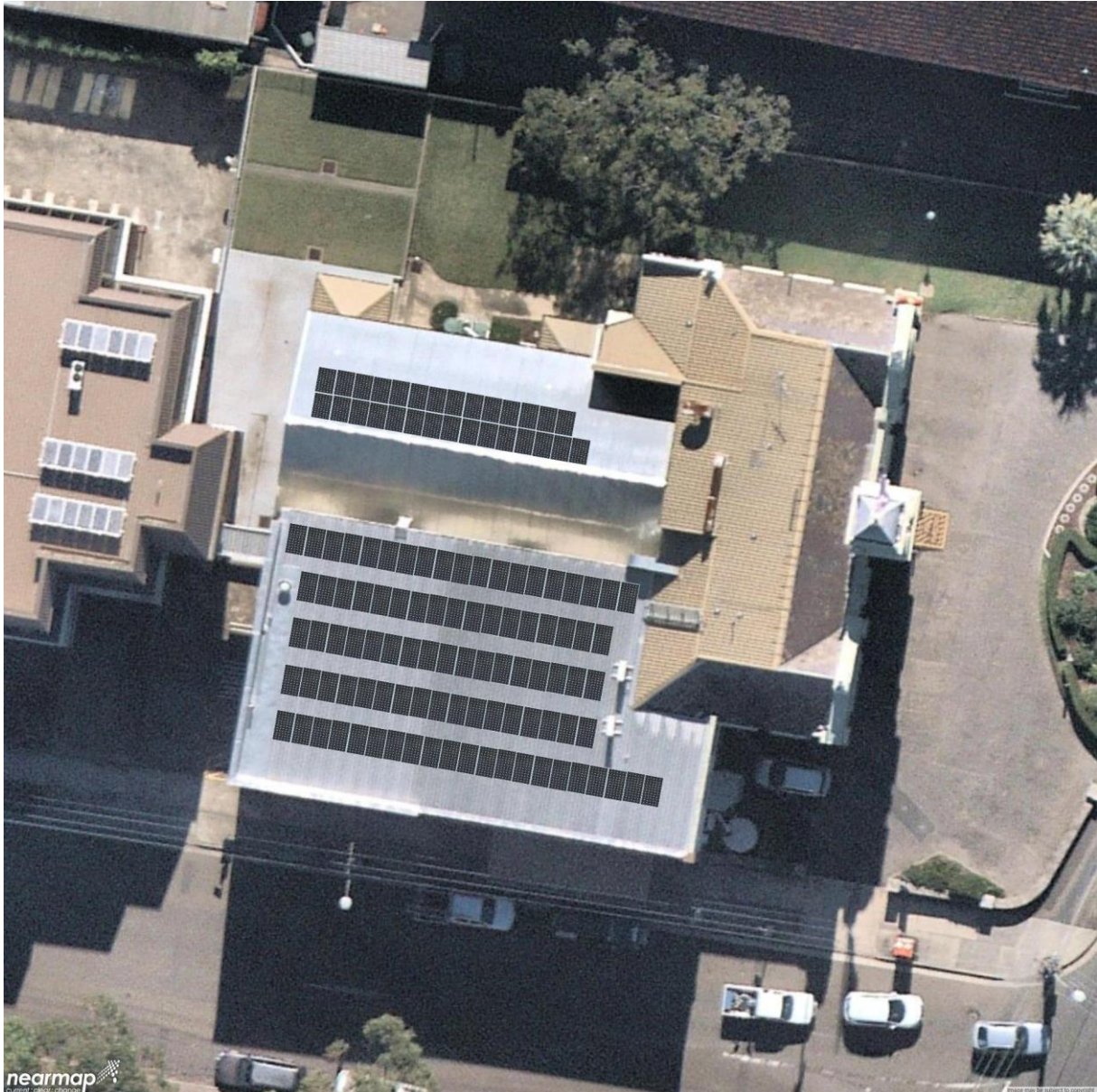


FIGURE 33: POSSIBLE SOLAR PV LOCATION (SUBJECT TO STRUCTURAL ANALYSIS) – TOWN HALL

5.3 Lionel Bowen Library

5.3.1 Load profile of Lionel Bowen Library

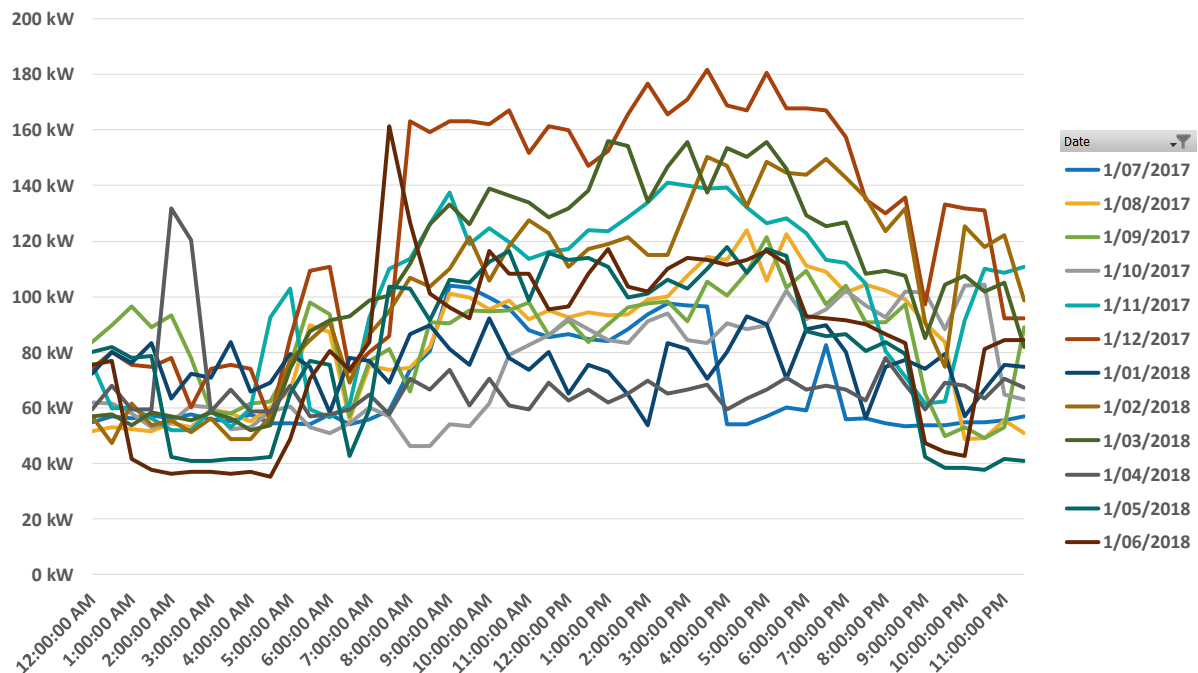


FIGURE 34: LOAD PROFILES DURING 2017-18 – LIONEL BOWEN LIBRARY

Load profile data for the library show the following:

- Base electrical demand at the library may actually be quite low once IT demand and emergency lights are taken into account. However, a low level of demand is rarely reached as it is apparent that control of mechanical equipment is quite poor. This was confirmed via a night audit which showed several air conditioning systems and the condenser pump operating.
- Daytime demand is highly variable and may reflect the old age and condition of both the main air conditioning units and the split systems.
- The above load profiles reflect the site with mainly linear fluorescent lighting. During the development of this roadmap, the lighting systems at the site have been wholly upgraded to LED technology, with a significant reduction in energy demand.

5.3.2 Energy management & renewable energy opportunities

A range of opportunities were identified that Council can assess and develop in coming years to reduce energy use and greenhouse gas emissions. These are tabulated below.

TABLE 8: ENERGY MANAGEMENT & RENEWABLE ENERGY OPPORTUNITIES - LIONEL BOWEN LIBRARY

Project type	Description
Solar PV	Install a further 30 to 45 kW solar PV which is likely to be absorbed on site.
Lighting	Whole building lighting upgrade to LED – this was recently completed.
Out-of-hours demand	Review timers for HVAC and lighting to reduce out of hours demand.
Carpark Ventilation CO / VSD control	Assess the potential for VSDs and CO control for car park ventilation plant.
Library Store Room Fan operation	Assess the potential for VSD control of the Library Storeroom fan, based on humidity levels in the store room. An alternative may be to run the fan for a reduced number of hours daily, adjusted as required to ensure the room remains dry.
HVAC Control	The major HVAC plant AC 5, 6, 8, 9 serving levels 1 and 2 may have opportunities for improvement including: <ul style="list-style-type: none"> - review run hours and run-on timer operation and duration - dampers to reduce air to the Heritage section unless this area is in use - VSD control of condenser water pump (fan is already VSD controlled) - VSD control of supply and return air fans - BMS upgrade / optimisation - Link Toilet Exhaust Fans to lights
HVAC Upgrade	The major HVAC plant AC 5, 6, 8, 9 serving levels 1 and 2 are dated, R22 refrigerant systems and a strategy for replacement should be put in place.
Split system AC	A replacement and control strategy should be developed to ensure efficient operation of split units (which appear to be in generally poor condition) and plan for efficient replacement systems.
Voltage Optimisation	Verify savings from VO units

These measures could reduce electricity consumption by more than 600 MWh of electricity. Initial estimates developed as part of this project indicate that investment of more than \$0.4 million could result in cost savings of more than \$110,000 per year.



FIGURE 35: POSSIBLE SOLAR PV LOCATION (SUBJECT TO STRUCTURAL ANALYSIS) – BOWEN LIBRARY

5.4 Randwick Council depot

5.4.1 Load profile of Council depot

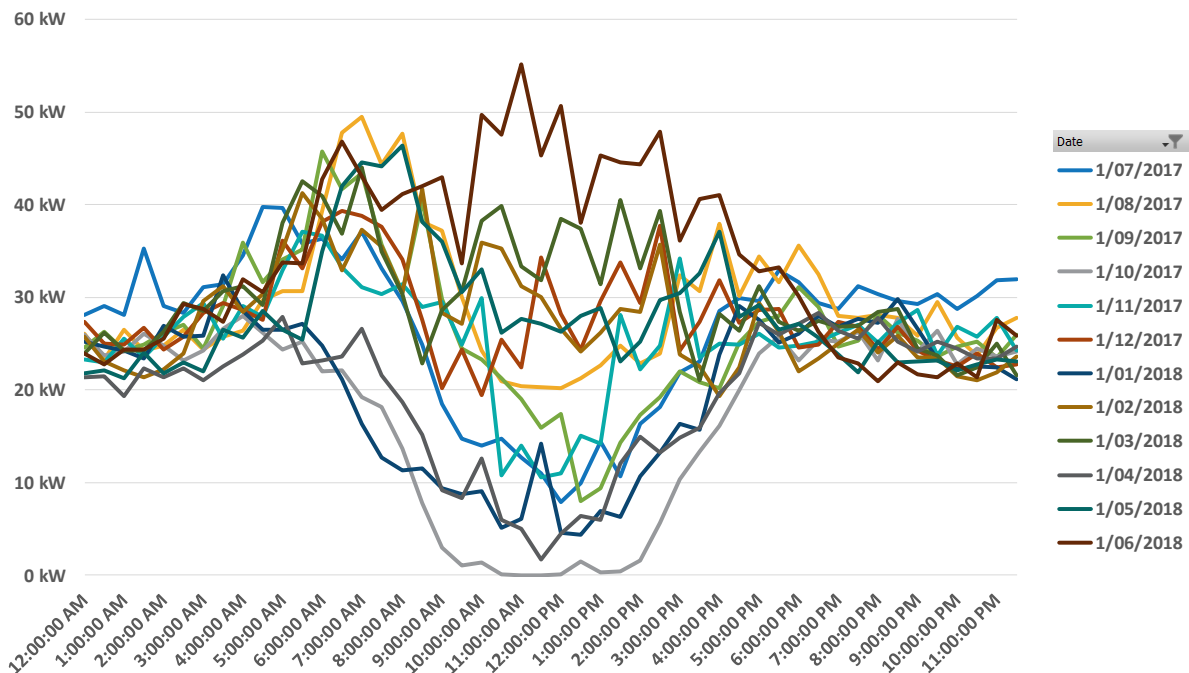


FIGURE 36: LOAD PROFILES DURING 2017-18 – COUNCIL DEPOT

Load profile data for the depot show the following:

- The impact of solar PV on the site's load profile is clear, with export seen from time to time, mostly on weekends.
- Night time demand relative to daytime demand is very high. Night audit of the site shows that this includes all warehouse LED lights, external lighting, the site's air compressor, appliances and the truck wash water treatment plant.
- The shape of the load profile reflects operations, with first staff arriving early in the morning (e.g. garbage collection staff) and most staff leaving by late afternoon.

5.4.2 Energy management & renewable energy opportunities

A range of opportunities were identified that Council can assess and develop in coming years to reduce energy use and greenhouse gas emissions. These are tabulated below.

TABLE 9: ENERGY MANAGEMENT & RENEWABLE ENERGY OPPORTUNITIES – COUNCIL DEPOT

Project type	Description
Solar PV	Install an additional 30 kW solar PV which is likely to be self-consumed on weekdays but mainly exported on weekends (longer term a larger system with battery may be feasible)
Lighting	Upgrade all fluorescent lighting to LED technology.
Out-of-hours demand	Reduce out of hours demand such as upgrade external lights to LEDs and review the need to run the wash plant out of hours. The lights, air compressor and water recycling system in the Warehouse could be controlled to turn on/off with the main doors which open at 4am and close at 8pm.

These measures could reduce electricity consumption by more than 100 MWh of electricity. Initial estimates developed as part of this project indicate that investment of more than \$50,000 could result in cost savings of more than \$20,000 per year.



FIGURE 37: POSSIBLE SOLAR PV LOCATIONS (SUBJECT TO STRUCTURAL ANALYSIS) – COUNCIL DEPOT

5.5 Streetlighting

5.5.1 Load profile of streetlighting

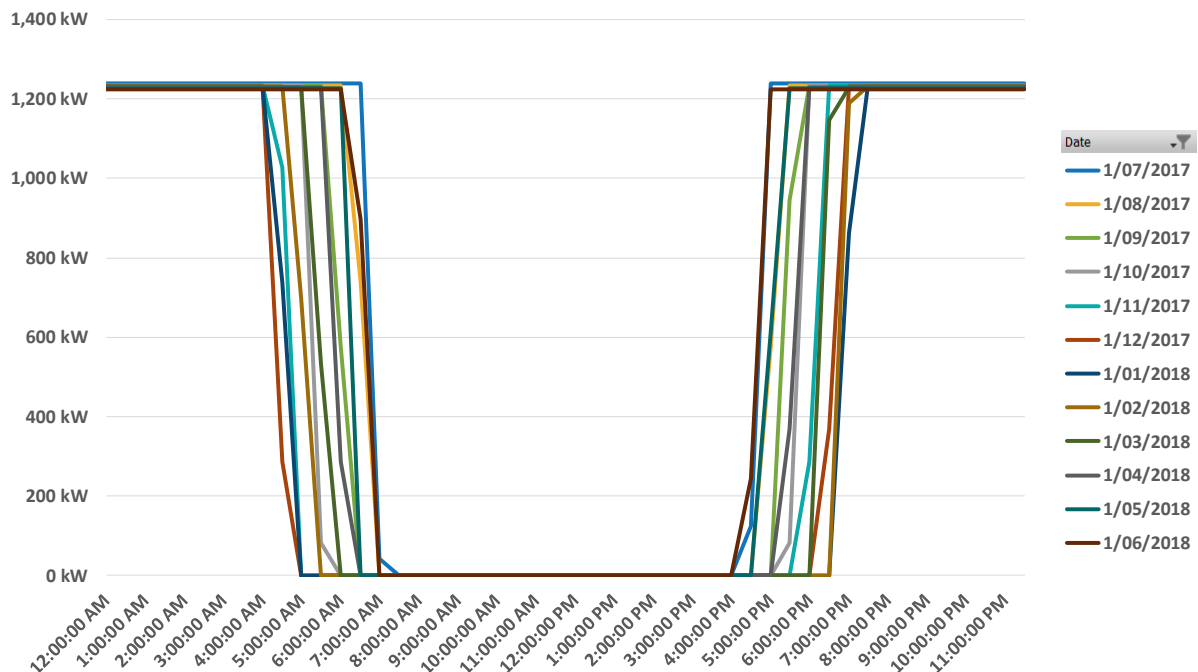


FIGURE 38: LOAD PROFILES DURING 2017-18 – STREETLIGHTING

5.5.2 Energy management & renewable energy opportunities

As part of the Street Lighting Improvement (SLI) Program, many of Randwick City Council's dated HID and CFL lights will be upgraded to LED technology in a bulk part-replacement of their streetlight network.

A total of 3,943 luminaires will be upgraded in the short term, from a total streetlighting inventory of over 10,500 luminaires. More than 1,700 LED fittings have been installed in recent years, under a spot replacement program that saw failed lamps replaced with LEDs.

The planned bulk replacement will see 3,943 luminaires, consuming 1,492 MWh per year replaced with LEDs consuming just 330 MWh per year. This is a saving of almost 78% (1,162 MWh per year). When applied across the full streetlighting system estimated savings of approximately 4,000 MWh per year are expected.

If funded from Council's reserves the net capital cost for the short term upgrade will be \$1.8 million, with recurrent annual savings of \$385,000 giving a 4.8 year simple payback.

A summary of Council's full streetlighting inventory and estimated annual electricity use by lamp type is tabulated below, and forms the basis for estimates of short term and longer term savings. For the purpose of this analysis it is assumed that the balance of lights will be upgraded to LED in 2025, though in practice a mix of ongoing spot replacement and future bulk upgrades will likely occur.

TABLE 10: RANDWICK CITY COUNCIL STREETLIGHTING INVENTORY AND ENERGY USE

Lamp Type	Nominal Wattage (W)	Number of luminaires	Sub-total kWh p.a.	Total kWh p.a.
Mercury Vapour	80 W	2,750	1,075,045 kWh	2,716,444 kWh
	125 W	282	172,252 kWh	
	250 W	777	949,216 kWh	
	400 W	264	516,022 kWh	
	800 W	1	3,909 kWh	
High Pressure Sodium	50 W	24	5,864 kWh	1,743,674 kWh
	70 W	99	33,864 kWh	
	100 W	149	72,810 kWh	
	150 W	1,120	820,944 kWh	
	250 W	476	581,502 kWh	
	400 W	112	218,918 kWh	
	1000 W	2	9,773 kWh	
Compact Fluorescent	42 W	2,127	436,537 kWh	436,537 kWh
LED	17 W	343	28,494 kWh	212,048 kWh
	22 W	560	60,203 kWh	
	25 W	133	16,248 kWh	
	29 W	642	90,978 kWh	
	100 W	17	8,307 kWh	
	200 W	8	7,819 kWh	
Fluorescent	20 W	4	391 kWh	126,787 kWh
	28 W	24	3,284 kWh	
	40 W	505	98,709 kWh	
	80 W	1	391 kWh	
	116 W	8	4,535 kWh	
	216 W	1	1,055 kWh	
	290 W	13	18,422 kWh	
Metal Halide	70 W	46	15,735 kWh	92,698 kWh
	250 W	3	3,665 kWh	
	400 W	35	68,412 kWh	
	1000 W	1	4,887 kWh	
Incandescent	60 W	3	880 kWh	15,051 kWh
	100 W	29	14,171 kWh	
Grand Total		10,559	5,343,238 kWh	5,343,238 kWh

6 Randwick City Council renewable energy project implementation plan

Approximately 125 energy and emission reduction opportunities were identified from consultations with key Council personnel and site visits, with 105 of these selected to be included in a roadmap of measures that can see Randwick City Council's electricity demand decrease and renewable energy supply increase to meet Council's targets. This section summarises these actions, including site, action type and description and expected simple payback. Actions are categorised as follows:

- Energy efficiency including upgrading building and sports field lighting to LED, air conditioning systems and hot water, for example.
- Street lighting upgrades to LED technology via accelerated bulk replacement programs.
- Solar PV onsite – this includes recently installed systems that will yield emissions savings from FY2020.
- Operation and maintenance (O&M) – typically procedures or simple controls that can reduce unnecessary energy waste, such as high night-time demand.
- Fleet emissions reduction measures such as incentives to increase the number of hybrid vehicles, trialling electric vehicles and developing future fleet transition plans.
- Fuel switching, in particular from gas to electric heat pumps for water heating.
- All energy – such as sustainable procurement policies that apply to all purchases of equipment that impact on energy use.
- Renewable energy power purchase agreements (PPA).

Council's potential renewable energy roadmap is developed by 'implementing' these 105 initiatives over time, from the FY2020 financial year through to FY2030. The tables below provide a summary of a suggested implementation plan. Suggested timing is based on discussions with Council, though it is indicative and may be changed to reflect needs during the development of each subsequent Operational Plan and 4-year Delivery Program. Suggested implementation timing reflects a range of factors, such as:

- Equipment reaching end of life.
- End and start dates for existing agreements (e.g. electricity supply).
- Rollout initiatives (such as sporting field lighting, fleet upgrades and sustainable procurement) that are modelled at an estimated rate of implementation per year, though actual implementation rates will be influenced by a range of factors including age, condition, resources and available budget.

6.1 Projects implemented in FY2019

Projects implemented in 2018/19 (FY2019) will start to deliver energy and emissions savings from FY2020.

TABLE 11: RANDWICK CITY COUNCIL EMISSION REDUCTION PROJECTS IN FY2019

Site	Resource	Description	Payback	Year of implementation
Des Renford Aquatic Centre	Energy Efficiency	50m pool hot water pump has been disconnected as it is no longer required.	0 years	FY19
Bowen Library	Energy Efficiency	Whole building lighting upgrade to LED.	1-2 years	FY19
Bowen Library	Energy Efficiency	A VO unit was installed at the main incoming supply to the library.	3.3 years	FY19
Malabar Library	Energy Efficiency	Upgrade of all fluoro lights to LEDs.	3 years	FY19
Malabar Library	Solar PV	Install 10 kW of rooftop solar.	4 years	FY19

6.2 Projects implemented over multiple years

Policies for sustainable procurement, sporting field lighting & public lighting upgrades to LED, fleet transition to low emissions vehicles, effective management of sporting club amenities appliances are 'implemented' over multiple years rather than taken to be implemented in any particular year. Policies are adopted on the basis that they are cost-effective; generally, this means that the *marginal cost* at the time an asset is replaced is paid back via savings within an acceptable timeframe.

TABLE 12: RANDWICK CITY COUNCIL MULTI-YEAR EMISSION REDUCTION PROJECTS

Site or asset type	Category	Opportunity	Description
Macartney Oval	Energy Efficiency	LED Lighting & Smart Controls	Upgrade park lighting to LED with daylight and dimming controls.
Chifley Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 73 sporting field HID lights to LED.
Pioneers Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 52 sporting field HID lights to LED.
Nagle Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 20 sporting field HID lights to LED.
Heffron Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade sporting field HID lights to LED.
Latham Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 24 sporting field HID lights to LED.
Coral Sea Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 41 sporting field HID lights to LED.

Site or asset type	Category	Opportunity	Description
Snape Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 17 sporting field HID lights to LED.
Paine Reserve	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 8 sporting field HID lights to LED.
Burrows Park	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 8 sporting field HID lights to LED.
Kensington Oval	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 20 sporting field HID lights to LED.
Yarra Bay Oval	Energy Efficiency	LED Lighting & Smart Controls	Upgrade sporting field HID lights to LED.
Coogee Oval	Energy Efficiency	LED Lighting & Smart Controls	Upgrade 11 sporting field HID lights to LED.
Heffron Centre Development	Solar PV	Solar PV	Implement solar PV when designing and building new facility.
Whole of RCC	Sustainable Procurement	Sustainable Procurement	Adopt a Sustainable Procurement policy based on updated guidelines for local government (2017)
Whole of RCC	Sustainable Procurement	Sustainable Procurement	Incorporate SP requirements in specifications & project briefs for all commonly sourced services and equipment
Whole of RCC	Sustainable Procurement	Sustainable Procurement	Seek low emissions outcomes through early engagement with major projects team in the design and specifications phase
Whole of RCC	Sustainable Procurement	Sustainable Procurement	Develop specifications and briefs with facilities maintenance to seek low emissions outcomes
Fleet	Fleet	Existing vehicles	Rationalise number of vehicles that are part of Council's footprint.
Fleet	Fleet	Fleet Strategy, Electric & Hybrid Vehicles	Develop a fleet transition strategy and plan focused on zero and low emissions outcomes aligned with Council's policy to transition to hybrids and EVs for new vehicles by 2022
Appliances	O&M	Operation & Removal	Rationalise the number of appliances in use and change operating practices

6.3 Projects recommended for implementation in FY2020

Projects recommended for FY2020 are tabulated below.

TABLE 13: RANDWICK CITY COUNCIL EMISSION REDUCTION PROJECTS IN FY2020

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Randwick Recycling Centre	Solar PV	Install 5 kW of rooftop solar	\$6,000	\$1,225	5.3 Years
Des Renford Aquatic Centre	VSD	Install VSDs for the Competition pool and Training pool pump	\$15,000	\$3,750	4.0 Years
Des Renford Aquatic Centre	VSD	Install VSDs for the Competition pool and Training pool fan coil units	\$15,000	\$3,750	4.0 Years
Des Renford Aquatic Centre	Lighting	Replace Competition pool deck lighting with LED floodlights	\$23,315	\$4,663	5.0 Years
Des Renford Aquatic Centre	Lighting	Replace Training pool deck lighting with LED floodlights	\$11,657	\$2,331	5.0 Years
Bowen Library	Night demand	Review timers for HVAC and lighting to reduce out of hours demand	\$500	\$24,663	<<1.0 Years
Bowen Library	Carpark Ventilation	Assess the potential for VSD and CO for car park ventilation	\$2,000	\$2,000	1.0 Years
Bowen Library	Library Store Fan	Assess the potential for VSD and CO for the Library Store room fan	\$2,000	\$2,000	1.0 Years
RCC Administration Building & Town Hall	Lighting	Basement level and stairwell lighting can be upgraded to LED technology with controls to minimise out of hours energy demand.	\$40,000	\$8,000	5.0 Years
Randwick Recycling Centre	Lighting	Upgrade all Recycling Centre lighting to LEDs	\$506	\$337	1.5 Years
Randwick Council Depot	Night demand	Reduce out of hours demand such as upgrade external lights to LEDs	\$6,606	\$6,606	1.0 Years
RCC Administration Building & Town Hall	Night demand	Reduce out of hours demand such as upgrade external lights to LEDs	\$7,417	\$7,417	1.0 Years

Site	Project type	Description	Capital expenditure	Savings	Payback in years
La Perouse Museum	Lighting	Replace existing lighting with LEDs	\$4,414	\$441	10.0 Years
Prince Henry Centre	Lighting	Upgrade carpark lights to LED technology.	\$8,672	\$434	20.0 Years
Prince Henry Centre	Lighting	Upgrade u/ground carpark and stairwell lights to LED.	\$4,019	\$1,914	2.1 Years
Prince Henry Centre	Lighting	Upgrade the function centre T5 and CFL lighting to LED with controls system.	\$41,442	\$2,072	20.0 Years
Matraville Youth and Cultural Hall	Lighting	Upgrade hall and kitchen lights to LED.	\$2,069	\$1,035	2.0 Years
Maroubra Senior Citizens Centre	Lighting	Upgrade Centre's lights to LED.	\$6,014	\$3,007	2.0 Years
Malabar Memorial Hall	Lighting	Upgrade Centre's lights to LED.	\$1,509	\$302	5.0 Years
Coogee Beach Amenities	Lighting	Upgrade lighting to LED	\$11,751	\$3,357	3.5 Years
Whole of RCC	Renewable Energy PPA	Source 20% of electricity from renewables (solar) on top of the RET obligation level, via a renewable energy power purchase agreement (PPA) (implemented from 1 July 2019)	Not added costs or risk to Council compared with 'regular' retailer agreement for electricity supply		
Moverly Childcare	Lighting	Upgrade all lighting to LED	\$5,000	\$1,250	4.0 Years
Randwick Community Centre	Lighting	Replace hall lighting with LED	\$3,000	\$200	15.0 Years
Maroubra Beach lighting & Pavilion	Lighting	Upgrade beach lighting to LED	\$90,000	\$7,500	13.5 Years
Maroubra Beach lighting & Pavilion	Lighting	Upgrade carpark lights to LED technology.	\$47,250	\$6,750	7.0 Years
Maroubra Beach lighting & Pavilion	Lighting	Upgrade pavilion lighting to LED	\$3,000	\$600	5.0 Years
Randwick Library	HVAC	Upgrade controls of HVAC system	\$5,070	\$5,070	1.0 Years
Randwick Literary Institute	Lighting	Upgrade all lighting to LED	\$1,171	\$293	4.0 Years
Randwick Nursery	Lighting	Upgrade all lighting to LED	\$4,589	\$1,147	4.0 Years

6.4 Projects recommended for implementation in FY2021

Projects recommended for FY2021 are tabulated below.

TABLE 14: RANDWICK CITY COUNCIL EMISSION REDUCTION PROJECTS IN FY2021

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Des Renford Aquatic Centre	Solar PV	Install 70 kW solar PV (minor structural works on the training pool roof are assumed to be required)	\$80,000	\$12,798	7.0 Years
Bowen Library	Solar PV	Install 30 kW solar PV	\$30,000	\$8,100	4.0 Years
Randwick Council Depot	Solar PV	Install 30 kW solar PV	\$30,000	\$5,083	6.5 Years
RCC Administration Building & Town Hall	Solar PV	Install 40 kW solar PV on the roof of the Town Hall	\$40,000	\$7,254	6.2 Years
Coogee Oval Groundsman's Room / Grandstand	Solar PV	Install 8 kW of rooftop solar on the grandstand	\$9,600	\$1,961	5.3 Years
Coogee Senior Citizens	Solar PV	Install 4 kW of rooftop solar on the grandstand	\$4,800	\$980	5.3 Years
Moverly Childcare	Solar PV	Replace the 2 kW old PV system with an 8 kW array	\$9,600	\$1,961	5.3 Years
Maroubra Beach lighting & Pavilion	Solar PV	Install 5kW solar PV on the pavilion roof	\$6,000	\$1,225	5.3 Years
Randwick Literary Institute	Solar PV	Fix current PV array	\$0	\$0	0.0 Years
Des Renford Aquatic Centre	VSD Control	Install a VSD on the 50m pool filter pump	\$15,543	\$3,886	3.9 Years
Des Renford Aquatic Centre	VSD Control	Install a VSD for the Dome pool fan	\$5,000	\$1,250	4.0 Years
Randwick Council Depot	Lighting	Upgrade all fluorescent lighting to LED technology.	\$20,000	\$8,000	2.5 Years
RCC Administration Building & Town Hall	HVAC	Upgrade the central HVAC system - planned	Not estimated		20.0 Years

Site	Project type	Description	Capital expenditure	Savings	Payback in years
RCC Administration Building & Town Hall	Lighting	Upgrade all Ground, level 1 and Level 2 lighting to LED technology	\$139,063	\$27,813	5.0 Years
RCC Administration Building & Town Hall	Lighting	Upgrade all Town Hall lighting to LED technology	\$16,688	\$1,669	10.0 Years
Street Lighting	Lighting	Replace 3,943 streetlights with LEDs	\$1,838,274	\$385,034	4.8 Years
Des Renford Aquatic Centre	Night demand	Implement shut down procedures to minimise night demand.	\$19,429	\$9,715	2.0 Years
Heffron Park	Night demand	Shut down lights in the Bunnerong Rd amenities block at night, and the amenities on the corner of Bunnerong Rd and Jersey Rd.	\$0	\$811	0.0 Years

6.5 Projects recommended for implementation in FY2022-23

Projects recommended for FY2022-23 are tabulated below.

TABLE 15: RANDWICK CITY COUNCIL EMISSION REDUCTION PROJECTS IN FY2022-23

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Des Renford Aquatic Centre	Additional Solar PV	Install an additional 93 kW solar PV in the medium to long term (allows for structural works to the main sloped roof to allow this project to be implemented)	\$204,335	\$16,642	12.0 Years
Randwick Community Centre	Solar PV & Battery Storage	Install a battery at the RCC or tenant system/s to capture surplus and re-use on site.	\$48,720	\$9,950	5.3 Years
Des Renford Aquatic Centre	Power Supply	Reinstall new power factor correction unit	\$20,000	\$5,000	4.0 Years
Des Renford Aquatic Centre	Lighting	Upgrade amenities and studio and office T5 lighting with LED	\$11,657	\$2,331	5.0 Years

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Heffron Park	Lighting	Upgrade carpark lights to LED technology.	\$53,262	\$2,663	20.0 Years
Heffron Park	Lighting	Upgrade amenities blocks lighting with LED	\$2,434	\$304	8.0 Years
Whole of RCC	Renewable Energy PPA	Implement further RE PPAs to increase purchasing towards 100% renewables. Modelling increases the PPA % every three years however Council could consider switching to 100% renewables much earlier if this proves to be feasible.	Not estimated		
Heffron Centre Development	Design	Have influence in the design of new facilities to promote Energy efficiency	Not estimated		
Randwick Nursery	Electric Vehicles	Install an EV charger and upgrade nursery delivery vehicle to EV when next renewed.	Not estimated		

6.6 Projects recommended for implementation from FY2024 onwards

Projects recommended from FY2024 are tabulated below. It is recommended that Council review their Roadmap ahead of this time so that projects can be re-assessed and prioritised for the following Delivery Program period.

TABLE 16: RANDWICK CITY COUNCIL EMISSION REDUCTION PROJECTS FROM FY2024

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Prince Henry Centre	Solar PV & Battery Storage	Implement battery storage 14 kWh or 28 kWh to capture and use export from existing 30 kW system	\$10,500	\$933	'>10 years
Randwick Nursery	Expand solar PV	Install up to 3 kW of solar PV on east and west roof of office building with microinverters. If EV charge point is	\$3,600	\$735	5.3 Years

Site	Project type	Description	Capital expenditure	Savings	Payback in years
		installed, a larger system could be feasible			
Kensington Community Centre	Battery storage	Install a battery at the KCC to capture surplus and re-use on site.	\$21,000	\$1,663	6.0 Years
Des Renford Aquatic Centre	Fuel Switch	Switch to heat pump from gas boiler for the Dome pool	\$186,218	\$37,244	5.0 Years
Des Renford Aquatic Centre	Fuel Switch	Replace the gas heater of the Competition pool and Training pool with heat pumps	\$372,435	\$74,487	5.0 Years
Des Renford Aquatic Centre	Fuel Switch	Disconnect all gas devices (chipper and amenities hot water)	\$62,073	\$12,415	5.0 Years
Des Renford Aquatic Centre	Lighting	Replace tower lighting with LED	\$10,492	\$1,166	9.0 Years
Des Renford Aquatic Centre	UV Technology	Replace UV for the Competition and Training pools with new systems	\$28,963	\$3,620	8.0 Years
Bowen Library	HVAC Upgrade	The major HVAC plant AC 5, 6, 8, 9 serving levels 1 and 2 are very old, R22 refrigerant systems and a strategy for replacement should be put in place.	Not estimated		
Bowen Library	Split system AC	A replacement and control strategy should be developed to ensure efficient operation and plan for efficient replacement systems.	Not estimated		
RCC Administration Building & Town Hall	HVAC	Upgrade older HVAC plant	\$159,752	\$7,988	20.0 years
Chifley Park	Lighting	Upgrade 21 carpark lights to LED technology.	\$20,000	\$1,485	13.5 Years
Coogee Beach lighting	Lighting	Upgrade beach lighting to LED	\$101,250	\$6,750	14.8 Years
Randwick Library	Lighting	Upgrade all lighting to LED	\$37,500	\$7,500	4.7 Years

Site	Project type	Description	Capital expenditure	Savings	Payback in years
Street Lighting	Lighting	Replace remaining streetlights with LEDs	\$2,124,877	\$445,065	4.8 Years
Coogee Oval Groundsman's Room / Grandstand	Lighting	Upgrade lighting to LED (assumes carpark lights at beach side are also upgraded)	\$22,000	\$2,000	11.0 Years

Part 7

Renewable Energy Roadmap

7 Renewable Energy Roadmap Scenarios

Implementation of the actions identified above will have a significant impact on Council's energy demand and greenhouse gas emissions. Some initiatives will have greater impact than others, such as renewable energy PPAs and streetlighting upgrades. Some measures are challenging to predict in terms of the level of implementation that will occur by 2030, in particular, transition from fuel vehicles to electric. The bulk of measures, including onsite solar and efficiency actions will produce a modest overall emissions impact but can achieve good returns on investment. As Council's past onsite measures have shown, this typically serves to offset growth that occurs in services provided by Council.

The outcome in terms of Council's future emissions will depend on the extent to which actions implemented and are successful. Three scenarios were modelled based on the above tables.

- **Slow scenario** – this sees all of the onsite measures including street lighting implemented over time. The purchase of renewables via a PPA is assumed to increase to 100% from FY2025, as committed to by Council. In addition, uptake of electric vehicles may not be rapid, and this scenario assumes the following:
 - Passenger vehicles reduction to 50 vehicles by 2022
 - Passenger vehicles transition to EVs and Hybrids
 - 10% to be EVs and 90% to be Hybrids by 2025
 - Transition to 50% EVs, 50% Hybrids by 2030 from 2025
 - Depot and LCV (Light Commercial Vehicles) transition to EVs and Hybrids
 - Remain as is until 2025
 - Transition to 50% EVs, 50% Hybrids to begin in 2025 linearly to 2030
- **Medium scenario** – the same as the slow scenario, however with a more rapid transition to EVs and Hybrids.
 - Passenger vehicles reduction to 50 vehicles by 2022
 - Passenger vehicles transition to EVs and Hybrids
 - 10% to be EVs and 90% to be Hybrids by 2022
 - Transition to 100% EV by 2030 from 2022
 - Depot and LCV (Light Commercial Vehicles) transition to EVs and Hybrids
 - 10% to be EVs and 90% to be Hybrids by 2025
 - Transition to 100% EVs to begin in 2025 linearly to 2030
- **Fast scenario** – this scenario sees Council continue to increase its level of renewable energy purchased via PPAs to 100% by FY2022. It also sees 100% of petrol and diesel vehicles switch to electric by FY2025.
 - Passenger vehicles reduction to 25 vehicles by 2022
 - Passenger vehicles transition to EVs and Hybrids
 - 50% to be EVs and 50% to be Hybrids by 2022
 - Transition to 100% EV by 2025 from 2022
 - Depot and LCV (Light Commercial Vehicles) transition to EVs and Hybrids
 - 50% to be EVs and 50% to be Hybrids by 2022
 - Transition to 100% EV by 2025 from 2022

These three scenarios are illustrated below.

7.1 Slow scenario

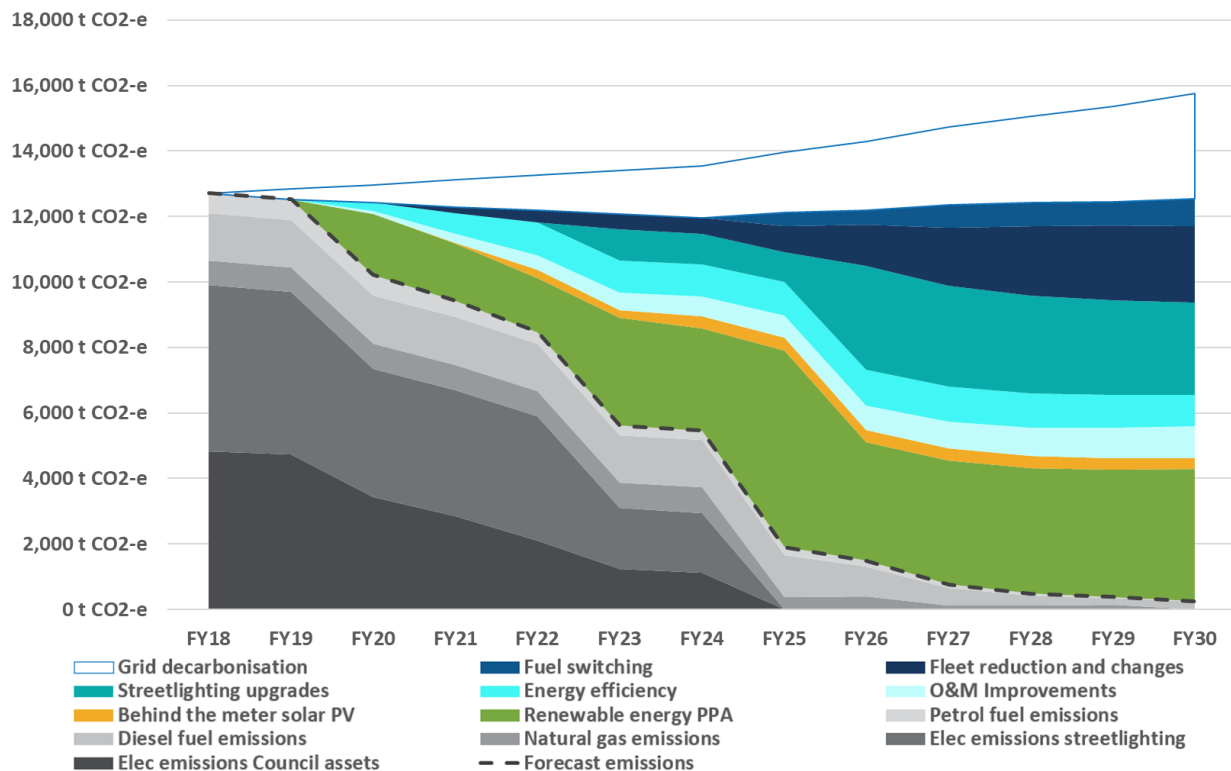


FIGURE 39: SLOW SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

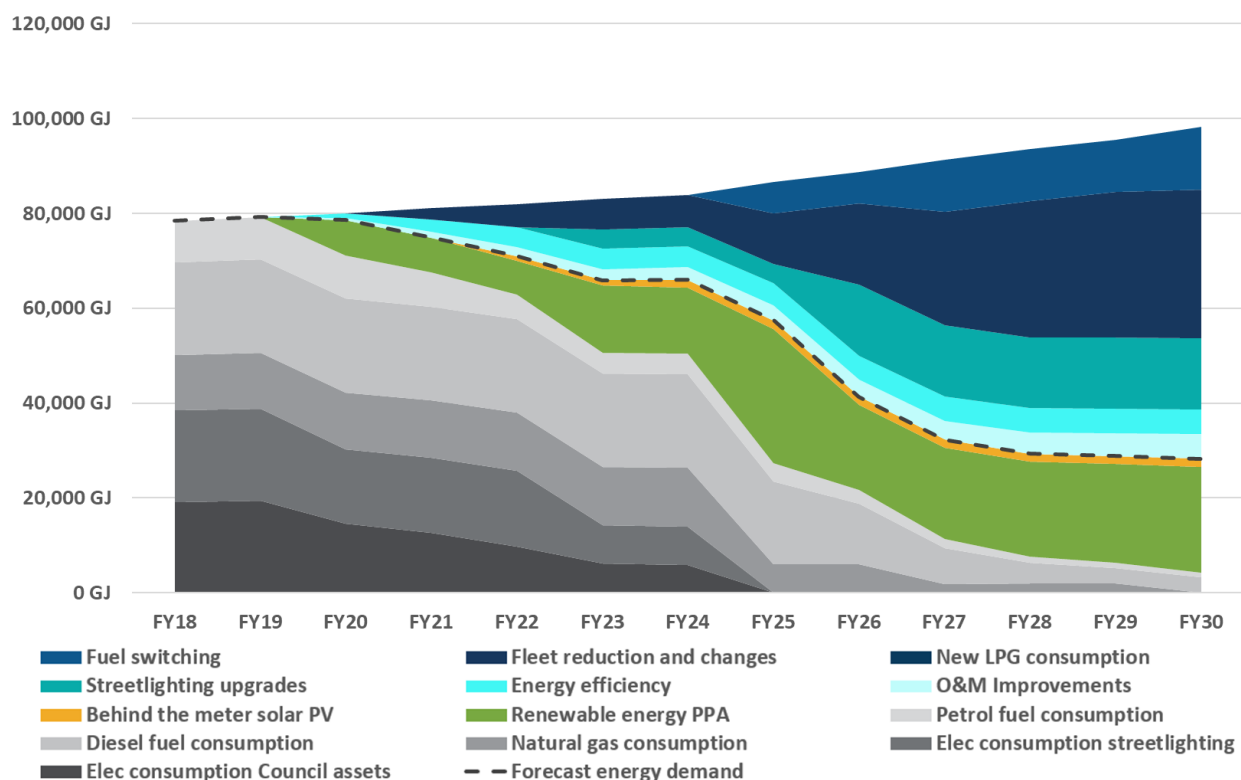


FIGURE 40: SLOW SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

7.2 Medium scenario (Council target)

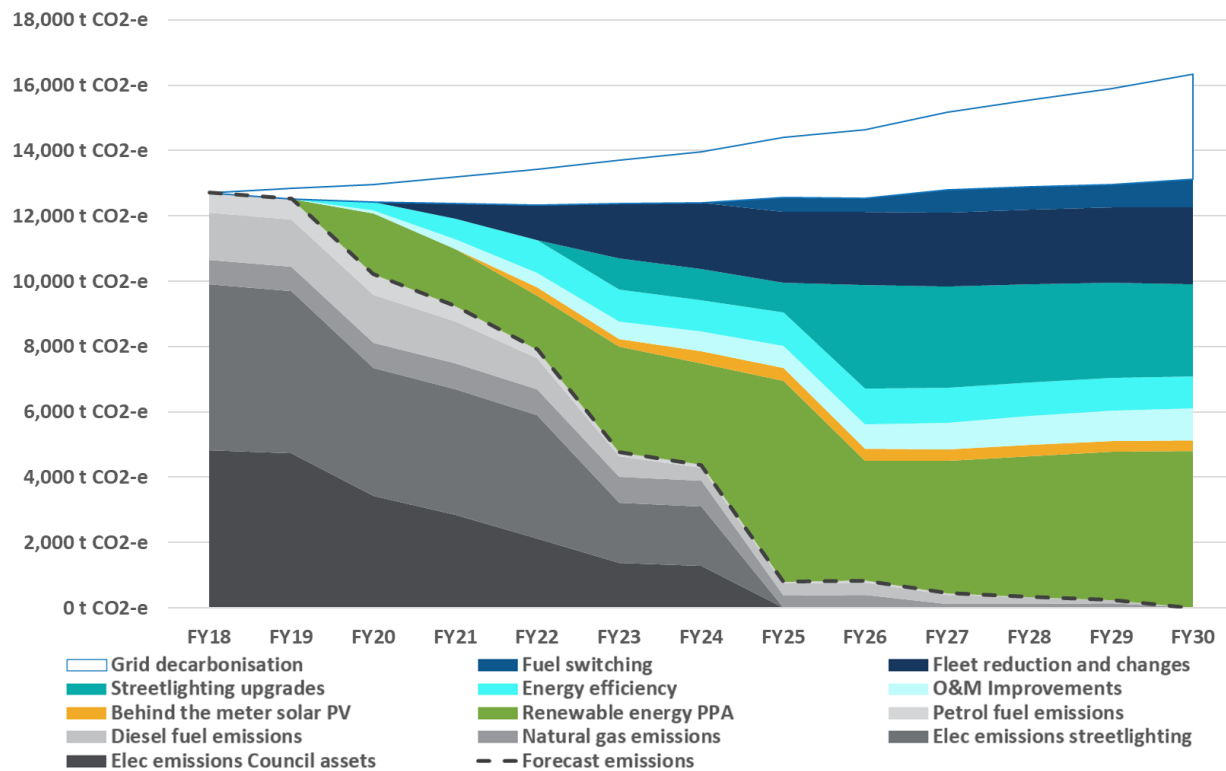


FIGURE 41: MEDIUM SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

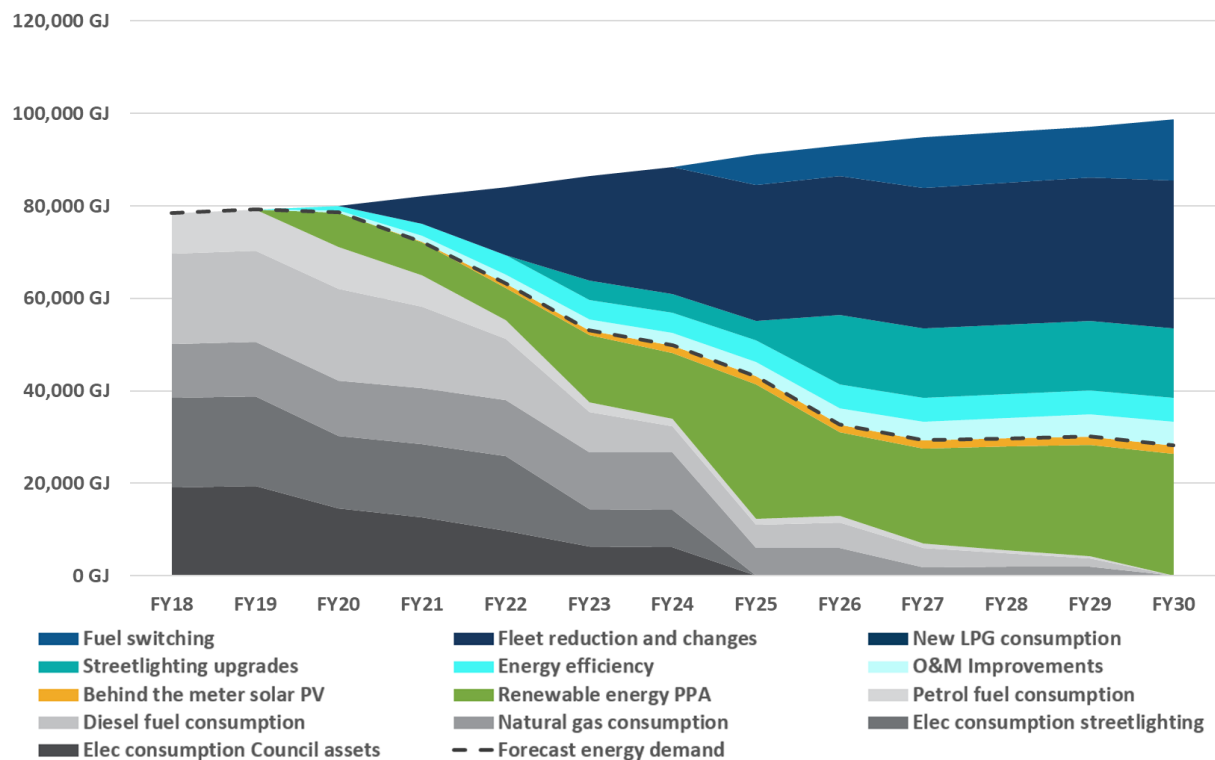


FIGURE 42: MEDIUM SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

7.3 Fast scenario

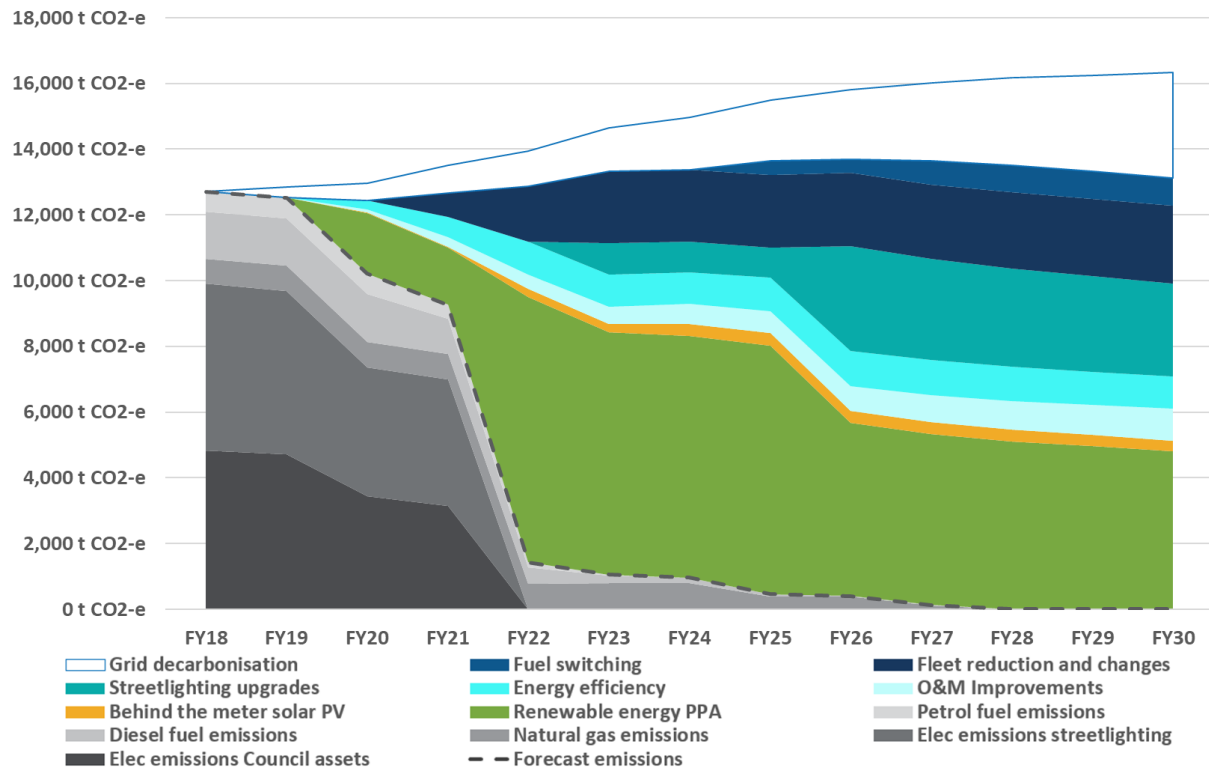


FIGURE 43: FAST SCENARIO: CARBON EMISSIONS PATHWAY FOR RANDWICK CITY COUNCIL

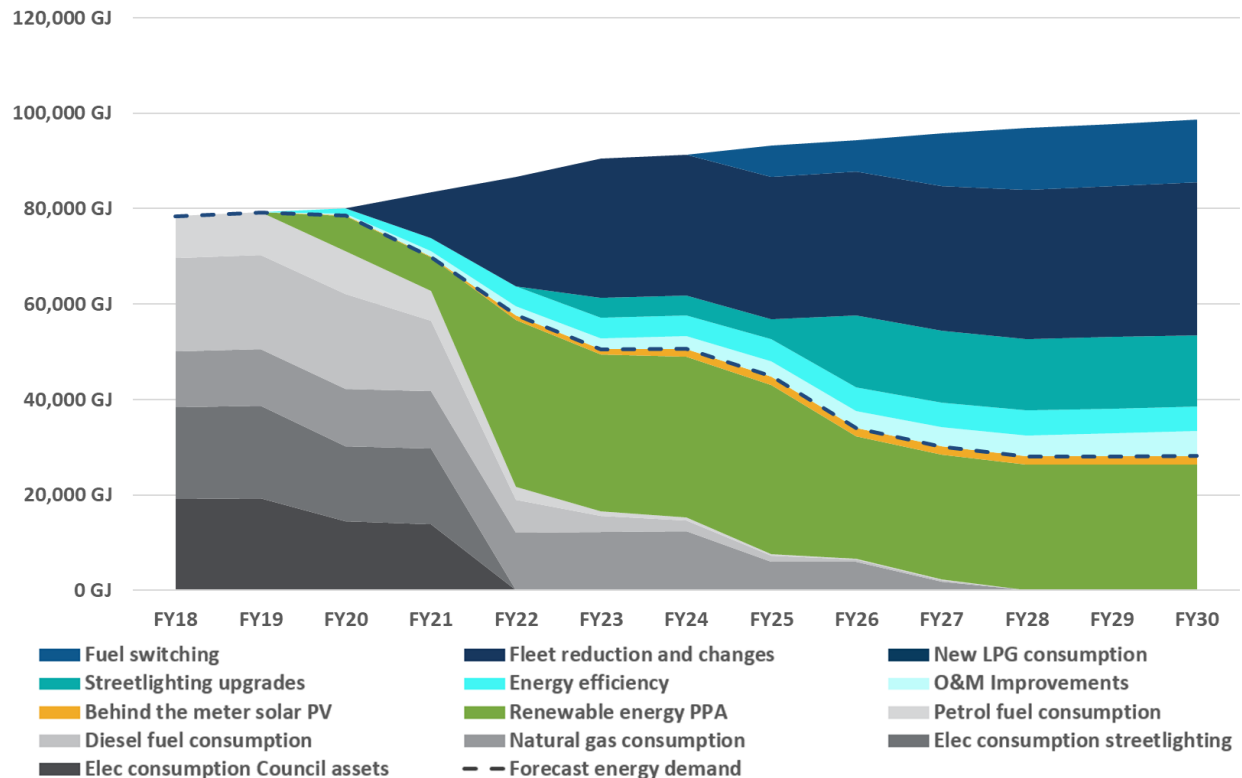


FIGURE 44: FAST SCENARIO: RENEWABLE ENERGY ROADMAP FOR RANDWICK CITY COUNCIL

Part 8

Investment by Randwick City Council

8 Investment required by Randwick City Council

The investments required by Randwick City Council to achieve the levels of carbon abatement estimated in this Roadmap are summarised below.

8.1 Streetlighting

Upgrading of streetlights to LED in FY22 is estimated to require capital investment of \$1,838,274 (August 2018 cost estimates). This has already been budgeted. Net annual cost savings to Council from this are estimated to be \$385,034, giving a simple payback of 4.77 years (Ausgrid estimates).

The investment required to upgrade the balance of lighting is simply extrapolated from this cost estimate applied to the remaining energy demand by streetlighting. This gives an estimate of \$2,124,877 with annual cost savings of \$445,065 for the same simple payback.

Clearly future costs for LED technology as well as energy and maintenance charges will see an amended business case developed, so this current estimate simply gives an indicative investment figure.

8.2 Onsite energy efficiency and solar

Based on the suggested investment timing, the table below summarises annual potential costs and savings associated with the investment made in each year, additional to amounts already budgeted.

TABLE 17: ESTIMATED EFFICIENCY & ONSITE SOLAR INVESTMENT

Year	Capital cost	Annual cost savings
FY19	\$133,125	\$63,996
FY20	\$590,969	\$143,926
FY21	\$1,328,223	\$108,768
FY22	\$53,262	\$2,663
FY23	\$287,146	\$34,228
FY24	\$736,529	\$102,707
FY25	\$250,000	\$25,000
FY26	\$299,253	\$55,278
Total	\$3,678,507	\$536,566

The timing of larger projects such as the implementation of HVAC upgrades at Bowen Library and Council Administration Centre, heat pumps at the pool, and solar PV at the pool and potentially Heffron Centre, can significantly change the year-to-year budget required. The overall potential payback for onsite measures is expected to be at around 7 years.

8.3 Sporting field lighting

Implementation of LED lighting in sporting field upgrades and new field activation should be adopted as policy by Council. As such, no additional capital cost is assumed to be required, and the pathway reflects the potential for most of Council's field lighting to be upgraded by 2030.

8.4 Major capital projects

The one major capital works project is the construction of the Heffron Centre. This pathway assigns no capital costs or savings against this project, excepting solar PV. It is assumed that Council's requirements for these include achieving sustainable outcomes across energy, water, waste, materials etc.

8.5 Sustainable procurement

Updating Council's sustainable procurement policies will help to ensure that new projects, major equipment upgrades and appliances are energy efficient, with marginal capital cost for efficiency justified by savings in energy and operation / maintenance over the life of equipment. No costs for this policy are included in this pathway study.

8.6 Fleet

Council plans to radically change its fleet to be fully electric by 2030, and to reduce the size of passenger fleet to 50 by 2022. The plan aims to achieve this through firstly replacing the majority of vehicles to hybrids, and then gradually replace these hybrids with EVs. Costs for this transition are not included, although it should be noted that incentives may be helpful in making the switch to a low or zero emissions vehicle viable.



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