100% renewables

CITY OF BAYSWATER
The Garden City - Quality Lifestyle

City of Bayswater

EMISSION REDUCTION AND RENEWABLE ENERGY PLAN

Final Report

July 2021

www.100percentrenewables.com.au

Contents

Table of Figures

Table of Tables

Glossary of climate change & project abbreviations

Acronym	Definition
AC, DC	Alternating & direct current
ACCU	Australian Carbon Credit Unit
AEMC	Australian Energy Market Commission
AEMO	Australian Energy Market Operator
AER	Australian Energy Regulator
AFOLU	Agriculture, Forestry and Other Land Use
APVI	Australian Photovoltaic Institute
ATA	Alternative Technology Association
B20, B50	Diesel blends with 20% and 50% biodiesel
BAU	Business-as-usual
BCA	Building Code of Australia
BEEC	Building Energy Efficiency Certificate
BESS	Battery Energy Storage System
BMS	Building Management System
BEV	Battery electric vehicle
CDM	Clean Development Mechanism
C40	Network of the world's megacities committed to addressing climate change
CCF	Climate Change Fund
CER	Certified Emissions Reductions (offsets)
CFL	Compact fluorescent
CFD	Contract for Difference
COP	Coefficient of performance
COP21	Conference of the Parties in Paris at which the Paris Agreement was reached
CO_2-e	Carbon Dioxide Equivalent
CPP	Cities Power Partnership
CPRS	Australia's Carbon Pollution Reduction Scheme
CSP	Community Strategic Plan
C4CE	Coalition for Community Energy
DOL	Direct On Line
E3	Equipment Energy Efficiency program
EER	Energy efficiency ratio
EPC	Energy Performance Contracting
EPC(M)	Engineer, Procure, Construct (Maintain)
ERF	Emissions Reduction Fund
ESB	Energy Security Board
ESC	Energy Saving Certificates
EUA	Environmental Upgrade Agreement
EV	Electric Vehicle
FiT	Feed-in-tariff
GFC	Global Financial Crisis
GHG	Greenhouse Gas

HVAC	Heating, ventilation, and air conditioning
ICE	Internal combustion engine
ICLEI	Local Governments for Sustainability
IPCC	Intergovernmental Panel on Climate Change
kWh, MWh, GWh	Units of energy – usually used for electricity
LED	Light Emitting Diode (lighting technology)
LGC	Large-scale Generation Certificate
MJ, GJ	Units of energy – usually used for gas
LGA	Local Government Areas
LPG	Liquefied Petroleum Gas
NABERS	National Australian Built Environment Rating System
NCC	National Construction Code
NDC	Nationally Determined Contributions by countries to meet Paris commitments
NEM	National Electricity Market
NCOS	National Carbon Offset Standard
NGA	National Greenhouse Accounts
O&M	Operation and maintenance
P2P	Peer to Peer trading of renewable energy
PHEV	Plug-in hybrid electric vehicle
PPA	Power Purchase Agreement
PV	Solar photovoltaic technology
REF	Revolving Energy Fund
RET	Australia's Renewable Energy Target
RMU	Removal Units (offsets)
ROI	Return on Investment
S1	Scope 1 greenhouse gas emissions, from combustion of fuel at your facilities
S2	Scope 2 greenhouse gas emissions, caused by consuming electricity
S3	Scope 3 greenhouse gas emissions, indirect emissions upstream and downstream of your business
SDGs	Sustainable Development Goals
SRES	Small-scale Renewable Energy Scheme
SPS	Sewer Pumping Station
STC	Small-Scale Technology Certificates
VCS	Verified Carbon Standard
VFD, VSD	Variable Frequency Drive / Speed Drive
VGA	Virtual Generation Agreement
VPPs	Virtual Power Plants
W, kW, MW	Units of power – usually used for electricity
WA	Western Australia
WEM	Wholesale Electricity Market
WP	Western Power

1 Executive Summary

The City of Bayswater engaged 100% Renewables to develop the City's Emission Reduction and Renewable Energy (ERRE) Plan, that will help it to cost-effectively increase the amount of renewable energy, improve energy efficiency and reduce greenhouse gas emissions at its facilities. Drivers for the development of the Emission Reduction and Renewable Energy Plan include:

- On 20 August 2019, Council discussed a Renewable Energy and Emission Reduction Position and Action Statement (PAAS) and as a result set itself the following targets:
    - a corporate renewable energy target of 100% by 2030.
    - a corporate greenhouse gas emissions reduction target of 100% by 2040.
- To meet these targets the City has undertaken to look at a range of renewable energy and emissions reduction areas (including onsite solar, energy efficiency, sustainable procurement and fleet, mid-scale renewables, power purchasing, behavioural change, sequestration and carbon offsets) in order to develop a roadmap of feasible and cost-effective measures that can help the City achieve its targets.

City of Bayswater's ERRE Plan builds on the numerous energy efficiency, solar PV and other emissions reduction initiatives that the City has implemented in recent years and puts a framework around future actions and management processes that will help ensure the goals of the ERRE Plan are achieved.

1.1 Emissions reduction and renewable energy targets

This report sets out a plan that will enable the City to meet and exceed the targets established in the ERRE PAAS and achieve net zero by 2040 as follows:

- *2025 100% renewable electricity for the City's operations, excluding streetlighting*
- *2030 100% renewables and/or carbon offsets for all City energy use, including streetlighting*
- *2040 Net Zero greenhouse gases for the City energy-related and value chain emissions*

City of Bayswater will achieve this by:

- Ensuring that the ERRE Plan is supported with suitable governance and the appointment of staff to oversee the Plan's implementation over time
- Engaging the City's workforce and the community in making the behaviour changes required to support reducing its carbon footprint
- Entering into a Power Purchasing Agreement to source City electricity from renewable energy
- Continuing to install solar panels, initially up to 100 kW to avail of Government incentives, before progressing to larger installations at the City's energy intensive sites
- Progressively deliver identified energy efficiency upgrades to City facilities, such as LED lighting and air conditioning upgrades
- Converting Western Power and City-owned streetlights and public lights to LED technology
- Progressively electrifying all transport fleet, large and small plant
- Replacing the gas-fired hot water boiler with an electric heat pump at Bayswater Waves
- Optimising value chain greenhouse gas emissions through the City's procurement processes
- Offsetting any residual emissions by purchasing carbon credits

The proposed roadmap to achieve the targets and its financial implications is described in Chapter 7.

A key focus in the development of this Plan has been the identification and scheduling of emissions reduction actions that are cost effective, where the City of Bayswater will achieve a financial return on investments it makes. Solar PV, energy efficiency and upgrading the City's streetlights to LED are measures that will pay for themselves within a few years. Sustainable procurement processes can lead to better whole-of-life cost benefits, and renewable energy power purchasing is increasingly price-competitive with 'regular' power purchasing.

The City could accelerate its emissions reduction actions – to fund larger solar systems, battery storage, electric vehicle charging infrastructure and electric vehicles for example, by reinvesting the savings from ERRE initiatives into a renewable energy fund to pay for the program.

1.2 City of Bayswater's carbon footprint

The City of Bayswater's carbon footprint was assessed for the year 2019/20. Emissions from energy used across the City's corporate assets was 9,441 tonnes of carbon dioxide (t CO_2-e). These emissions, and forecast changes over time due to population growth as well as decarbonisation of the electricity grid, are the main focus of the City's 2030 target, to reduce energy-related emissions to zero.

The City's 2040 target to reduce all corporate emissions to net zero follows best practice (in Australia this is the Climate Active Standard, or CA) and includes refrigerant gases as well as all value chain greenhouse gas emissions associated with the City's corporate activities. It is estimated that these increase the City's 2019/20 carbon footprint to approximately 15,000 t CO_2-e. The City's carbon footprint and business-as-usual forecast emissions to 2040 are shown below.

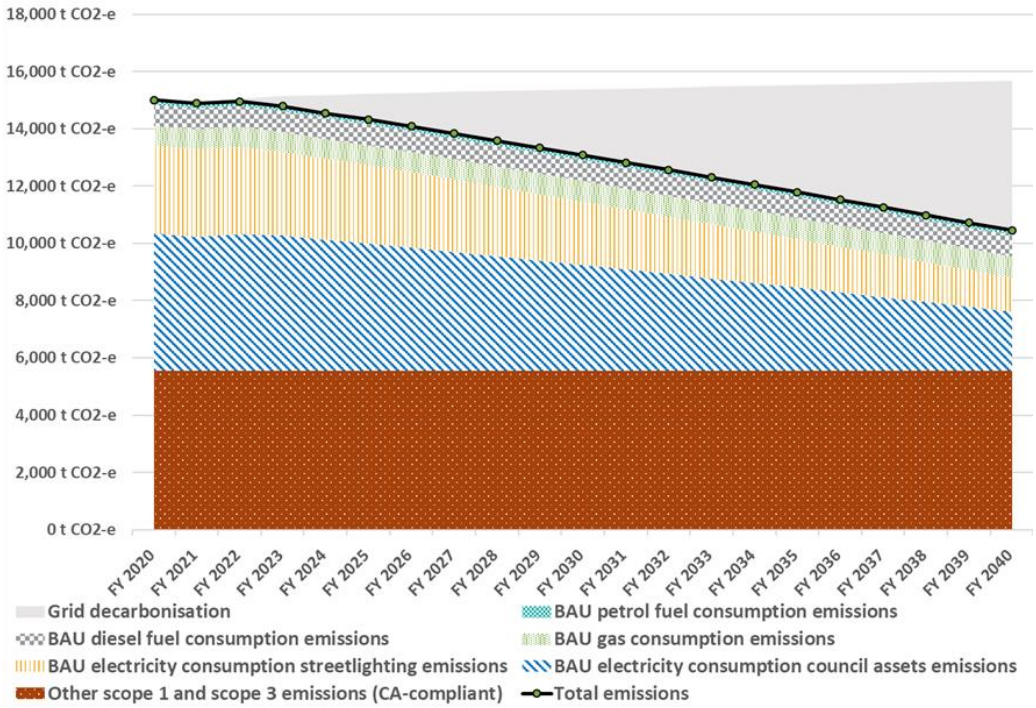


FIGURE 1: CITY OF BAYSWATER'S ESTIMATED CLIMATE ACTIVE-COMPLIANT CARBON PROJECTION TO 2040

1.3 Roadmaps to achieve City of Bayswater's targets

City of Bayswater's renewable energy and emissions reduction opportunities are assessed across nine areas that respond to the brief for the development of the ERRE Plan. These are illustrated below.

FIGURE 2: NINE AREAS OF ENERGY AND EMISSION REDUCTION FOR CITY OF BAYSWATER

1.3.1 ERRE Plan Roadmap to meet the 2030 target

A roadmap was developed, showing how the City of Bayswater can cost-effectively meet its 2030 target, including sourcing 100% of electricity from renewables by 2025, and reducing or offsetting other energy-related emissions by 2030. This is illustrated below.

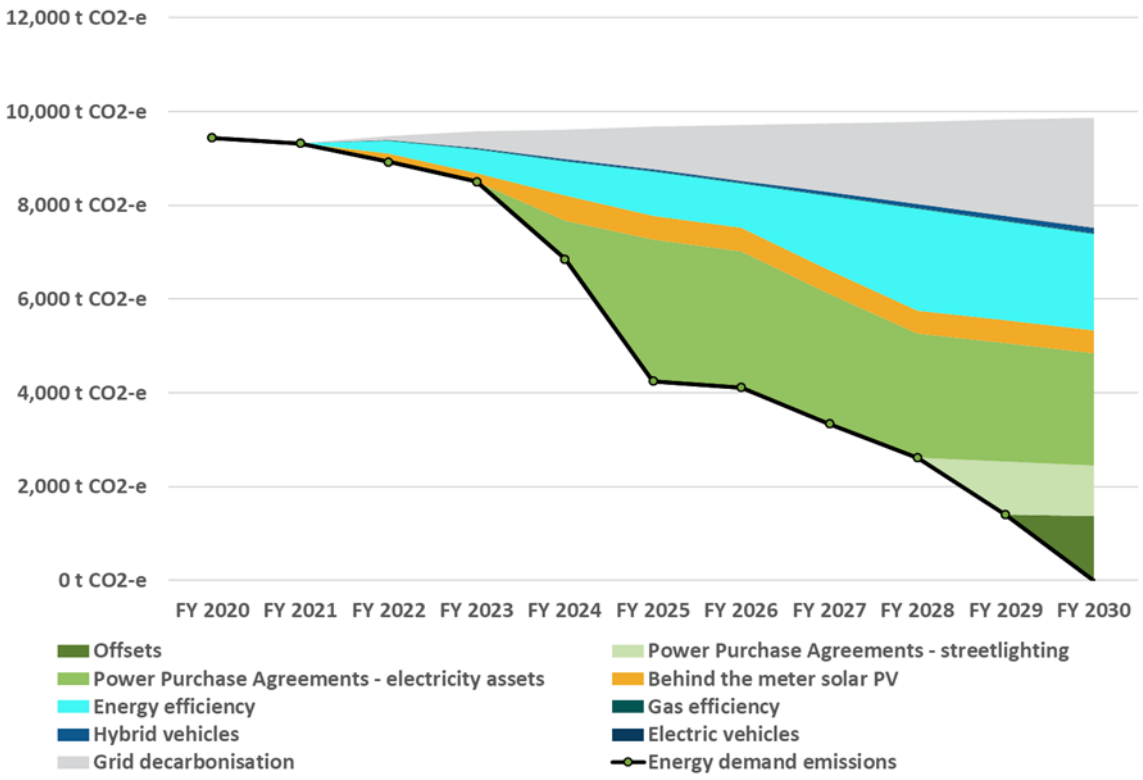


FIGURE 3: CITY OF BAYSWATER'S EMISSIONS REDUCTION ROADMAP TO MEET ITS 2030 TARGETS

1.3.2 ERRE Plan Roadmap to meet the 2040 target

A second roadmap was developed that builds on the 2030 roadmap, showing how the City of Bayswater can cost-effectively meet its 2040 target, including sustainable procurement in the City's value chain, eliminating gas consumption at City facilities such as Bayswater Waves, electrifying City fleet, and offsetting other emissions by 2040. This is illustrated below.

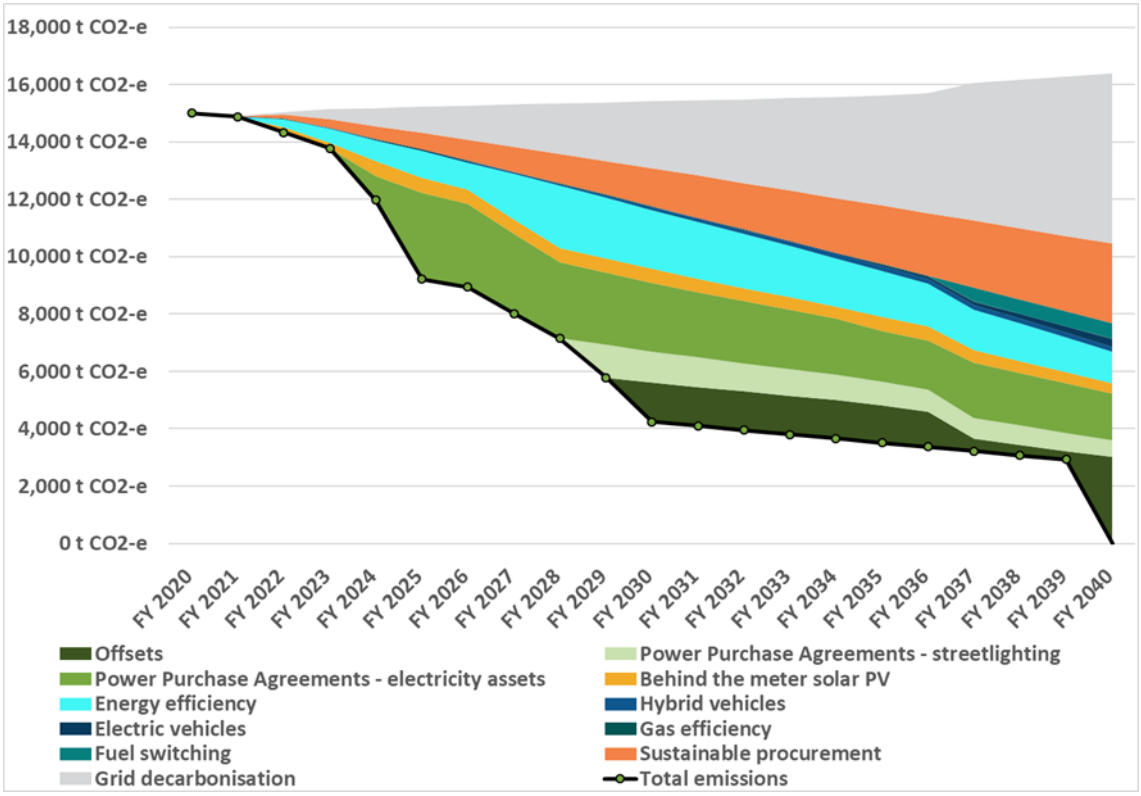


FIGURE 4: CITY OF BAYSWATER'S EMISSIONS REDUCTION ROADMAP TO MEET ITS 2040 NET ZERO TARGET

100% renewables

Scope

Summary of the scope of work and work stages

2 Approach and scope of work

100% Renewables was engaged by the City of Bayswater to develop an Emission Reduction and Renewable Energy Plan (ERRE) that will help the City to cost-effectively achieve its 100% renewables target by 2030 and its net zero emissions target by 2040 using commercially available and feasible measures.

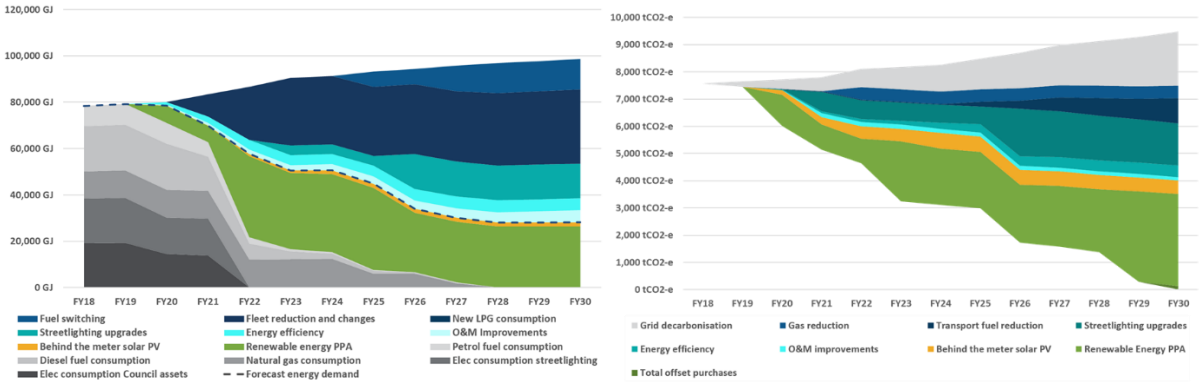


FIGURE 5: ILLUSTRATIVE PATHWAYS TO 100% RENEWABLES AND NET-ZERO EMISSIONS

The scope of this project is outlined below. Owing to covid-19 restrictions, face-to-face meetings and site inspections were not feasible during the early stages of the project. Face-to-face engagement and site visits occurred following the delivery of a first draft ERRE Plan, following the lifting of travel restrictions.

FIGURE 6: SEVEN-STEP PROCESS TO DEVELOP THE ERRE PLAN FOR CITY OF BAYSWATER

100% renewables

Background and context

Factors underpinning climate action at global and sectoral levels

3 Global context for climate action and targets

3.1 The need to reach 'net-zero' greenhouse gas emissions

Due to all historical and current carbon emissions, global temperatures have increased by ~1°C from pre-industrial levels. The main driver of long-term warming is the total cumulative emissions of greenhouse gases over time. As shown by the *Climate Action Tracker*[1] below, without additional efforts, human-caused carbon dioxide (equivalent) emissions may increase to over 100 billion tonnes annually by 2100, which is double current global emissions. The resulting increase in global temperatures would be up to 4.8°C (as per the IPCC Climate Change 2014 Synthesis Report[2]).

With current policies around the world, global temperatures are projected to rise by up to 3.1°C. To prevent dangerous climate change by limiting global warming, close to 200 of the world's governments signed the landmark Paris Agreement. This Agreement underpins science-based targets to limit global temperature increase to well below 2°C by 2050. With current pledges, and if all countries achieved their Paris Agreement targets, it would limit warming to 2.4°C. According to the Climate Action Tracker, to limit warming to 1.5°C, carbon emissions must decline sharply in the short-term and reach net-zero by mid-century (refer to the green line / band in the chart).

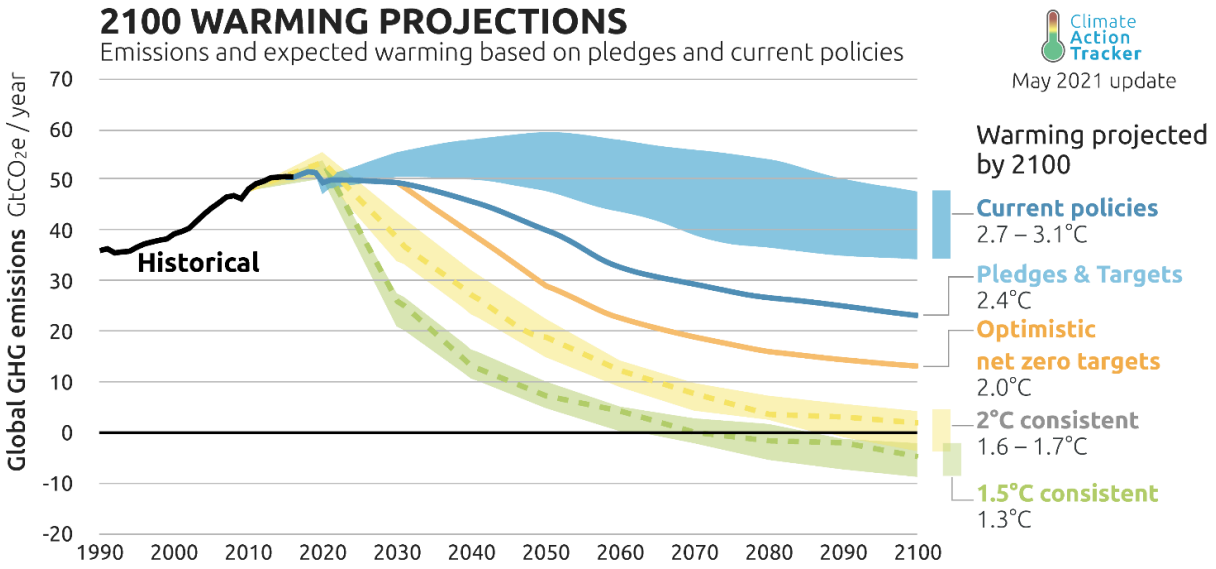


FIGURE 7: THE CLIMATE ACTION TRACKER'S WARMING PROJECTIONS FOR 2100, VARIOUS POLICY SCENARIOS

A net-zero target means that by the target date, there must be no greenhouse gas emissions on a net basis. For energy use in a local government's operations, for example, this would mean:

1. GHG emissions from stationary fuel combustion such as natural gas use are minimised, and
2. GHG emissions from transport fuel combustion are minimised, and
3. GHG emissions from electricity consumption are minimised, and
4. GHG emissions from emissions in the supply chain are minimised, and
5. Remaining emissions are offset or removed through sequestration measures.

[1] https://climateactiontracker.org/global/temperatures/
[2] IPCC Climate Change 2014 Synthesis Report

3.2 International drivers for climate action

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 2030[3]. 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, countries adopted the Paris Agreement at the COP21 in Paris on 12 December 2015, referred to above. 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°C Celsius[4].

3. **Special IPCC report on 1.5°C warming (SR15)**

   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 society[5].

FIGURE 8: GLOBAL CONTEXT FOR ACTION ON CLIMATE

The IPCC is currently in its sixth assessment report cycle (AR6), and their synthesis report is due to be released in 2022, which will bring together the latest science, evidence and projections for global warming.

[3] Sourced from https://www.un.org/sustainabledevelopment/development-agenda/
[4] Sourced from https://www.un.org/sustainabledevelopment/climatechange/
[5] Sourced from https://www.ipcc.ch/news_and_events/pr_181008_P48_spm.shtml

In addition, the World Economic Forum's Global Risks Report 2021[6] continues to highlight adverse climate change-related outcomes as among the most likely to occur with the highest impacts to the global economy. The chart below from the WEF's report shows several key climate risks clustered in the top right corner; that is, these risks are assessed to be among the most likely to eventuate, with the greatest economic impact among all the global risks that were assessed.

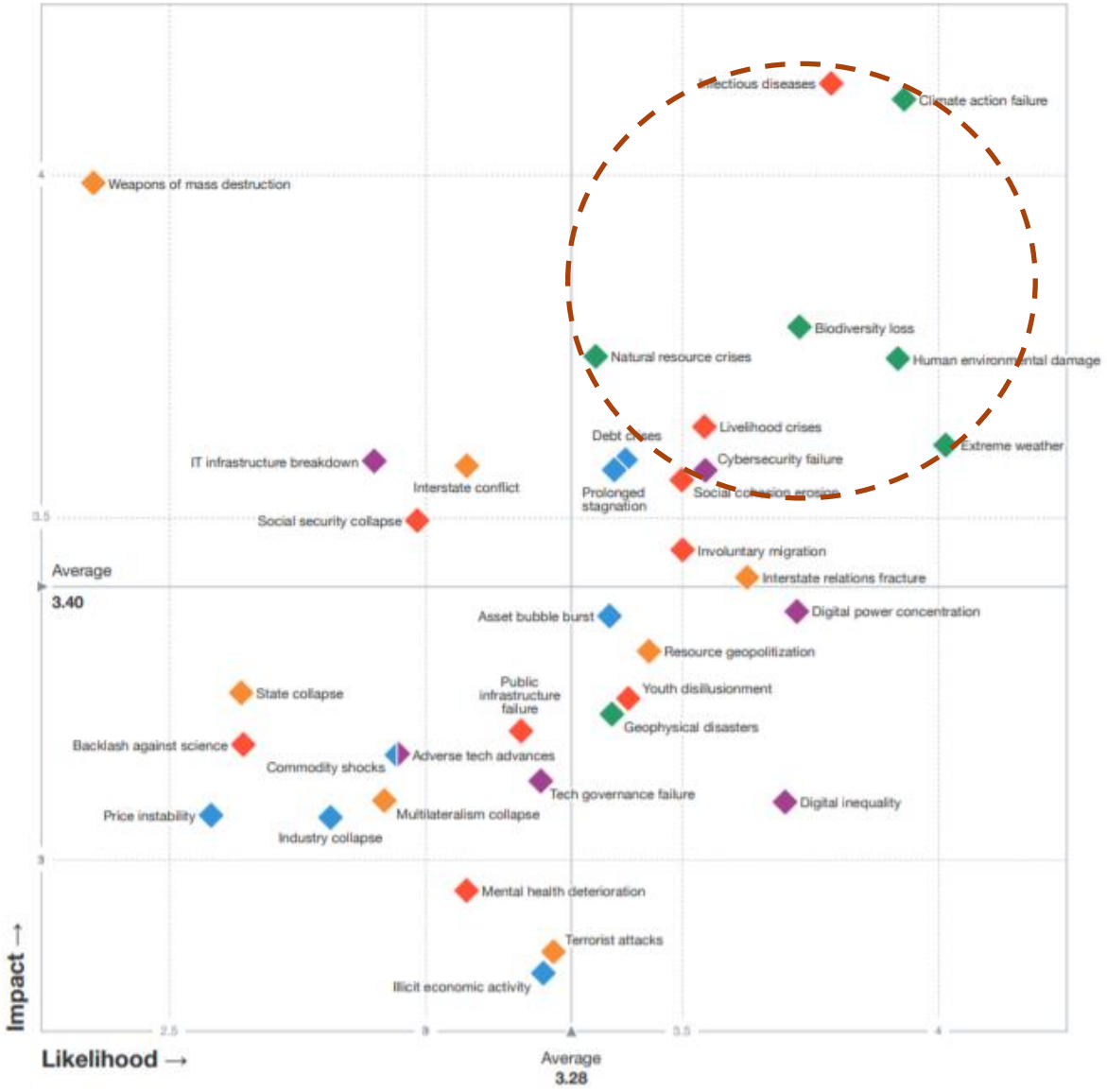


FIGURE 9: GLOBAL RISKS REPORT – LIKELIHOOD & IMPACT OF CLIMATE, OTHER RISKS TO GLOBAL ECONOMY

[6] http://www3.weforum.org/docs/WEF_The_Global_Risks_Report_2021.pdf

4 National, State and Local Government action

4.1 National targets

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 of 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 from renewable energy sources by 2020.

FIGURE 10: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – NATIONAL LEVEL

According to the Clean Energy Regulator[7], the Renewable Energy target has been met and renewable energy generation will exceed the target by some 7,000 GWh in the short term.

The RET is the main successful policy underpinning Australia's climate mitigation efforts. Other key initiatives include the Climate Solutions Fund, formerly the Emissions Reduction Fund, which sources abatement from eligible activities in the economy via periodic auction processes. Despite these initiatives, Australia's GHG emissions remained relatively steady over the period 2015 to 2020, with a sharp dip in emissions observed throughout calendar year 2020 due to Covid-19.

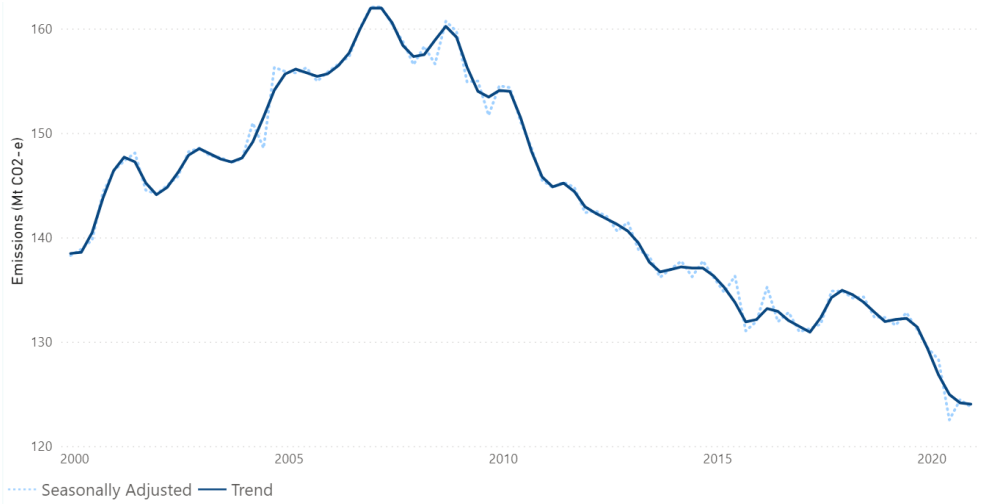


FIGURE 11: AUSTRALIA'S QUARTERLY GHG EMISSIONS FROM ALL SOURCES[8]

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

[8] https://www.industry.gov.au/data-and-publications/national-greenhouse-gas-inventory-quarterly-update-december-2020#quarterly-emissions-data

4.2 Western Australia State target and climate policy

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

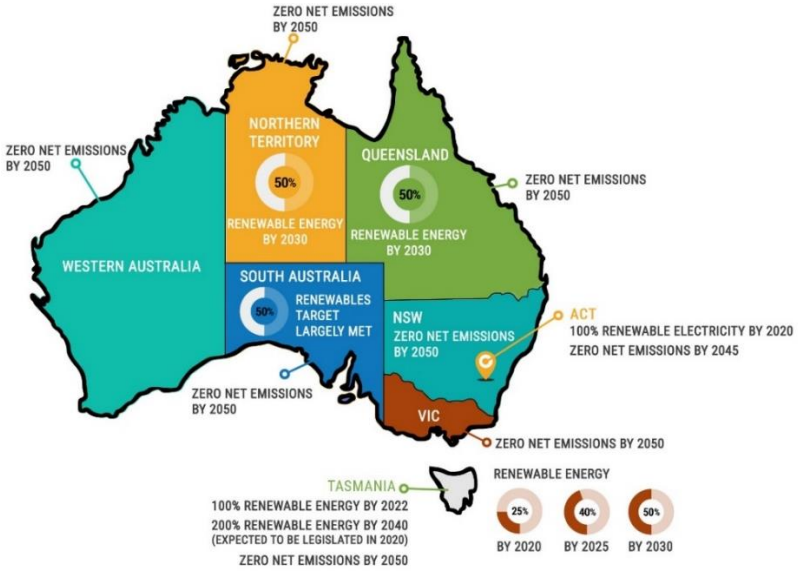


FIGURE 12: AUSTRALIA'S RENEWABLE ENERGY AND CARBON GOALS – STATE & TERRITORY LEVEL

Western Australia's government supports the Commonwealth Government's GHG emissions reduction target of 26% to 28% below 2005 levels by 2030, and has committed to working with all sectors of the WA economy to (aspirationally) achieve net zero greenhouse gas emissions by 2050.

In November 2020 the Government released its Western Australian Climate Policy[9]. This reaffirms the State's aspiration to reach net zero emissions for Western Australia by 2050, and a commitment to work with all sectors of the economy to achieve that goal. The policy highlights planned action in six key areas. The table below shows selected planned actions in each of these six areas.

TABLE 1: WESTERN AUSTRALIA CLIMATE POLICY 2020 – KEY ACTION AREAS & SELECTED ACTIONS

Key action area	Selected planned actions
Clean manufacturing and future industries	• Green industry transformation • Western Australian Bioeconomy Strategy • Renewable Hydrogen Strategy • Future Battery Industry Strategy • Greenhouse Gas Emissions Policy for Major Projects
Transforming energy generation and use	• Energy Transformation Strategy • Whole of System planning for net zero emissions • Distributed Energy Buyback Scheme • Solar Schools Program • Clean Energy Future Fund
Storing carbon and caring for our landscapes	• Restoration of landscapes under Plan for Our Parks

[9] https://www.wa.gov.au/government/publications/western-australian-climate-policy

	• Native Vegetation Rehabilitation Scheme • Main Roads offsets
Lower-carbon transport	• Electric Vehicle Strategy • Additional cycling infrastructure
Resilient cities and regions	• Climate Resilience Action Plan 2022–25 • Pilot Sectoral Adaptation Plan • Waterwise Perth
Government leadership	• State Government net zero transition • Energy-efficient social housing • Sectoral emissions reduction strategies • Climate risk framework

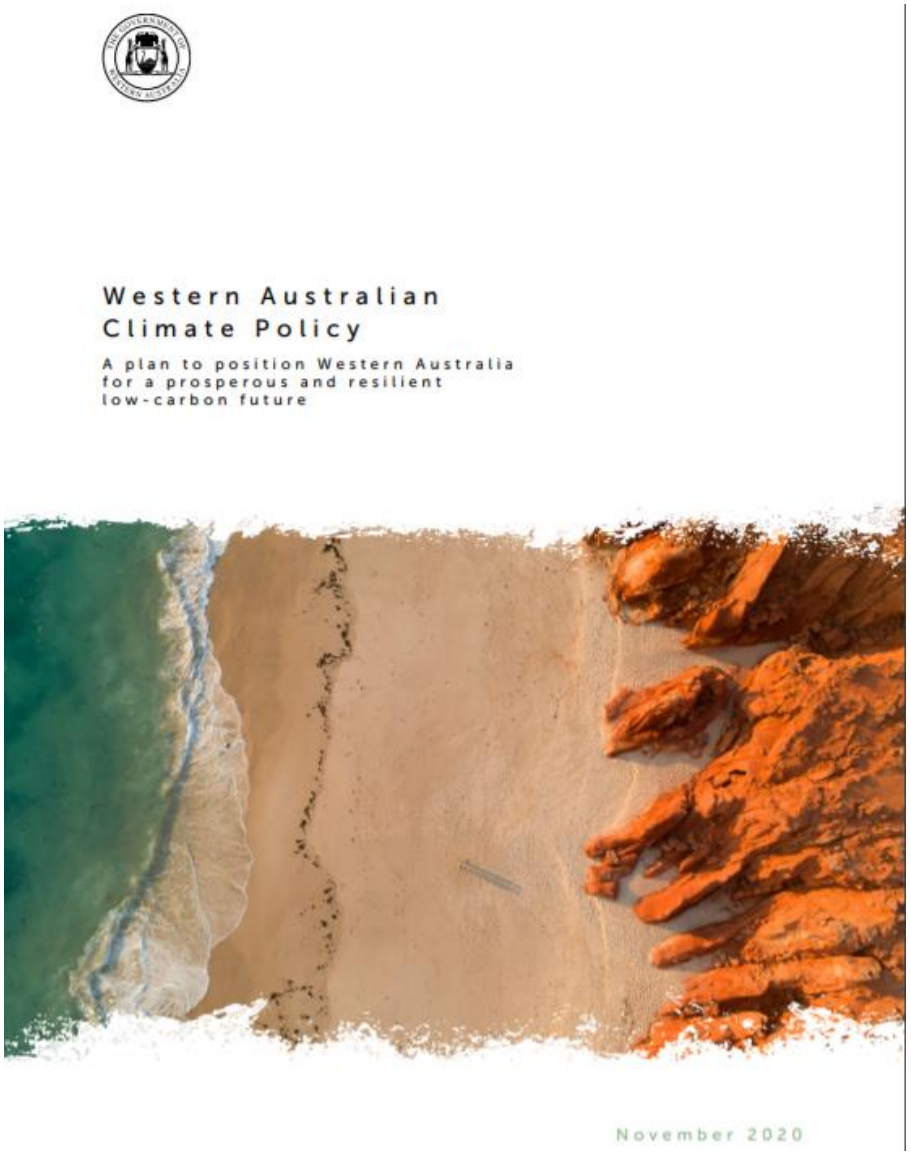


FIGURE 13: WESTERN AUSTRALIA'S CLIMATE POLICY, NOVEMBER 2020

4.3 Western Australia 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. Cities Power Partnership or CPP is an initiative of the Climate Council and it represents Australia's largest local government climate action network with >130 councils. This includes 25 local councils from Western Australia, including City of Bayswater. Key aspects of the CPP include:
    a. Making five action pledges to tackle climate change.
    b. Connection and sharing between participants.
    c. Access to an online Knowledge Hub and Power Analytics tool to help track emissions, energy and cost savings.
    d. Councils can also access support from local and international experts.
2. Adoption and publication of ambitious targets for renewable energy and/or carbon emissions for the City's operations and setting targets for renewables or emissions reduction in the community. The chart shows the status of targets set by councils in WA (September 2020).

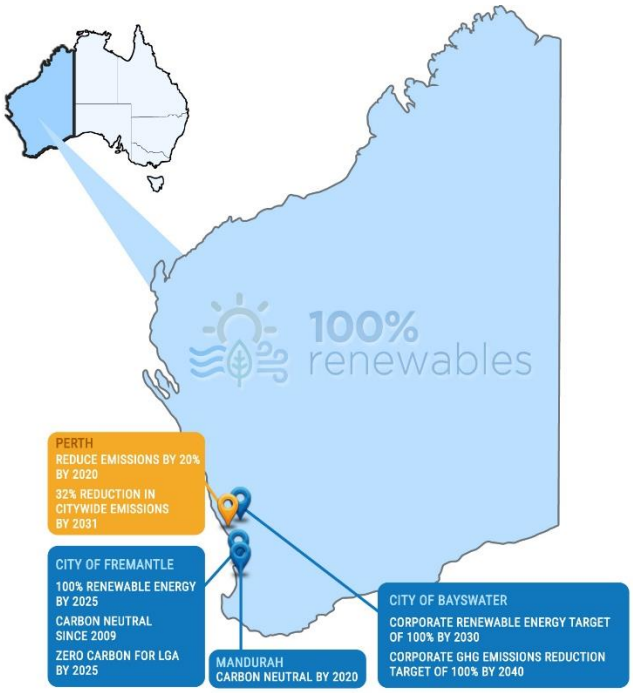


FIGURE 14: RENEWABLE ENERGY & CARBON TARGETS BY WA COUNCILS

3. In 2019, only 13% of streetlighting in Western Australia were LED or CFL, but councils are working together with the Western Australia Local Government Association (WALGA) and Western Power to progress LED streetlighting upgrades in WA, including opportunities to carry out bulk upgrades to LED technology and 'smart city' controls.[10]

[10] SONG Meeting – Energy Efficient Street Lighting (WALGA), June 2019

4.4 Local trends – what is occurring in City of Bayswater?

City of Bayswater Local Government Area is in the upper middle of LGAs in terms of the uptake of solar hot water and solar PV systems. According to data sourced from the Australian Photovoltaic Institute (APVI)[11], City of Bayswater LGA has:

- 7,567 PV installations, a 25.3% penetration rate, in April 2021, with more than 33.6 MW of installed capacity. Refer to the APVI map with City of Bayswater LGA details highlighted below.
- 204 installations over 10 kW and less than 100 kW and 7,363 installations of less than 10 kW.

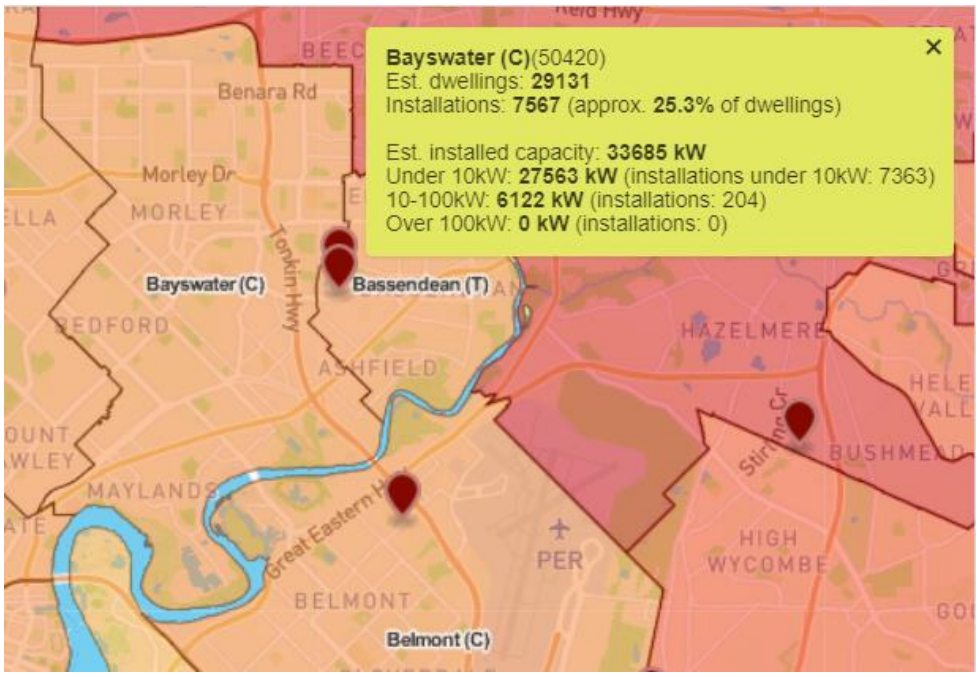


FIGURE 15: CITY OF BAYSWATER LGA SOLAR PV INSTALLATIONS, APRIL 2021

4.5 City of Bayswater initiatives

4.5.1 Renewable Energy and Emissions Reduction PAAS

A Position and Action Statement (PAAS) is a tool developed by the City to provide timely and responsive actions (in the short term) to emerging environmental issues. In response to a Council Notice of Motion of 25 June 2019, City of Bayswater adopted a PAAS for Renewable Energy and Emissions Reduction which set out the following objectives.

- Setting a renewable energy target of 100% by 2030 for the City's corporate operations;
- Outlining a framework to achieve a corporate greenhouse gas emissions reduction target of 100% by 2040; and
- Proposing a staged approach to reach the targets

A three-stage process was outlined for how these objectives would be met:

[11] Sourced from: https://pv-map.apvi.org.au/historical#12/-31.9427/115.8778

- Stage 1: Development of the City's emission profile by monitoring and reporting on emissions from electricity/gas, street lighting and the City's vehicle fleet and engineering plant. This includes adoption of interim emission reduction and renewable energy targets to be able to track progress in coming years.
- Stage 2: Preparation of a corporate Emissions Reduction and Renewable Energy (ERRE) plan outlining possible actions to be undertaken by the City to achieve the targets. This plan will also provide an initial business case for each of the options.
- Stage 3: Implementing, monitoring and reporting on the City's actions, emission reductions, cost savings achieved and progress towards emission reduction and renewable energy targets.

This report responds to both Stage 1 (partial – review and refinement of the City's emissions profile from energy use) and Stage 2. Implementation of effective management and governance systems are vital to the City's ability to achieve the abatement required to meet the adopted targets, together with the implementation of abatement measures described in this Plan.

4.5.2 Emissions reduction actions implemented and planned

City of Bayswater has implemented a number of initiatives to reduce energy demand and cost. For example the City has installed solar panels at 15 sites, with a total installed capacity of 376 kW. This solar PV can generate around 620 MWh of electricity per year, equal to 5% of the City's electricity demand. In the baseline year for this plan (2019/20) these systems generated 3.2% of the City's electricity needs, with several systems installed during the last financial year.

TABLE 2: SUMMARY OF CITY OF BAYSWATER'S SOLAR PV INSTALLATIONS

Site	Year of implementation	Size (kW)	Annual Potential Yield (kWh)
Works depot	2015	30.00 kW	51,000 kWh
Civic Centre system #1	2014	35.00 kW	56,028 kWh
Civic Centre system #2	2019	64.00 kW	100,356 kWh
The Rise #1	2011	15.00 kW	21,000 kWh
The Rise #2	2018	20.00 kW	30,660 kWh
Bayswater Waves	2017	40.00 kW	64,174 kWh
Bayswater Library	2016	10.14 kW	16,800 kWh
Olive Tree House	2016	7.80 kW	9,855 kWh
Morley Senior Citizens Centre	2016	8.80 kW	12,410 kWh
Lightning Park	2013	7.85 kW	13,200 kWh
Maylands Bowling Club	2014	5.61 kW	28,500 kWh
Men's Shed	2017	12.88 kW	19,740 kWh
Bayswater Bowling and Recreation Club	2020	26.40 kW	44,156 kWh
Bayswater Morley District Cricket Club	2020	13.20 kW	22,625 kWh
Morley Noranda Rec Club	2020	39.60 kW	63,862 kWh
Morley Windmills Soccer Club	2020	13.20 kW	22,625 kWh
Les Hansman	2020	26.60 kW	42,700 kWh
TOTAL		**376 kW**	**619,691 kWh**

Additionally the following initiatives are being developed by the City to reduce its emissions:

- Fleet: the majority of passenger fleet are migrating to hybrid technology, with 60% of passenger cars now hybrid and a target to reach 80-90% within the next two years. The City also has one hybrid truck in its fleet, and large trucks are at Euro v fuel emissions standard.
- Fleet: City of Bayswater currently has two electric vehicles in its passenger fleet with plans to introduce additional vehicles in the future, as well as EV charging points at City facilities.
- Waste: implementation of FOGO from March 2021 will increase diversion of the community's waste to landfill by approximately 50% compared with current levels
- The City has completed energy audits of thirteen of its largest energy using sites and expects implementation of actions from these to underpin energy savings in the next few years.
- City-owned public lighting will be upgraded to LED technology in future years, including Bayswater (completed), Morley (2021), Maylands (largely completed), and Anchorage Point.
- The City is actively examining opportunities to upgrade passive lighting in parks and reserves to LED and/or solar, focused initially on assets that are in need of replacement. A survey of existing lights will be completed in 2021.
- The City has been progressively changing to LED lighting for indoor and outdoor facilities, typically when lights require replacement.
- City of Bayswater's ICT equipment is being progressively upgraded, including consolidation of servers to offsite locations, installation of multi-function devices, reduction in printing, replacement of high-powered devices with low-energy devices such as ipads and Surface Pros, and replacement of spinning disk driven devices with solid-state devices (SSDs). Advised savings are a reduction in IT demand at the City's main building from 20 kW to just 4 kW.
- The City's urban forest strategy has an aspirational target to grow the current canopy from its 2018 level of 13.2% to 20% by 2025. Current planting rates are approximately 1,500 per year.

The scale and scope of initiatives being implemented by City of Bayswater evidence an organisation that is well on the way, through policies, plans and actions, to achieving its clean energy goals.

100% renewables

Baseline

City of Bayswater's energy and carbon footprint

5 2019/20 energy use and associated carbon footprint

The City's energy use and carbon footprint were assessed based on energy consumption and emissions from electricity, gas and fuel, based on data supplied covering the financial year 2019/20.

In 2020 the City's carbon footprint was dominated by electricity consumption, followed by diesel consumption for fleet, then natural gas and petrol. Energy consumption of leased and city-owned public lighting assets was estimated based on limited billing data. Many leased assets are in the process of changing to City responsibility for utilities, and data will improve as this process evolves. City public lighting was assumed to have an annual consumption of 400,000 kWh. This includes limited billing information for 213 city-owned lights, allied to advice from the City regarding lighting estimates based on its ongoing audit of outdoor assets (around 300 COB-owned streetlights, 123 bollard lights and 442 park light poles). This data is a best estimate, and this area of the City's energy use and emissions can also be improved in future.

TABLE 3: CITY OF BAYSWATER – ENERGY AND CARBON FOOTPRINT 2019/20

	Emission source	Activity data	Units	Scope 1 t CO2-e	Scope 2 t CO2-e	Scope 3 t CO2-e	Total	%
	Diesel for fleet	261	kL	708.6		36.2	744.9	7.9%
	Petrol for fleet	65	kL	150.4		8.0	158.4	1.7%
	Natural gas used in Council assets	11,971	GJ	616.9		49.1	666.0	7.1%
	Natural gas used in leased assets	116	GJ	6.0		0.5	6.5	0.1%
	Electricity use, Council assets	6,194,100	kWh		4,212.0	123.9	4,335.9	45.9%
	Electricity use, leased assets	649,293	kWh		441.5	13.0	454.5	4.8%
	Electricity use, streetlighting	3,992,267	kWh			2,794.6	2,794.6	29.6%
	Electricity use, city public lighting	400,000	kWh		272.0	8.0	280.0	3.0%
	Electricity yield from solar PV	373,545	kWh				0.0	N/A
	TOTAL:			**1,481.9**	**4,925.5**	**3,033.3**	**9,440.7**	**100.0%**

In 2020 the City's energy-related carbon footprint was 6,407 t CO_2-e for Scope 1 and 2 emissions sources, rising to 9,441 t CO_2-e including energy-related Scope 3 emissions (including streetlighting, which is owned by Western Power).

This carbon footprint breakup is typical of many metropolitan councils, where electricity consumption is dominant, led typically by streetlighting and recreation facilities such as aquatic centres. Diesel and petrol use for passenger vehicles and plant is typically small relative to electricity, as inner metropolitan road networks are relatively small.

The above inventory summary is repeated graphically below, by carbon emissions scope (refer to Sections 5.6 & 6.8 for more detailed overview of emissions scopes).

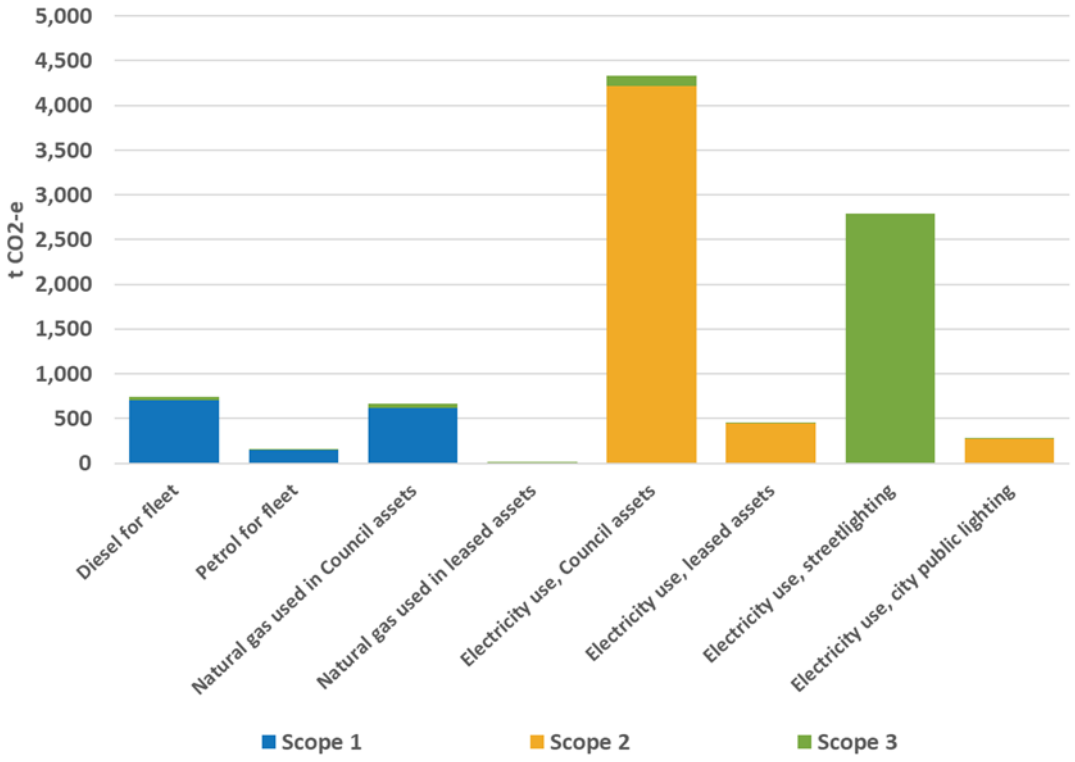


FIGURE 16: CITY OF BAYSWATER CARBON FOOTPRINT BY EMISSIONS SOURCE, ENERGY ONLY

5.1 Electricity consumption summary

Nearly 83% of the City's energy-related emissions are due to the consumption of electricity. As the main source of operational greenhouse gas emissions, electricity use was assessed further.

The following three charts provide a summary of where and how electricity is used, including:

- Top 10 electricity using accounts / sites seen against the balance of consumption
- Electricity use by site type, and
- Estimated electricity end use by equipment type

Electricity use is dominated by a small number of large sites / accounts (including the main streetlighting account) and many individually small electricity using sites. The 'top 10' sites' use 78% of all the City's electricity.

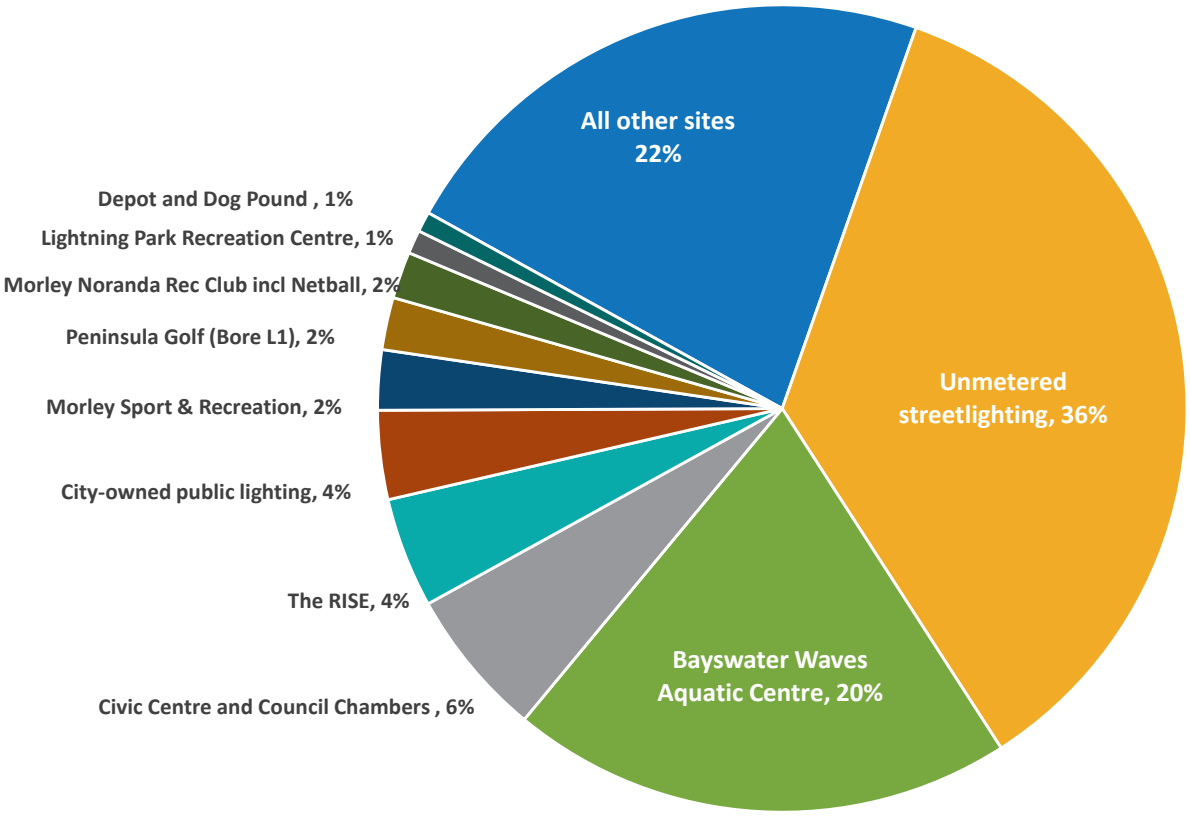


FIGURE 17: CITY OF BAYSWATER'S LARGE ELECTRICITY USING SITES

With 56% of all electricity consumed by two accounts – Western Power-owned streetlighting and Bayswater Waves aquatic centre, it is clear that achieving 100% renewable energy and carbon neutrality should focus in particular on these accounts. Other large energy-using sites are mostly buildings, including administration, recreation and community, and a focus on these will also help to drive the City's emissions down.

Viewed by site type it can be seen that unmetered streetlighting (City-owned as well as Western Power) consumes almost 40% of the City's power, while buildings and Bayswater Waves use 23% and 20%, respectively. Outdoor sites and leased buildings consume 18% of power, and other sites are small users. Discussions with staff indicate that achieving energy efficiency in outdoor assets such as irrigation pumping can be challenging, with bore pumps typically re-built at long intervals. Many leased sites have only recently come back under the City's responsibility in terms of energy billing, and improvements in this category will be made as sites are improved over time.

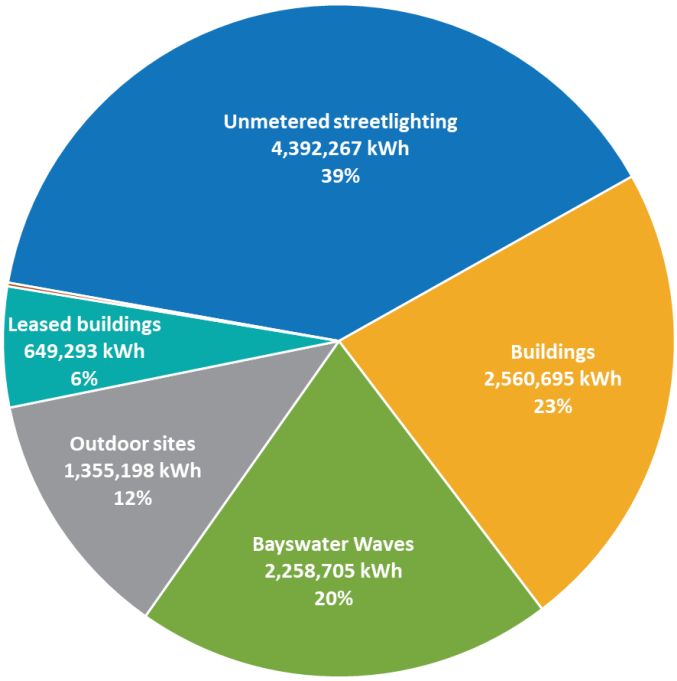


FIGURE 18: CITY OF BAYSWATER'S MAIN ELECTRICITY USING ASSET CATEGORIES

It is also possible to estimate the contribution by major equipment types to electricity use, based on experience with similar operations. The major equipment types include motor systems, lighting, air conditioning (HVAC) and power & appliances. The estimated contribution to the City's electricity consumption is illustrated below, highlighting lighting as the major user of electricity across all of the City's assets, and a high priority in terms of its focus on energy efficiency.

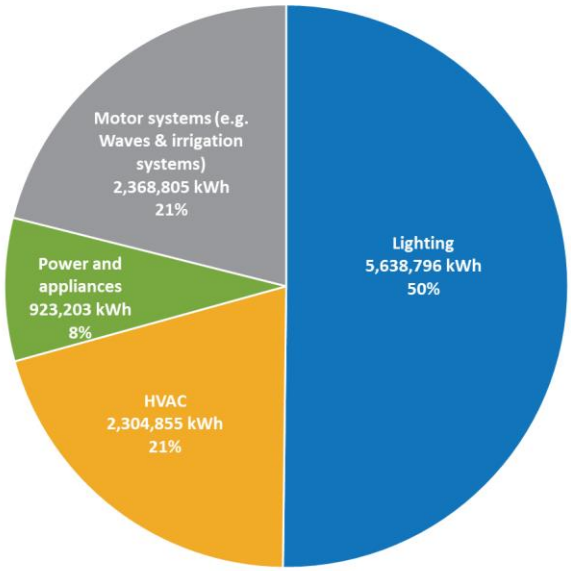


FIGURE 19: CITY OF BAYSWATER 'S ELECTRICITY USE BY END USE EQUIPMENT

5.2 Natural gas consumption summary

Natural gas use at Bayswater Waves Aquatic Centre accounts for 95.8% of the total gas consumption by the City. The balance is used in small quantities by a small number of sites. According to an energy audit report[12], pool heating contributes around 92% of Bayswater Waves Aquatic Centre's natural gas consumption while the rest is used for domestic hot water. Future strategies to help the City achieve its renewable energy and net zero emissions targets may need to consider electrification of these assets as they are replaced at the end of their life[13]. The figure below shows the large natural gas using accounts / sites seen against the balance of consumption.

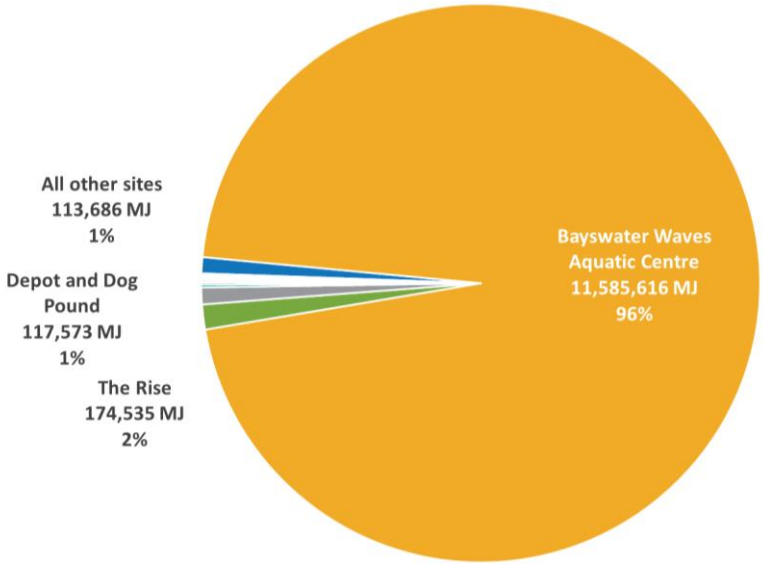


FIGURE 20: CITY OF BAYSWATER'S LARGE NATURAL GAS USING SITES

5.3 Fleet fuel consumption summary

Diesel and petrol consumption for fleet vehicles in 2019/20 was 260,732 L and 65,040 L, respectively. These figures represent a continuing decrease in the City's fleet fuel use as seen by summary data for the last four financial years.

TABLE 4: CITY OF BAYSWATER – FUEL CONSUMPTION 2016/17 TO 2019/20

Total	16/17	17/18	18/19	19/20
Unleaded Petrol	90,681 L	82,169 L	88,758 L	65,040 L
Diesel	285,969 L	269,352 L	278,259 L	260,732 L

[12] GFG Consulting: Bayswater Waves – Energy Efficiency/Sustainability Findings

[13] At this time there are no renewable 'Green Gas' products sold in the WA gas network. A certificate market is emerging in NSW and a small number of grid-injected biomethane projects are also being developed. The emergence of a market for renewable gas could make the retention of gas heating for Bayswater Waves a feasible option in future, but for the purposes of this current ERRE Plan a switch to electric heat pumps is assumed to occur, powered with renewable electricity.

The City's fuel consumption is further broken down into fleet and plant vehicles as shown below.

TABLE 5: FURTHER BREAKDOWN OF FUEL CONSUMPTION – FLEET AND PLANT CATEGORIES

Fleet	16/17	17/18	18/19	19/20
Unleaded (L)	83,243.88	75,320.10	80,731.97	58,421.48
Diesel (L)	100,356.58	97,293.41	110,740.51	98,144.89
Plant	**16/17**	**17/18**	**18/19**	**19/20**
Unleaded (L)	5,001.75	4,413.81	5,088.78	4,022.92
Diesel (L)	185,215.97	171,662.25	167,039.98	162,164.10
Two stroke (L)*	2,831.97	2,831.04	3,415.82	3,017.93

*2 stroke fuel consumption is assumed to be 14% diesel and 86% petrol based on information supplied

In order to inform modelling of the impact of different fuel efficiency / switching strategies, a further estimate of fuel breakdown was made. The City recently upgraded its fuel and fleet monitoring systems, and going forward it will be feasible to develop accurate reports of fuel use by vehicle and vehicle / plant type. For this emissions roadmap modelling purpose, the following were assumed:

- All fleet petrol consumption refers to the City's passenger vehicles and 2019/20 data reflects a passenger fleet that is 60% hybrid
- All fleet diesel consumption refers to the City's utility and other light commercial vehicles (LCVs)
- All plant petrol and two stroke fuel consumption refer to small plant equipment.
- All plant diesel consumption refers to heavy plant equipment

5.4 Solar PV contribution to demand

As noted above, solar PV systems met over 3% of the City's electricity demand in 2019/20, with this figure expected to rise to 5% in 2020/21 once all systems have operated for a full year.

5.5 Business-as-usual energy and emissions projection to 2040

A business-as-usual (BAU) energy and carbon projection to 2030 and 2040 was modelled for City of Bayswater. In developing the model, the following assumptions were made:

- According to City of Bayswater's Local Planning Strategy[14], the population is forecast to increase by 12% by 2026 from the 2016 population. It was assumed that 50% of the annual population growth rate correlates to the BAU growth rate for the City's facilities[15].
- Renewable energy and energy efficiency initiatives that City of Bayswater recently implemented have been taken into account.

[14] https://www.bayswater.wa.gov.au/city-and-council/council/council-meetings/agendas-and-minutes/2019/april/ordinary-council-meeting-minutes-30-april-2019

[15] This gives an approximate assumed BAU growth rate of 0.6% per year. While energy demand for many services may remain relatively fixed, it is common to forecast at the higher end of potential growth so that the size of the abatement task in future years in not understated.

- The BAU growth rate for streetlighting was assumed to be zero as development will mostly be infill rather than greenfield.
- The BAU growth rate for outdoor sites was assumed to be zero as the number and irrigation practices for parks, and lighting of parks is not expected to change.
- The City's capital work program includes the expansion of the Morley Sport & Recreation facility. It is assumed that electricity demand will increase by two-thirds of the current demand from FY2022-23.
- The capital works program also includes the re-development of Maylands Waterland. It is assumed that this account will have twice its historical electricity demand from FY2022-23 and will further increase by another 50% from 2025 due to increased water usage when stage 2 of the development is completed.

Modelling of future energy demand and greenhouse gas emissions results in the BAU scenarios shown below. Note that for greenhouse gas emissions projections, a straight-line reduction in the State's grid carbon intensity has been assumed, with zero emissions projected to be achieved by 2050 in line with the State's net zero target. The actual trajectory of grid emissions intensity reduction will depend on the changing fuel mix in energy supply in coming years.

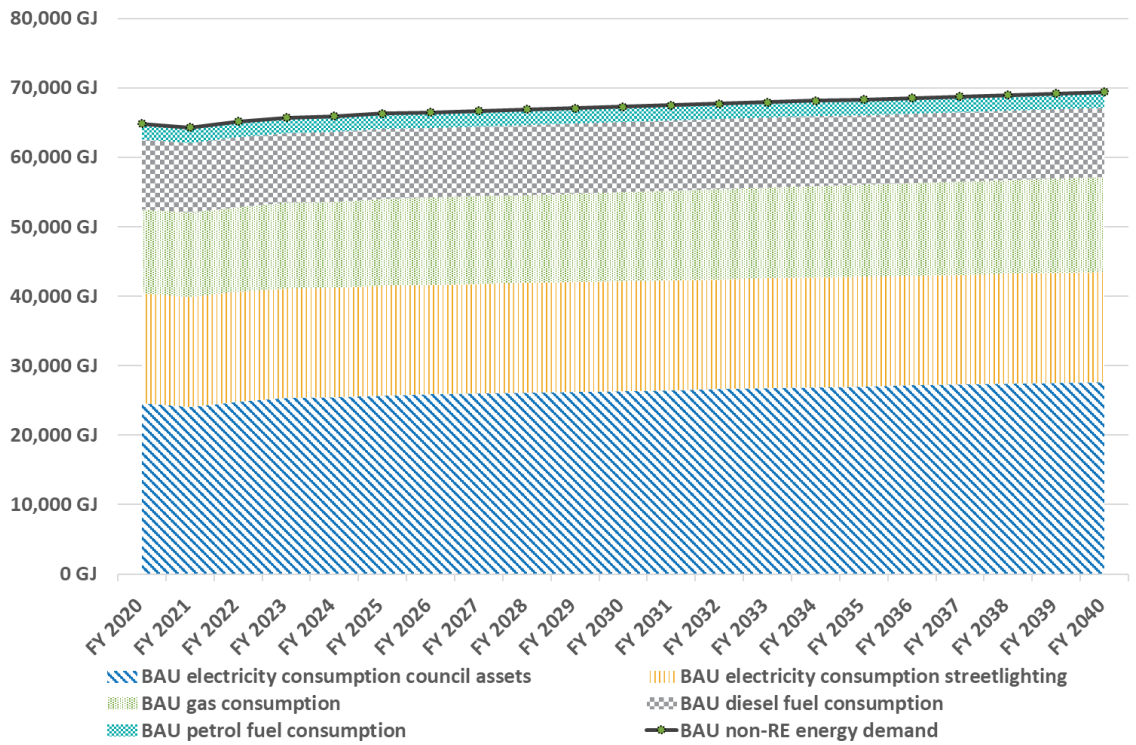


FIGURE 21: BAU ENERGY PROJECTION TO 2040 – CITY OF BAYSWATER (OPERATIONS)

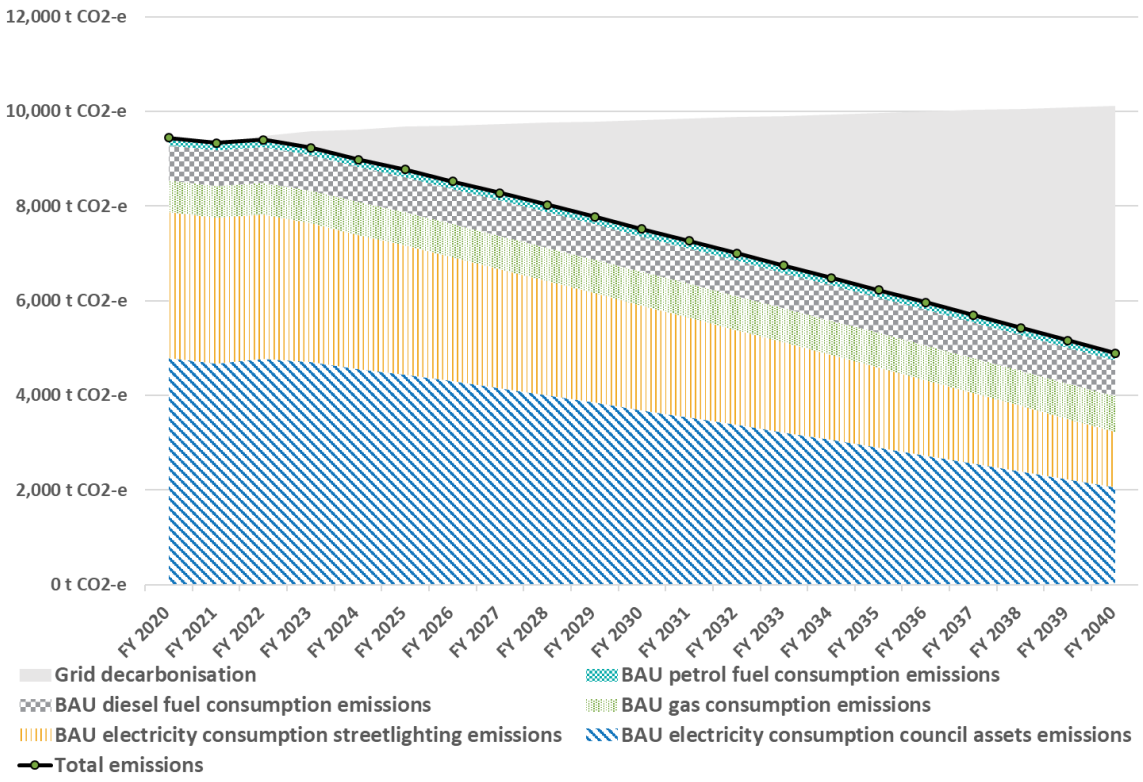


FIGURE 22: BAU GREENHOUSE GAS EMISSIONS PROJECTION TO 2040 – CITY OF BAYSWATER (OPERATIONS)

5.6 Value chain scope 3 emissions

City of Bayswater's current carbon footprint encompasses all energy-related emissions associated with the City's operations. It is becoming more common for organisations to consider the full impact of their organisation on emissions, beyond energy to run their operations and into their value chains and non-energy scope 1 emissions. Several local councils are now taking this approach, drawing on or certifying their emissions to the Australian Government's Climate Active Standard. This standard includes 15 categories of value chain scope 3 emissions, that would be added to energy-related emissions, plus scope 1 emissions from refrigerant gases. These categories include:

- Purchased goods and services
- Capital goods
- Fuel- and energy-related activities (not included in Scope 1 or Scope 2)
- Upstream transportation and distribution
- Waste generated in operations
- Business travel
- Employee commuting
- Upstream leased assets
- Downstream transportation and distribution
- Processing of sold products
- Use of sold products
- End-of-life treatment of sold products
- Downstream leased assets
- Franchises
- Investments
- Refrigerant gases (scope 1)

At this time these emissions are not accounted for by City of Bayswater. Based on experiences of other Councils', accounting for emissions that are considered relevant to the City could add ~40% to energy-

related emissions, potentially raising the City's carbon footprint to ~15,000 t CO_2-e. Options available to Bayswater to include these emissions within the scope of its net zero emissions target, and to account for and offset these emissions, are outlined in this Plan. An expanded BAU projection of the City's carbon footprint including possible value chain emissions is shown below.

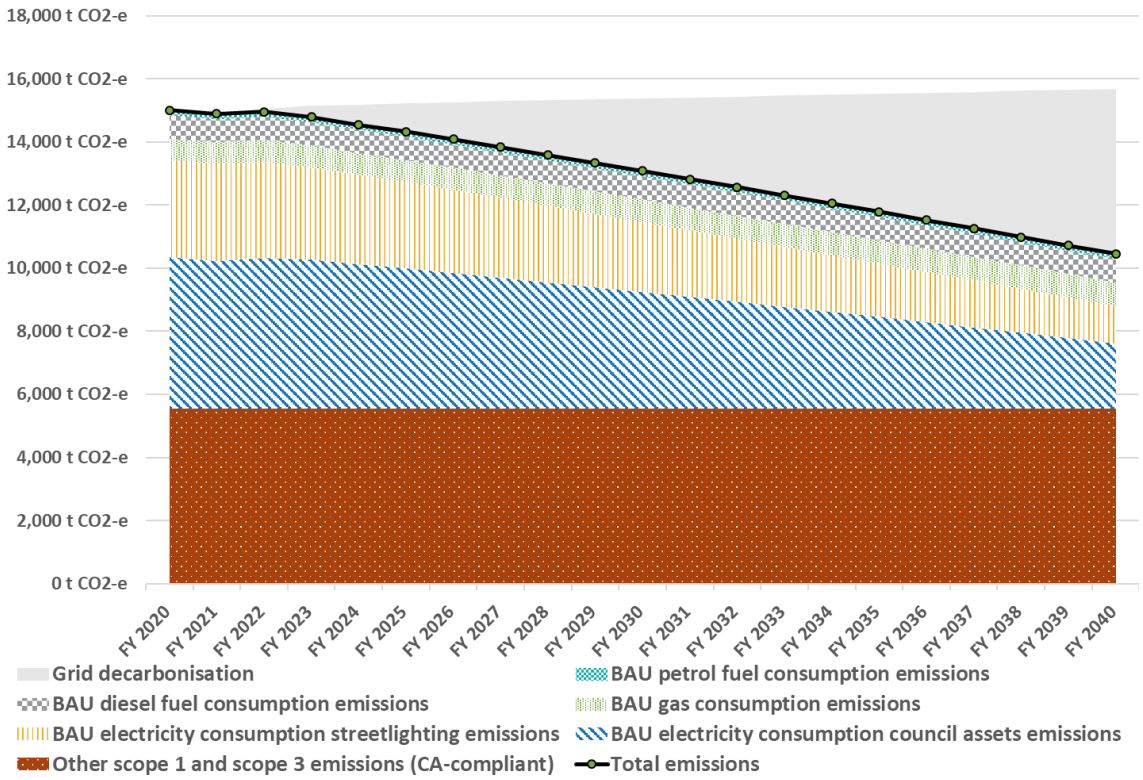


FIGURE 23: PRELIMINARY ESTIMATE OF A CLIMATE ACTIVE-COMPLIANT BAU CARBON PROJECTION TO 2040

100% renewables

Abatement Strategy

City of Bayswater's emissions reduction and renewable energy opportunities

6 City of Bayswater's emissions reduction and renewable energy opportunities

6.1 City of Bayswater's renewable energy and emissions targets

The ERRE Plan responds to targets for renewable energy and emissions reduction that the City set for its operations in August 2019, namely:

- a corporate renewable energy target of 100% by 2030
- a corporate greenhouse gas emissions reduction target of 100% by 2040

In responding to these targets this Plan recommends that the following refinements to the targets be made to both include interim targets and reflect current and emerging opportunities for renewables and emissions reduction.

- *2025 100% renewable electricity for the City's operations, excluding streetlighting*
- *2030 100% renewables and/or carbon offsets for all City energy use, including streetlighting*
- *2040 Net zero greenhouse gases for the City energy-related and value chain emissions*

6.2 Measures available to reduce City of Bayswater's footprint

A review of City of Bayswater's current energy demand and carbon footprint, review of other data and information supplied by the City, and engagement with key stakeholders and external parties was conducted to develop a picture of renewable energy and emissions reduction opportunities. These are organised into nine areas that respond to the brief for the development of the ERRE Plan, illustrated below.

1. On-site solar PV
2. Mid-scale renewable generation
3. Renewable energy power purchasing
4. Carbon offsets
5. Sequestration
6. Energy efficiency
7. Electric vehicles and plant
8. Behavioural change
9. Sustainable procurement

In addition to these abatement levers, management and governance of the ERRE Plan and consideration of financing / funding of the Plan need to be addressed so that the City has the resources and processes to achieve its targets.

These nine measures are illustrated in the graphic below. Following this, a summary of the scope, scale, cost-effectiveness and risks associated with each of these measures is presented that can enable the success of City of Bayswater's abatement efforts. This is then followed by the development of action plans that will enable the City to achieve its targets.

ONSITE SOLAR PV
Generate renewable energy locally, e.g., through solar panels

MID-SCALE RENEWABLE GENERATION
Solar Farm construction, Wind Energy projects, Geothermal projects, Bio-energy projects

RENEWABLE POWER PURCHASING
Power purchasing agreements (PPA) with green supplier

CARBON OFFSETS
Voluntary carbon offset agreements

SEQUESTRATION
Tree planting

ENERGY EFFICIENCY
Improving energy efficiency in Council buildings and assets; changing City-owned streetlights and ancillary lights to LED

ELECTRIC VEHICLES AND PLANT
Introduction of Electric Vehicles and electric engineering plant

BEHAVIOURAL CHANGE
Awareness and education programs; Development of a Carbon Neutral Buildings and projects policy

SUSTAINABLE PROCUREMENT
Make purchasing decisions based on the entire life cycle of costs and environmental impacts.

FIGURE 24: NINE CATEGORIES OF ENERGY AND EMISSION REDUCTION FOR CITY OF BAYSWATER

6.3 Management and governance of ERRE Plan

Description

Executive leadership and commitment is required if the Emissions Reduction and Renewable Energy Plan is to be successful. The implementation of management and governance systems for the plan, and commitment and authority to act at relevant levels to reduce emissions, is also key for success. Key priorities at leadership and management systems level may include:

- A leadership group that brings together key stakeholders from cross-functional areas
- Refine, monitor and re-evaluate targets for the City for emissions reduction and renewable energy, including definition/scope, scale, timing and any interim targets (refer to Section 6.1)
- Employ dedicated staff resources within the City to develop suitable systems and processes, engage with internal stakeholders to plan works to be implemented in Annual Budgets and the Corporate Business Plan, engage with and educate the Bayswater community particularly in City-owned facilities that are used by the community, identify and secure external funding to implement abatement projects, and report regularly to the Executive and to Bayswater's councillors on progress
- Develop and track metrics of the ERRE Plan's success, such as the City's carbon footprint, the percent of renewables (rooftop and in supply agreements) in the City's overall energy supply, progress towards implementation of agreed actions (completed, in progress, not completed), and potentially bottom-up indicators such as the number of hybrid and electric vehicles / plant in the City's assets.
- Integration of the ERRE Plan with the City's Integrated Planning and Reporting framework, and with other relevant strategic plans
- Establish responsibilities and accountabilities related to the plan, included in position descriptions
- Review billing, metering and external providers to improve systems for energy data collection and reporting of energy use and carbon emissions (i.e. through Azility)
- Implement suitable measurement and verification systems, including M&V of significant abatement projects, and the analysis of monitoring systems to determine overall progress on emissions reduction
- Develop communication, engagement and capacity-building plans that identify key staff, identify communication channels, report progress against the City's goals, identify and develop training, induction and awareness materials, and solicit input that increases awareness, recognition and buy-in
- Engage with other Councils, EMRC, other key stakeholders (e.g. Western Power, WALGA) and peer networks such as the Cities Power Partnership (CPP)

Data collection and management

The development of the City's carbon footprint as part of the development of the ERRE Plan has highlighted challenges associated with getting accurate and timely information, needed to inform future tracking and reporting of progress.

The work has highlighted that management of energy and emissions data is an ongoing, active task that requires both external and internal resources. The table below highlights a few of the key observations and recommendations from the development of the City's footprint for this project.

TABLE 6: OBSERVATIONS AND RECOMMENDATIONS FOR IMPROVEMENT

Observation	Recommendation for improvement
During the establishment phase of an energy / emissions database there is scope for large data gaps and duplication of sites.	All work to develop the City's energy and carbon footprint needs to be regularly checked to ensure that it is reflective of the current set of accounts, and that duplicates are removed. A review of the accounts is taking place during 2021 with the help of the Finance department.
Many large sites were duplicated, potentially due to a change in City of Bayswater's large sites retailer, leading to double entries in the database.	The City should regularly review their energy data with Azility to assure its currency and accuracy.
Some facilities and accounts have different names in asset databases compared with Azility	From time to time the City will acquire / build and divest assets, and as this occurs a process needs to be in place to ensure that new and old sites are identified and handled accurately. With divested sites it is important that historical data is retained for reporting of trends.
More than 80 leased sites have limited or no energy or billing data available or in Azility at this time.	With the transfer of sites to the City's responsibility, a process needs to be in place to ensure all data is transferred to Azility, that there are no duplicates (e.g. where leased sites are co-located with other City accounts) and that data to the start of the City's responsibility is obtained. This requires coordination between City of Bayswater and Azility.
The City owns a large number of public lights, in town centres, Maylands foreshore and across its park network. Some lights are grid-connected, others are not. Some lights are metered while others are unmetered. There is no single consolidated database that captures all of these lights and their power use and cost, though an audit process to capture this in ongoing.	The City should develop a full database of the city-owned public lights and their associated electricity accounts, and capture this information in Azility.

Integrated Planning and Reporting Framework

A desired outcome of this ERRE Plan, and of future updates to this Plan, is that it be implemented through successive Corporate Business Plans and in Annual Budgets. The ERRE Plan, and the 100% renewable energy and net zero emissions goals in particular, should sit alongside other key strategic plans of the City of Bayswater and be integral to the normal business processes of the City. Some of the plans and policies that the ERRE will sit alongside to inform future business plans and budgets include:

1. City of Bayswater, Greening our Garden City: Urban Forest Strategy
2. Environment and Liveability Framework
3. Waterwise Bayswater, a strategy to 2030
4. The City's Vehicle Fleet Policy and strategy
5. The City's Procurement Policy

FIGURE 25: CITY OF BAYSWATER'S INTEGRATED REPORTING AND PLANNING FRAMEWORK

Scope for abatement

By itself, this will not result in actual emissions reduction, but good leadership, accurate data and an effective management framework for ERRE will be key factors in City of Bayswater achieving its targets for renewable energy and net zero emissions.

Risks and mitigation

Without good governance, management and monitoring of progress the City's efforts to reduce its emissions will be less effective in the long term.

Costs and benefits

The main cost will be the allocation of budget for staff resources to establish, govern and implement the City's Emission Reduction and Renewable Energy Plan over the coming two decades, including management and engagement with internal and external stakeholders. Experience of metropolitan Councils who are developing and implementing programs to deliver on ambitious targets such as those set by City of Bayswater indicates that at least two to three full time staff are engaged in this work. At present City of Bayswater has just 0.3 FTE dedicated to the role that is intended to drive the ERRE Plan.

6.4 Funding of the ERRE Plan

Description

The impact of emissions reduction measures on the City's budget will depend on the timing and scale of actions implemented over time. Many measures will likely be implemented through the City's budget process, and grants, incentives and loans may also be considered. There are typically four categories of funding that could be used, as illustrated below. Two funding options, including Grants & Incentives, and Revolving Energy Funds are then outlined further.

FIGURE 26: CATEGORIES OF FUNDING OPTIONS FOR ERRE PLAN

Grants and incentives

Grant funding is an important tool in most Councils' plans for achievement of ambitious efficiency and renewable energy goals. As WA's Climate Policy evolves to meet the State's aspirational net zero goal by 2050 it is likely that programs and funding will be available, typically on a competitive basis.

For example the Clean Energy Future Fund was launched in April 2020 and supports the implementation of innovative clean energy projects in Western Australia. This program provides a minimum of $250,000 and up to a maximum of $4 million in grant funding to eligible projects that reduce emissions. With a maximum grant contribution of 25%, the fund is targeting projects with a total value of $1 million to $16 million. For the City of Bayswater, this could potentially support a range of initiatives, for example:

- Streetlight upgrade to LED technology
- Bundle community facilities that the City owns to deliver LED lighting, solar panels, battery storage and potentially electric vehicle charging solutions
- Expand solar PV at large community facilities such as Waves and the Rise to maximise rooftop solar and implement carport solar PV systems with EV charging

EMRC, on behalf of the City has applied for funding under this scheme. The City is still to receive information as to whether the City is successful

In addition to grants, financial incentives may also be available for eligible renewable energy or emissions reduction measures. For example, under the Renewable Energy Target (RET) scheme, Small-scale Technology Certificates (STCs) can be claimed against the upfront price of a solar PV system, typically equal to 30% of the total cost (but declining annually until the scheme expires in 2030). The City is currently maximising use of the STCs by installing several solar PV systems each financial year.

Similarly, Large-scale Generation Certificates (LGCs) can be created and sold (or withheld) for renewable energy systems greater than 100 kW.

At this time Western Australia does not have any certificate schemes for energy efficiency, and does not offer solar feed-in tariffs for most businesses. If either of these situations change in future, or other incentives become available, the City should position itself to avail of incentives that improve the financial outcomes for their efficiency and renewable energy projects.

A key function in relation to grants and incentives is having a person or people who are tasked to identify, prioritise and respond to these opportunities when they arise. Having 'shovel-ready' projects is often necessary to be successful in grant applications, so ensuring the ERRE is regularly reviewed and the next group of projects to be implemented have good documentation on scope and business case is important.

Revolving Energy Fund

City of Bayswater can consider the establishment of a Revolving Energy Fund in future to assist with the sustainable funding of initiatives that help to drive the City's emissions down and increase renewable energy.

A Revolving Energy Fund (REF) is a sustainable funding mechanism, whereby savings from sustainability projects are tracked and used to replenish the fund for the next round of investments. In this way, funds used for energy efficiency, renewable energy, and potentially other sustainability projects can be spent multiple times to drive emissions reduction, energy and cost savings. REFs allow a monetary investment to be spent a number of times (through reinvesting energy cost savings) without reducing its value. Several options exist in terms of how a REF would operate:

- It could start with seed funds that do not need to be repaid, such as a % of funds from an environmental levy or similar. Savings from efficiency and renewable energy measures are returned to the REF and used to fund future initiatives.
- Savings are largely returned to the project owners so that they see the savings on their bottom line, with some savings retained in the REF to fund new measures.

- The REF operates as a loan fund with savings repaid into the fund before project owners have access to the savings. This way, the initial fund level is maintained and can be added to over time.
- The REF could be set up to be a contestable funding source. Projects would need to meet and be scored against agreed criteria to be eligible to apply for funding. Projects with the highest scores could receive funding from the REF.

The diagram below illustrates how a REF could operate.

FIGURE 27: REVOLVING ENERGY FUND – TYPICAL FUNDING CYCLE

Key to a successful REF is that it is sustainable and can fund projects that meet an organisation's goals, while achieving a balance between seed and top-up funds from the budget, returned savings from implementation of projects, and grant funds. The development of an implementation plan, plus an auditable project and savings cashflow model for a REF is a good idea that can help with the design of the fund to ensure this outcome. An example of a REF cashflow model is shown below.

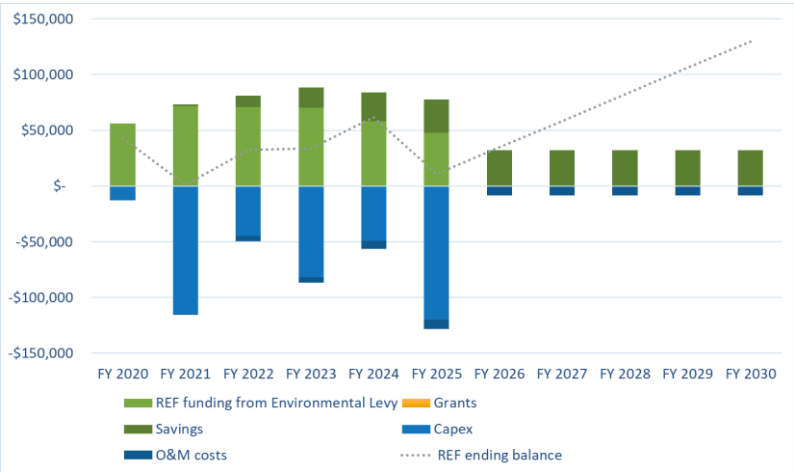


FIGURE 28: MODELLED CASHFLOW OF A REVOLVING ENERGY FUND

Scope for abatement

By itself, a planned approach to financing / funding of the City's ERRE Plan will not result in actual emissions reduction, but a planned approach to funding at ERRE Plan, Corporate Business Plan and Annual Budget levels will help to sustain implementation to meet targets. A pro-active approach to identifying, prioritising and applying for grants – allied to having 'shovel-ready' projects will help City of Bayswater successfully attract funds that can accelerate implementation of the ERRE Plan.

Risks and mitigation

Without a planned, structured approach to the identification of projects to be implemented, and to the securing of budget or external funds to implement ERRE Plan projects, there is a greater risk that opportunities are missed, and City of Bayswater does not achieve its goals within its target timeframe.

Costs and benefits

The main cost will be the allocation of staff resources and time to plan and implement agreed funding approaches, including management and engagement with internal and external stakeholders, documenting and following a grant application process, and if applicable establishing and managing a Revolving Energy Fund. Key to successful development and implementation of a REF over time is resourcing to manage and govern the ERRE Plan as noted above.

6.5 On-site solar PV

Description

Solar PV is a well-established technology, and more than 20% of Australian homes and an increasing number of businesses have already installed solar panels to reduce their grid energy costs and greenhouse gas emissions. Uptake of battery energy storage (BESS) remains low but will become more cost effective in future.

Current status of solar PV in City of Bayswater

As described the City of Bayswater has actively pursued solar PV opportunities across its portfolio, with systems installed having a capacity of 376 kW, capable of generating an estimated 620 MWh annually, equal to ~5% of the City's electricity demand.

The City's largest system is a 99 kW array on the Civic Centre, installed in two stages in 2014 and in 2019. Large energy using facilities including Bayswater Waves and The RISE have modest solar systems, at 40 kW and 35 kW respectively.

Recently, the number size of PV systems installed by the City has increased, with five systems at 119 kW generating capacity installed in 2020.

New solar PV opportunities in City of Bayswater

An assessment of further solar PV capacity at City of Bayswater facilities is made via the following approaches.

- Firstly, energy audit reports commissioned by the City have been completed and provide an indication of new or additional capacity at some sites. The indicated PV potential for these sites is taken from audit reports.
- Secondly, facilities staff have reviewed site lists and indicated which sites could be suitable for solar, though in many cases barriers have been identified that may be required to be overcome, such as shading, roof structural assessments and the like. For these sites solar PV systems are sized with the assumption that they can meet 25% of the site's electricity usage with 20% export to grid (noting that this has zero value at this time).
- The maximum solar that would be considered at any site would be sized to meet 100% of electricity demand, and in all cases would require battery storage.
- For large sites like Bayswater Waves, Civic Centre and The RISE we have modelled the potential capacity for solar at these sites, additional to what is already installed. The large demand at these sites and their prominence in the community may make them potentially attractive for larger-scale solar installations.

A summary of the solar PV and BESS opportunities that have been identified at City operated sites is provided below. There may be opportunities for individual large sites, or for an aggregation of multiple sites to bid for funding incentives via the Clean Energy Future Fund.

Scope for abatement

Small sites – from audit reports and estimates

Taking data from energy audits and assuming that solar PV can meet 25% of the daytime energy demand of small sites identified to be potentially suited to solar installation, City of Bayswater could potentially increase its solar capacity by close to 294 kW (excluding Bayswater Waves, the Civic Centre and The RISE, as well as very small sites where assessed PV capacity is less than 1 kW). This could cost in the order of $383,000 and return savings of more than $71,000 annually to the City based on current energy rates. The list of potential sites, with estimated PV sizes, costs, savings and paybacks is tabulated below.

Solar yield for these small sites would be around 421 MWh per year, with approximately 80% of this likely to be consumed at City sites. Hence electricity demand could be reduced by 337 MWh per year, equal to 3% of current electricity demand. Bayswater could claim all of the renewable energy generated and count this towards its 100% renewable energy target.

A table of the potential capacity, yield and payback for solar PV at the City's small sites is provided in Appendix A. It should be noted that this is indicative, and site-by-site assessments will be needed to verify feasibility and capacity over time.

Small sites – maximising solar PV

The small sites assessed above could potentially install solar panels and battery storage to meet more of their energy demand. Around 1,200 kW of solar PV and likely more than 3 MWh of storage, fully utilised on these sites, would meet their energy demand. The capacity of these sites to host this much solar capacity, optimal sizing of batteries and other factors would likely significantly lower the potential for solar and storage, but these figures give a potential upper limit for solar at the City's small sites.

Large sites additional solar PV potential

The Civic Centre, The RISE and Bayswater Waves all have solar PV systems, with combined capacity of 175 kW, including almost 100 kW at the Civic Centre, 40 kW at Bayswater Waves and 35 kW at The RISE. Taken together these three sites still have a net grid electricity demand that exceeds 800 kW in mid-summer, 500-600 kW during winter daytimes, and more than 300 kW on weekends.

City of Bayswater's largest potential source of additional solar PV is through expansion over time of solar on these three sites. Locations could include:

- Expanding The RISE and Bayswater Waves up to 100 kW to avail of STC discounts,
- All main north-facing roofs at Bayswater Waves, as well as the outdoor pool grandstand,
- The Bayswater Waves carpark, which could meet more of the site's demand, provide covered parking to patrons and could host EV charging to the public as electric vehicle sales increase,
- The RISE roof, excluding the large auditorium,
- The RISE carpark, with north-east facing arrays at the north end of the facility,

- The rest of the Civic Centre roof, which already has two arrays installed, and
- The Civic Centre carpark, located near the entrance or to the rear of the site

The potential PV capacity of all locations modelled at these three sites is 755 kW, with generation potential of 1,176 MWh per year (refer to Helioscope modelling at Appendix C). This is 10% of the City's electricity demand. Practically, this capacity could be implemented over three stages, including:

- Expand to maximum STC size initially,
- Expand to maximise rooftop PV capacity with LGC-scale systems,
- Expand to carport solar PV systems in the long term, potentially with EV charging

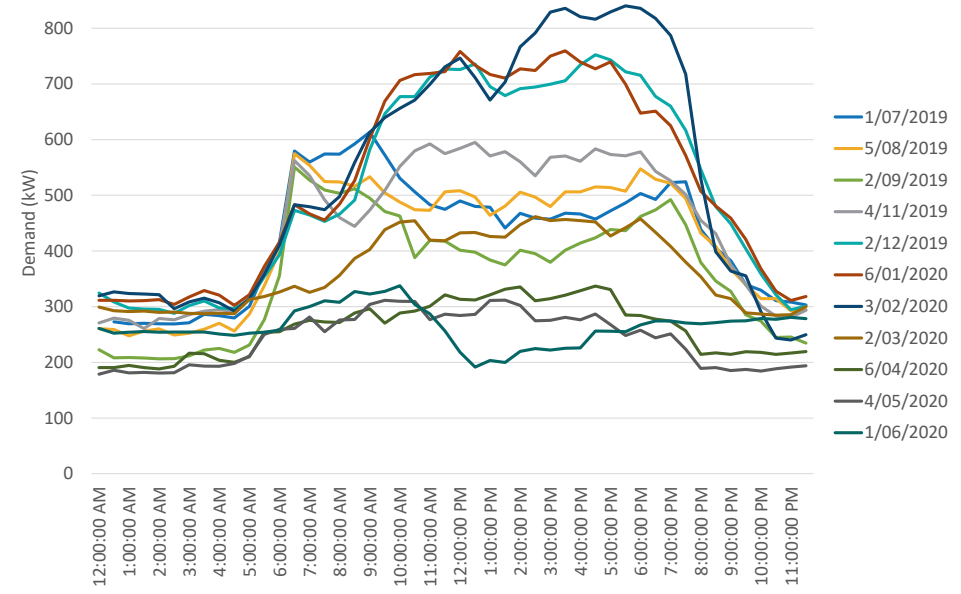


FIGURE 29: COMBINED LOAD PROFILES FOR BAYSWATER WAVES, THE RISE AND CIVIC CENTRE

FIGURE 30: BAYSWATER WAVES STAGE 1 – MODELLED 59.3 KW OF SOLAR PV ON ROOFS

FIGURE 31: BAYSWATER WAVES STAGE 2 – 140.7 KW OF SOLAR PV ON ROOFS INCL. THE GRANDSTAND

FIGURE 32: BAYSWATER WAVES STAGE 3 – MODELLED +99.6 KW OF CARPORT SOLAR

FIGURE 33: THE RISE STAGE 1 – MODELLED 65.2 KW OF SOLAR PV ON ROOFS

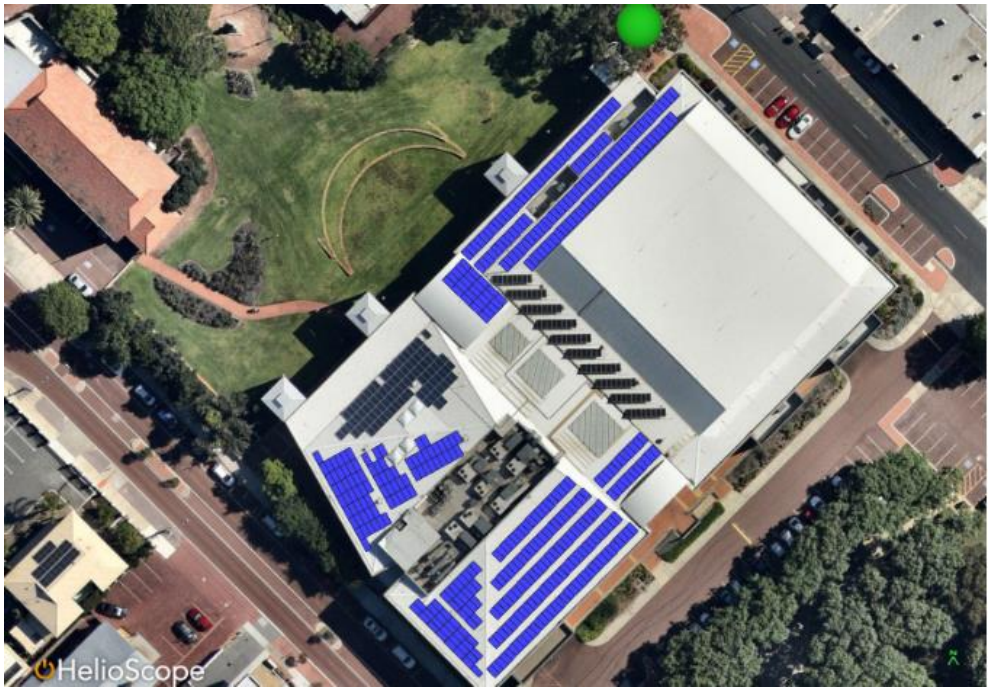


FIGURE 34: THE RISE STAGE 2 – MODELLED +116.6 KW OF SOLAR PV ON ROOFS

FIGURE 35: THE RISE STAGE 3 – MODELLED +87.2 KW OF CARPORT SOLAR

FIGURE 36: CIVIC CENTRE STAGE 1 - MODELLED +150.2 KW ADDED ROOFTOP SOLAR

FIGURE 37: CIVIC CENTRE STAGE 2 - MODELLED +36.1 KW OF CARPORT SOLAR

Risks associated with solar PV implementation are minimal provided systems are appropriately sized, designed, installed, connected and maintained on sound buildings and structures, as with any other asset.

Risks and mitigation

The cost effectiveness of solar PV has long been demonstrated, and panel prices continue to fall. The commercial sector has embraced solar PV in recent years, and this is the main factor that has driven further acceleration in the implementation of rooftop solar.

With a large number of community facilities, and with large sites like Bayswater Waves, The RISE and the Civic Centre highly visible in and used by the community, stakeholder consultation is an important element of any large solar rollout that should be implemented and managed.

Costs and benefits

The costs and benefits to City of Bayswater from solar have been demonstrated via the systems installed to date. Benefitting from the Small-scale Technology Certificate (STC) upfront discount, the City will have achieved paybacks in the range 3 to 6 years.

An STC-focused approach could see a further 294 kW of solar installed at small sites as highlighted above, and could see systems at Bayswater Waves and The RISE expand up to 100 kW (125 kW additional).

Combined this approach would see the following approximate financial and energy / GHG outcomes:

- Capital cost: $509,000
- Annual savings $116,500
- Payback: 4.37 years
- Annual electricity savings: 625 MWh per year
- Annual GHG savings (current grid intensity): 315 t CO_2-e (approximately 3.3% of the current carbon footprint)

An approach that seeks to progressively increase the amount of solar PV at the three large facilities – Bayswater Waves, The RISE and the Civic Centre – could see a further 630 kW installed over time, based on the current demand at the sites, and potentially more than this if these sites provide EV charging infrastructure for patrons / visitors / staff in future.

Costs for these systems will be higher than for the STC-scale approach above; based on current costs we have estimated this to be $1.75 million, though as solar and battery costs continue to decline the actual costs in the longer term will be lower than this:

- Systems will be more than 100 kW in size, and are ineligible for an upfront STC discount. The City would have to create Large-scale Generation Certificates (LGCs) and sell these to boost the business case, but would have to retire the LGCs if the renewable energy was to be credited to the City. With low forecast LGC prices within the next few years (<$10/LGC), with the RET scheme ending in 2030, and given transaction costs to create and manage LGCs there is a case for retiring and/or not creating LGCs for these systems.
- Carport systems are more expensive than roof mount systems.

- If batteries and EV charging form part of future expansion of solar at these sites there are further added costs.

Given higher upfront costs the business case for these expansion projects will be weaker than for STC-scale projects, but they would deliver a range of benefits:

- They would serve to significantly boost the contribution of behind-the-meter solar to the City's target,
- Insulate Bayswater against volatility in electricity pricing as the grid transitions to renewable energy
- Would be highly visible in and potentially used by the community (for EV charging in future), and
- The return on investment would still be good and predictable over the long term.

Lastly, as batteries become cheaper it will be feasible to consider expanding solar at smaller sites, to maximise the amount of each small site's energy demand that can be met with solar. As noted above an estimated upper limit based on energy demand for small sites is 1,200 kW of solar and 3 MWh of storage, but the true potential would require a more detailed assessment with reference to the energy use, roofs and activity patterns on a site-by-site basis. This assessment can be developed progressively over the next few years.

6.6 Mid-scale renewable energy generation

Description

The Renewable Energy and Emissions Reduction PAAS highlighted technologies that could be considered in the context of local renewable energy generation, including:

- Solar Farm (with potential for collaboration with other councils)
- Wind Energy (with potential for collaboration with other councils)
- Geothermal, and
- Bioenergy

Mid-scale renewable energy generation typically refers to a customer-scale grid-connected plant where the output is included within the customer's energy supply agreements. In examples from other states, these projects have:

- Access to land that is low cost or owned by the project proponent / host, and that is suitable to host a renewable energy generator,
- A connection agreement with the distribution network provider,
- A licensed electricity retailer who is the buyer of the renewable energy generated, 'sleeves' the output into a power supply agreement with the host, and manages any risks associated with the contract and the market so that the customer's price requirements are met,
- EPC and O&M contracts for design, construction and operation of the plant,
- Optionally generators could sell the output to the grid and take the spot price and sell or retire LGCs to achieve their financial and emissions goals

Like a renewable energy PPA that is negotiated for supply from remote / non-Council projects, developing a mid-scale project is a complex undertaking and requires assessment of a range of aspects as noted above. This has proven challenging in the Western Australia market to this time.

A further challenge for mid-scale renewable energy projects is their ability to generate energy at a price comparable to what utility-scale renewable energy generators can do. If both options are available it is more likely that the larger scale project will be able to offer power at a lower price than a small generator. In this case local co-benefits may need to factor into the business decision as well.

Across Australia there are numerous small-scale energy generators, mostly landfill gas and mini hydro projects built before the RET was introduced. Management of landfills may change as greater focus is placed on reducing organic waste to landfill, with the creation of biomethane for energy generation or sale of gas being one possible opportunity. Whether this is a future opportunity for City of Bayswater in conjunction with other councils or parties would require further evaluation.

Recent renewable energy mid-scale projects have mainly been solar, with three prominent examples being Sunshine Coast Council (15 MW solar farm at Valdora generates the equivalent of Council's electricity demand), City of Newcastle (5MW Summerhill landfill solar farm meets ~30-40% of Council's electricity needs), and Albury City's 1.1 MW solar farm co-located with a 1.1 MW landfill gas generator at the City's landfill.

FIGURE 38: IMAGE OF THE VALDORA 15 MW SOLAR FARM IN SUNSHINE COAST, QLD[16]

FIGURE 39: IMAGE OF THE SUMMERHILL 5 MW SOLAR FARM IN NEWCASTLE, NSW[17]

FIGURE 40: IMAGE OF THE ALBURY LANDFILL WITH 1.1 MW LFG + 1.1 MW SOLAR FARM[18]

[16] https://www.sunshinecoast.qld.gov.au/Environment/Sunshine-Coast-Solar-Farm/Solar-Farm-Overview
[17] https://newcastle.nsw.gov.au/council/news/latest-news/solar-farm-powering-city-operations-and-revenue
[18] http://maps.nearmap.com?q=Location%201%40-36.026649%2C146.897049&ll=-36.026649,146.897049&z=17&t=k&nmd=20201210

Current status and opportunities in City of Bayswater

At this time there are no known mid-scale renewable energy generation opportunities that City of Bayswater can pursue. Land in the city is unlikely to be viable, so collaboration with one or more organisations such as neighbouring councils, Eastern Metropolitan Region of Councils (EMRC) (e.g. at Red Hill landfill, where there is an existing LFG generation plant and grid connection) or other grouping is likely to be necessary.

In terms of load, the following graph below show the aggregated load profile in weekday, weekend and holiday for all City of Bayswater large sites with interval data. Taken together these account for around 40% of the City's electricity use, with streetlighting and small sites accounting for the remainder. City of Bayswater's overall load profile will be slightly biased towards night demand due to streetlighting.

In any mid-scale renewable energy project that City of Bayswater seeks to join in future, its metered sites' load, combined load of all sites, and changes to demand profiles due to future onsite solar and new sites will be required to help determine a project's scale and included sites. This highlights further the importance of developing and maintaining the City's energy data management systems.

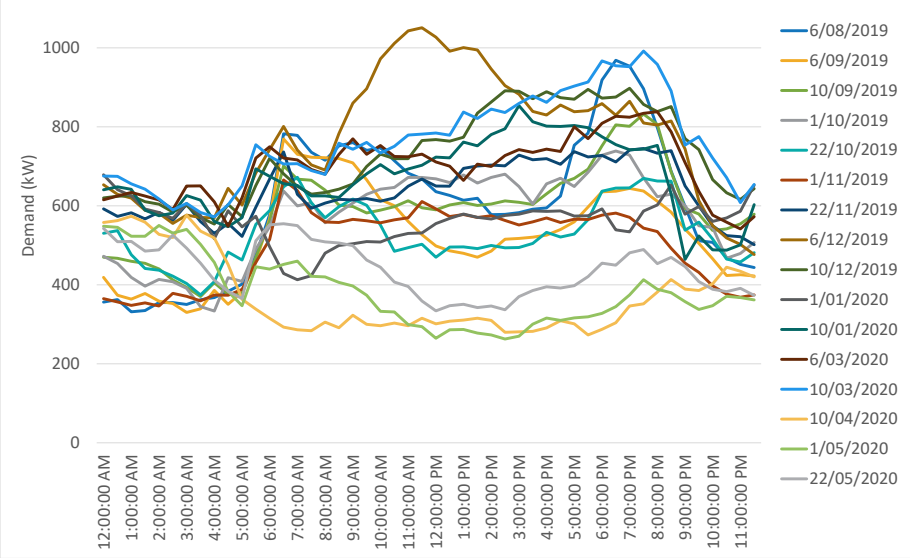


FIGURE 41: CITY OF BAYSWATER COMBINED LOAD PROFILE FOR ALL INTERVAL-DATA SITES

Scope for abatement

The scope for abatement of the City's emissions would depend on the scale and type of project, treatment of LGCs generated from the project's operation, and Bayswater's offtake fraction of energy generated, for example.

The case to develop a project such as this may have multiple aspects, such as meeting the City's own targets for renewables and abatement, its desire to see more renewable energy projects built in or close to City of Bayswater, its desire to build projects that involve community ownership and/or establishment of a community

energy retailer, or opportunities for grant funding that may make such a project economically viable compared with other options.

So, the scope for abatement of the City's emissions can range from a small fraction up to 100% of electricity emissions.

Risks and mitigation

Key risks include but are not limited to:

- Retailers willingness to purchase the output from a renewable energy generator and 'sleeve' the output into electricity agreements
- Subject to generator size, any registration requirements in the Wholesale Electricity Market (WEM) in Western Australia[19]
- Greater skills and knowledge of electricity markets would be required to manage revenue risk over time, or at least to increase literacy within City of Bayswater so that this opportunity can be explored, explained and informed decisions taken
- The value of Large-scale Generation Certificates (LGCs) is forecast to decline and there may be limited value in these in coming years, reducing the value of the project

These are examples and other risks may apply and would need to be identified, assessed and managed / mitigated as part of the project development.

Costs and benefits

The costs and benefits of mid-scale generation are not known at this time for City of Bayswater. Projects that have been developed will have drawn on electricity market and LGC forecast pricing at the time they were developed, and City of Bayswater would similarly draw on future forecasts in their assessment of the business case.

A key aspect of the business case should be the delivered price of electricity to the City from a mid-scale project compared with a renewable energy PPA from a utility-scale project or retailer, if and when this is feasible in the WEM.

[19] https://aemo.com.au/en/energy-systems/electricity/wholesale-electricity-market-wem/participate-in-the-market/information-for-current-participants/rule-participant-classes

6.7 Renewable energy power purchasing

Description

The single biggest opportunity to reduce electricity emissions is to purchase renewable energy and/or renewable energy offsets via City of Bayswater's electricity procurement process. Electricity consumption accounts for 83% of City of Bayswater's operational energy carbon footprint, with 66% of power consumed by just a few sites / accounts (including Bayswater Waves, Western Power-owned streetlighting, The RISE and the Civic Centre). Unlike other abatement options, this would not require City of Bayswater to physically implement change, only to stipulate that renewables be purchased to meet part or all of its electricity needs. There are three main ways in which an organisation can source renewable energy, illustrated below (the third option is covered in the above section on mid-scale renewable energy generation).

FIGURE 42: MAIN OPTIONS FOR SOURCING RENEWABLE ENERGY SUPPLY

The first of these – entering into a renewable energy power purchase agreement (PPA) is by far the most prominent approach, with around 8,000 GWh of electricity being sourced under PPAs entered into over the last four years, mostly by businesses located in NSW, Queensland and Victoria. This approach has been taken by several local governments in the National Electricity Market (NEM, eastern states) in recent years and underpins most goals to reach net-zero emissions[20].

City of Bayswater has been engaged in a process with other local councils to assess the feasibility of developing a renewable energy PPA, and this work is ongoing. The work is being led by the Western Australia Local Government Association (WALGA).

Subject to both this feasibility assessment, an assessment of the cost savings to City of Bayswater compared with both current electricity agreements and with 'brown' power savings in future agreements, and consideration of the City's goals for renewable energy and emissions reduction, Bayswater should seek to incorporate renewables into its electricity contracts in increments or in total over the next ten years.

Based on City of Bayswater's current energy mix, purchasing 100% renewables would lead to annual abatement of 7,865 t CO_2-e (83% of all energy-related

[20] Examples of NSW Councils' purchasing renewables as part of their electricity supply include: Southern Sydney Regional Organisation of Councils, City of Sydney, City of Newcastle, Northern Beaches Council, Eurobodalla Shire Council and Hawkesbury City Council.

Scope for abatement

emissions). In a first renewable energy PPA it is intended to only include the City's facilities and to exclude unmetered streetlighting owned by Western Power. In future the City's goal is that electricity sourced to supply streetlights is also from renewables, and City of Bayswater will work with key stakeholders to seek this outcome.

This is a significant abatement and renewable energy opportunity relative to others available to the City. Without the ability to source renewables for electricity supply the options to cost-effectively reduce emissions are limited, and purchasing of LGCs and/or carbon offsets would become the primary pathway to zero emissions.

If all vehicles were also electrified in future and supplied with renewable energy, then additional abatement will result.

Risks and mitigation

Establishing a corporate PPA is complex, time-consuming and contains approaches and risks not previously considered by most consumers. These take time and resources to assess and manage, and this will be reflected in WALGA's procurement process.

Based on experience of customers in the NEM a renewable energy PPA:

- is typically for a longer time period than a regular agreement,
- is associated with new-build solar, wind, hydro and battery projects,
- may be with recent or new entrants to the energy market, and
- occurs in an uncertain policy environment for renewable energy and climate change response

The key risk areas are illustrated below and may be assessed as part of a process to determine the best procurement solution for City of Bayswater and its partner councils.

FIGURE 43: KEY RISKS WITH RENEWABLE ENERGY PPAS

In the process being undertaken by WALGA it is understood that an initial three-year retail agreement with a progressively higher proportion of renewables is one of the options under consideration, with the potential for longer-term and/or fully renewable agreements in the longer term.

Costs and benefits

The costs or benefits of a renewable energy PPA are assessable via comparison of PPA offer pricing with forecast regular power pricing, and so is inherently subject to the quality of knowledge and assumptions underpinning forecasting.

The costs and benefits of a PPA for City of Bayswater are being established through a feasibility assessment and market testing process.

6.8 Carbon offsets

Description

The Renewable Energy and Emission Reduction Position and Action Statement sets a target of 100% corporate greenhouse gas emissions reduction by 2040. The target does not specify if scope 3 (energy-related and supply chain) emissions are to be included in calculations, nor whether accreditation is to be sought under the Climate Active standard (section 6.1 highlights this as a key review and decision action for City of Bayswater in coming years).

It is reasonable to expect that coverage of the emissions reduction target will be highlighted, within the City and the community, in coming years. Given this, this section of the strategy sets out the current national standard for carbon neutrality and what this may look like for City of Bayswater given the experience of other local councils.

What is Climate Active?

Currently, the gold standard for carbon neutrality attainment in Australia is Climate Active certification. Climate Active used to be called the 'National Carbon Offset Standard', or NCOS for short. The National Carbon Offset Standard and Carbon Neutral Program were launched by the Australian Government in 2010 to provide a credible framework for managing emissions and achieving carbon neutrality. Initially, the Standard was designed for organisations, products and services and was expanded to events, buildings and precincts in 2017.

The Climate Active Carbon Neutral Standard for Organisations (Organisation Standard) is a voluntary standard to manage greenhouse gas emissions and achieve carbon neutrality. It provides best-practice guidance on how to measure, reduce, offset, validate and report emissions that occur as a result of the operations of an organisation. Further information is available at www.climateactive.org.au.

Emission sources / carbon accounting 'scopes'

To help differentiate between different emissions sources, emissions are classified into the following scopes according to the GHG Protocol – Corporate Standard:

- Scope 1 emissions include all direct greenhouse gas emissions from sources that are within the organisation's control boundary. These could be emissions from fuel use, refrigerants and on-site electricity generation.
- Scope 2 emissions include purchased electricity, heat, cooling and steam (i.e. energy produced outside the organisation's control boundary but used within the organisation).
- Scope 3 emissions are all indirect emissions that occur as a result of the activities of the organisation but occur from sources outside the organisation's control boundary.

These emissions scopes are illustrated below.

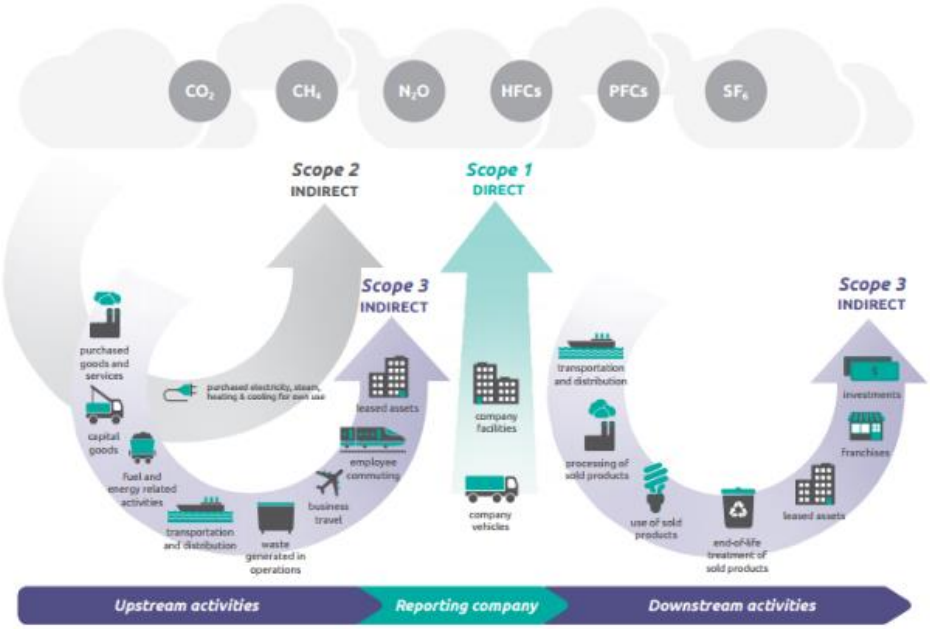


FIGURE 44: GHG EMISSIONS SCOPES

In Climate Active, the emission sources should include Scopes 1, 2 and 3, compared to National Greenhouse and Energy Reporting (NGER) which only covers Scopes 1 and 2 emissions.

What is included in Scope 3 emissions?

Broad categories of Scope 3 emissions sources that need to be considered are as follows (please refer to Appendix B: Description of scope 3 emission categories for more details regarding these categories. Note that these are GHG Protocol-defined categories and not all will necessarily apply to the City of Bayswater).

1. Purchased goods and services
2. Capital goods
3. Fuel- and energy-related activities (not included in Scope 1 or Scope 2)
4. Upstream transportation and distribution
5. Waste generated in operations
6. Business travel
7. Employee commuting
8. Upstream leased assets
9. Downstream transportation and distribution
10. Processing of sold products
11. Use of sold products
12. End-of-life treatment of sold products
13. Downstream leased assets
14. Franchises
15. Investments

An assessment of each data category will highlight those sources that must, should and do not need to be included in a Climate Active-compliant carbon inventory, based on a 'relevance' test. The emission sources included in the boundary should be related to the City's operations only. The figure below shows an example of emission sources that a council such as City of Bayswater may need to include when aiming for Climate Active certification for an organisation, based on experience of other local councils.

FIGURE 45: POSSIBLE ACTIVITY AND SCOPE INCLUSIONS IN A CLIMATE ACTIVE FOOTPRINT

What might City of Bayswater's emissions be under Climate Active?

It is typical for non-energy scope 3 emissions to add significantly to the Climate Active carbon footprint of a local council. While City of Bayswater's energy-related carbon footprint across all three scopes is approximately 9,500 t CO_2-e, its overall carbon footprint may be as much as 15,000 t CO_2-e, as a result of all of its activities and their carbon emissions impact.

Strategies to reduce the City's carbon footprint

If City of Bayswater was to determine that its greenhouse gas emissions reduction target should apply to the full scope of the City's corporate activities, then this would represent the emissions that would need to be offset.

This could simply be achieved by purchasing carbon offsets for all of the City's emissions. More likely though, in achieving its goal for 100% renewable energy, City of Bayswater would only have to offset the balance of its emissions.

The diagram below shows an illustrative emissions reduction pathway that adopts this approach (note this is not a profile of City of Bayswater's emissions and pathway to net zero emissions). Of course, the balance of emissions after reaching 100% renewable energy could also be reduced over time through sustainable procurement decisions, active travel strategies for staff, and waste reduction for example.

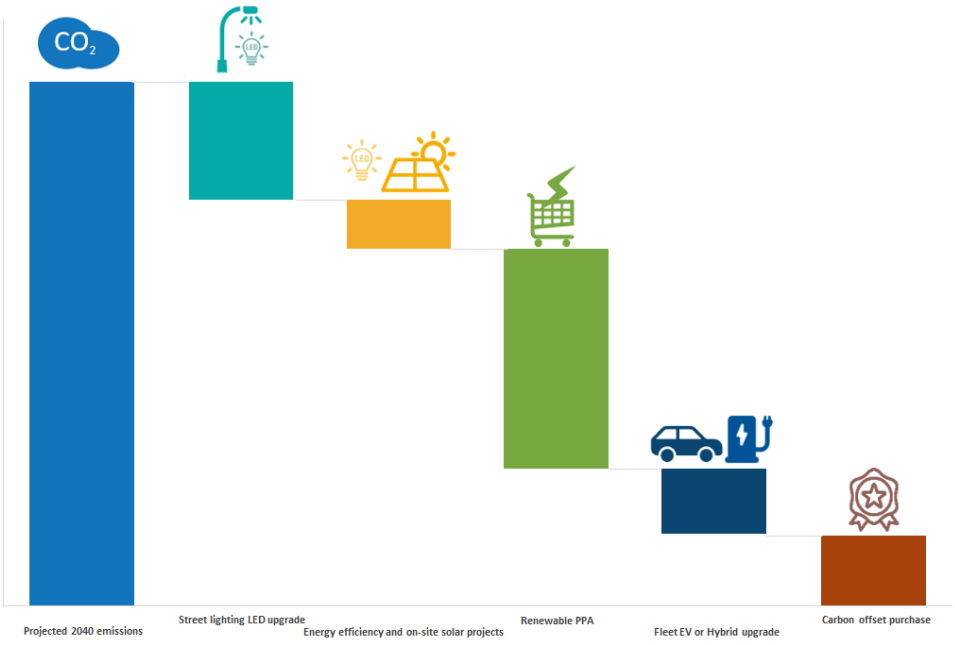


FIGURE 46: ILLUSTRATIVE PATHWAY TO CARBON NEUTRALITY WITH ABATEMENT + OFFSETS

What are the steps to become Climate Active carbon neutral?

The following diagram shows the steps that City of Bayswater would need to take to become certified under Climate Active as a carbon neutral organisation. Each of these steps, except the engagement of auditor/verifier, would need to be completed annually.

FIGURE 47: STEPS TO REACH CLIMATE ACTIVE CERTIFICATION

Under Climate Active, the City has the following responsibilities:

- Sign the Licence Agreement
- Pay an annual fee
- Engage an auditor/verifier
- Complete a report or provide all data to a Registered Consultant
- Purchase offsets
- Sign Product Disclosure Statement (PDS) and submit report
- Submit a web profile
- Use the Climate Active trademark correctly

What other Councils have been certified under Climate Active?

The following is a list of Councils that have undergone Climate Active certification[21].

- Bayside City Council
- Brisbane City Council
- City of Adelaide
- City of Melbourne
- City of Sydney
- City of Yarra Council
- City of Moonee Valley
- Maroondah City Council
- Moreland City Council
- Randwick City Council
- Woollahra Municipal Council

[21] https://www.climateactive.org.au/buy-climate-active/certified-brands#category1

Instead of full Climate Active certification, Councils can decide to self-certify their carbon neutral status. The recommended way to undertake self-certification is to use the Climate Active Standard for guidance, from determining the boundary of the carbon footprint and preparation of the carbon account to the purchase of carbon offsets. The following Councils have undergone self-certification:

- Maribyrnong City Council
- City of Fremantle[22]

Scope for abatement

The scope for abatement will depend on the City's agreed boundary (of activities and emission scopes). If the target is in alignment with the national carbon neutral standard, then emissions will be as assessed (in future) under Climate Active for City of Bayswater's corporate activities, which may be in the order of 15,000 t CO_2-e.

The City may determine that it simply wishes to reduce a narrower scope of emissions to zero – e.g. energy and waste from City activities. Bayswater can still purchase offsets to achieve this, but would not receive the recognition nor be able to make the same claims as a Climate Active-certified organisation could.

Risks and mitigation

Two of the principal risks associated with Climate Active certification are:

- Purchasing reputable carbon offsets and balancing cost and offset sources, and
- Data collection systems integrity

Purchasing reputable carbon offsets

Under Climate Active, only high-quality carbon offsets are allowed for reaching carbon neutrality.

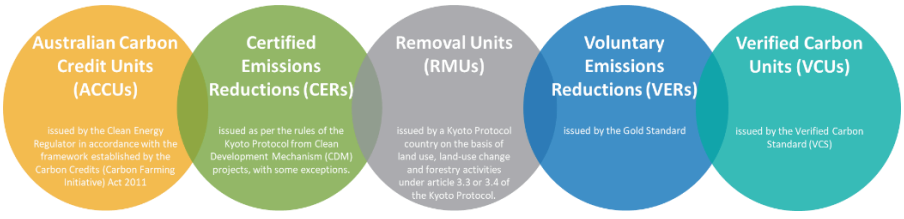


FIGURE 48: ACCEPTED OFFSETS FOR CLIMATE ACTIVE

- Australian Carbon Credit Units (**ACCUs**) issued by the Clean Energy Regulator in accordance with the framework established by the Carbon Credits (Carbon Farming Initiative) Act 2011 which has now been amended to establish the Emissions Reduction Fund (ERF).

[22] https://www.fremantle.wa.gov.au/towards-zero-carbon

- Certified Emissions Reductions (CERs) issued as per the rules of the Kyoto Protocol from Clean Development Mechanism (**CDM**) projects, with some exceptions.
- Removal Units (**RMUs**) issued by a Kyoto Protocol country on the basis of land use, land-use change and forestry activities under article 3.3 or 3.4 of the Kyoto Protocol.
- Voluntary Emissions Reductions (VERs) issued by the **Gold Standard**.
- Verified Carbon Units (VCUs) issued by the **Verified Carbon Standard** (VCS).

When deciding what offsets to purchase, the location, type, volume, price and accreditation standard would ordinarily be taken into account. In particular organisations will typically evaluate the balance between price (e.g. for high volume international offsets) and location (e.g. Australian offsets) or sustainability credentials. See below for a summary of possible offset costs.

Data collection systems integrity

The quality of data and good quality control processes are key to the integrity of a carbon account. Some of the things that an organisation would have to ensure are in place include:

- Records management systems and an audit trail of the carbon account
- A framework, systems and processes in place to accurately compile the carbon footprint, including data quality improvement plans and records of all changes made over time
- Development of methods to consistently handle and consolidate the additional Scope 3 information that Climate Active requires, across asset registers, expenditure records from ERP software, tracking of travel, accommodation, FTE numbers among others

Costs and benefits

The cost to offset an organisation's emissions is a function of the actual offset projects selected, their location, the volume of offsets purchased, the accreditation standard under which offsets have been created, and market demand and supply. In the current market offsets can be purchased for as little as ~$1.50/offset up to $18/offset.

The table below illustrates four approaches to purchasing 15,000 offsets in the current market (2020), including buying the least expensive offsets (typically international), buying international offsets with social benefits, Australian offsets, and a balanced strategy that buys 20% Australian / 80% international offsets. Costs for licensing (annual) and verification (initially and then only is the baseline is re-calculated) are also included so that the full cost of purchasing this volume of offsets can be seen and used to inform future decisions by the City.

Climate Active Carbon Neutral Certification - Estimated costs

OPTION 1: Purchasing the cheapest offsets available

Emissions	Licence fee		Verification fee		Carbon offset cost		Total estimated fees (ex GST)	
					International			
	Min	Max	Min	Max	Min	Max	Min	Max
15,000	$12,035	$12,035	$1,000	$15,000	$21,450	$128,700	**$34,485**	**$155,735**

OPTION 2: Purchasing international offsets with social benefits

Emissions	Licence fee		Verification fee		Carbon offset cost		Total estimated fees (ex GST)	
					International - REDD			
	Min	Max	Min	Max	Min	Max	Min	Max
15,000	$12,035	$12,035	$1,000	$15,000	$107,250	$275,550	**$120,285**	**$302,585**

OPTION 3: Purchasing Australian offsets

Emissions	Licence fee		Verification fee		Carbon offset cost		Total estimated fees (ex GST)	
					Australia			
	Min	Max	Min	Max	Min	Max	Min	Max
15,000	$12,035	$12,035	$1,000	$15,000	$240,000	$375,000	**$253,035**	**$402,035**

OPTION 4: 20% Australian, 80% international offsets

Emissions	Licence fee		Verification fee		Carbon offset cost				Total estimated fees (ex GST)	
					Australia		International			
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
15,000	$12,035	$12,035	$1,000	$15,000	$48,000	$75,000	$17,160	$102,960	**$78,195**	**$204,995**

Total	
Min	Max
$65,160	$177,960

FIGURE 49: POTENTIAL CARBON OFFSET COSTS UNDER DIFFERENT PURCHASING STRATEGIES

6.9 Sequestration

Description

The major climate action targets set through the Renewable Energy and Emission Reduction Position and Action Statement are 100% renewable energy by 2030 and 100% corporate greenhouse gas emissions reduction by 2040.

While the purchasing of carbon offsets may form a key part of the City's response to meet these targets in a manner that can be verified and certified, increasing the area's stored carbon may be able to contribute to the achievement of the objectives of the targets.

Two key areas for action that can potentially achieve an increase in local stored / sequestered carbon are:

- Increase in the urban tree canopy to meet or exceed the aspirational targets set in the City's Urban Forest Strategy (Greening our Garden City).
- Improve the capacity for the City's wetland areas to store carbon in sediment and plantings.

Urban Forest Strategy

City of Bayswater's Urban Forest strategy aims to *increase tree canopy coverage from 13.2% to an aspirational target of 20% by the year 2025 through street, parks and natural area plantings*.

FIGURE 50: CITY OF BAYSWATER URBAN FOREST STRATEGY

A major factor underpinning this aspirational target is to help the community adapt to the effects of climate change, by providing greater and more diverse canopy cover and reducing the number of hot spots in the City, thus improving liveability standards.

There are approximately 33,000 trees in the City of Bayswater at present (Urban Forest Strategy, p6), and based on discussions it is understood that achieving the target of 20% canopy coverage by 2025 would require the planting of an estimated 120,000 new trees (not including the loss of trees in private developments or due

to old age). Current planting rates are around 1,500 new trees per year, along with higher amounts of tube stock.

The reported carbon stored by trees varies in literature, and figures are cited in sequestration rates per hectare, which relies on assumptions about planting density, and in kilograms per mature tree per year. One reported figure of 22 kg CO_2 stored per mature tree per year[23] is used in this report.

Increasing the City of Bayswater's urban canopy can therefore play a small but important role in the City's emissions reduction / net zero task based on current planting levels, but this can increase in importance if the City can achieve its stretch targets. Notwithstanding this, the ability to accurately measure the net sequestration achieved is low, with the benefits to reducing urban heat and increasing climate change resilience likely to be more significant outcomes.

It is recommended that the City keep track of net tree planting data and use this to report on the estimated or potential net sequestration being achieved. However this should not be used to offset targets for emissions reduction, since the actual amount of carbon sequestered can't readily be measured and the transaction costs of using methods employed for projects creating ACCUs would be high.

Wetlands and Bushland[24,25,26]

The City of Bayswater is also host to a number of wetland and bushland areas. These include Lightning Swamp Bushland reserve, Eric Singleton Bird Sanctuary, Bagiup Wetlands, Bardon Park, Berringa Park and Maylands Samphire Flats. These cover a total area of around 115 Ha, or 3.3% of the City's total area.

The figure below highlights the Maylands Samphire Flats area on the City of Bayswater.

There is wide recognition that wetlands can play an important role in "blue carbon" storage / sequestration, among many other benefits they provide. Conversely, degraded wetlands can be a large source of emissions of CO_2. In general, wetland plants grow quicker than they decompose, leading to a net annual carbon sink.

[23] Sources reviewed include onetreeplanted.org and carbonneutral.com.au

[24] 2012, Issues Paper: The Role of Wetlands in the Carbon Cycle July 2012, Australian Government Department of Sustainability, Environment, Water, Population and Communities

[25] Department of Environment and Science, Queensland (2020) Wetlands and the carbon cycle, WetlandInfo website, accessed 24 September 2020. Available at: https://wetlandinfo.des.qld.gov.au/wetlands/ecology/processes-systems/carbon-cycle.html

[26] Carnell P, Windecker S, Brenker M, Yukate B, Johnson K and Macreadie P. 2016. Carbon sequestration by Victorian inland wetlands. Blue Carbon Lab, Deakin University, Victoria, Australia

FIGURE 51: MAYLANDS SAMPHIRE FLATS

There can be wide variability in the amount of carbon stored in different wetlands, and variability in sequestration rates. Figures cited in literature include:

- Carbon storage of ~240 tonnes C per ha to 1m depth in vegetated freshwater wetlands such as melaleuca forests, and ~550 tonnes C per ha to 1m depth in mangrove swamps.
- Sequestration rates in undisturbed mangrove ecosystems are expected to be about 2,669g CO_2 per m^2 per annum (Qld DES 2020).
- Sequestration rates across 25 inland wetland sites in Victoria were measured at 6.93+/-1.37 Mg per hectare per year, or 556-830 g CO_2 per m^2 per annum (up to 3,018 g CO_2/m^2 pa was measured at one site).

Scope for abatement

High level estimates for the City's Urban Forest Strategy indicate potential carbon sequestration potential of:

- 33 t CO_2 per year, and 660 t CO_2 sequestration at 2040 when the City's net zero emissions target is to be achieved, at current planting rates of 1,500 trees per year
- 2,640 t CO_2 sequestration per year if the City achieves its stretch target of 120,000 new trees, which is sizeable when compared with the City's energy-related carbon footprint (28%) and with the city's potential carbon footprint including supply chain emissions (18%)

Figures for wetlands highlight the wide variability in stored carbon and sequestration rates. They suggest that for the City of Bayswater, if we take wetland area to be 115 Ha, then there may be:

- 100-230 kt of stored carbon, and

- Annual sequestration potential of 638 – 3,061 t CO_2 (approximately 6.7% to 32.4% of the City's energy-related carbon footprint, and ~20% of the potential Climate Active-aligned carbon footprint)

These figures are indicative and show that sequestration from urban canopy and wetlands restoration are an important part of the City's climate response.

High costs to more accurately evaluate the carbon sequestration potential of these activities, allied to low accuracy of measurement, mean that including this towards the City's net zero targets is not justified.

Risks and mitigation

Reliance on data reported in literature should be treated with caution in terms of the potential for sequestration in the City of Bayswater. Local assessments based on current and planned tree plantings, the actual size and condition of wetlands in the City, and other local factors should be used to develop more correct estimates of this potential.

Costs and benefits

The costs for implementation of the City's Urban Forest strategy, and costs to restore degraded or enhance other wetland areas are not estimated as part of the ERRE Plan.

6.10 Energy efficiency

Description

Energy efficiency remains the cheapest form of greenhouse gas abatement in many situations. As highlighted earlier, City of Bayswater has been implementing numerous energy efficiency upgrades, and upgrading to LED and/or solar lighting is standard practice when replacing City-owned public lights, passive and active field lights, as well as building lighting.

Efficiency gains can be made via retrofit and asset upgrade works, and lighting typically offers the quickest and the most predictable savings. ICT systems tend to have a fairly rapid turnover compared with other energy-using assets, providing opportunities to upgrade to digital, cloud-based and low wattage IT devices every few years, and this has been happening at City of Bayswater.

Longer life assets such as air conditioning (10-25 years) and motor systems for irrigation may have short-term opportunities for smart controls and minor retrofits that save power, but the major savings come when these assets are at the end of their life and require replacement. As such the rate of improvement in energy use for these services tends to be modest and over a long period of time. Discussions with stakeholders suggest that 6-10 sites' air conditioning systems may be replaced in a typical year (mainly split systems, some packaged / ducted systems).

A high level assessment of the potential for electric energy efficiency was made via:

- Collation of the recommendations of energy audit reports of several of the City's facilities, carried out in 2020,
- Engagement with Western Power and Bayswater to develop an estimate of the costs and savings for a bulk upgrade of all of the non-decorative streetlights in the City of Bayswater, and
- Engagement with staff to get an understanding of the extent to which LED lighting and controls are installed, and the sites where air conditioning services are likely to be replaced over the next ten years. Based on responses provided for all of the City's facilities an indicative estimate was made of the potential savings by upgrading to LED with controls, and by upgrading to more energy efficient air conditioning over this period.

The outcome from this assessment is included as both a summary table and detailed table in Appendix A, together with a summary of the business case for upgrading streetlights to LED. Note that countering the scope for savings in energy, most organisations are also developing or improving assets. For City of Bayswater, the expansion of the Morley Sports and Recreation facility and the redevelopment of the Maylands Waterland facility may add to the City's electricity demand, offsetting some of the potential savings in other facilities.

The design of these upgraded facilities does however offer the potential for further savings, both through energy efficiency and the incorporation of solar and potentially battery storage in the designs.

In addition, the energy audit at Bayswater Waves does not highlight viable savings for gas heating of the pool, which accounts for nearly 7% of the City's energy-related carbon footprint. Looking ahead to 2040 and the net zero emissions goal, City of Bayswater may need to assess heating options, including:

- Geothermal – this has been assessed in a recent study and found to currently be unviable financially,
- Biomethane, which will require the development of site-based or gas network biomethane resources in WA, or
- The implementation of electric heat pumps for pool heating which would increase electricity demand, particularly in winter and at night.

Scope for abatement

The scope for energy efficiency across the City's sites is estimated to be 4,231 MWh per year, over 37% of current electricity demand. Around 50% of this potential is associated with upgrading all Western Power-owned streetlights to LED. More savings may be feasible through smart control of irrigation systems and their replacement with more efficient VSD-driven pumps and efficient motors in future. An additional savings of around 141 MWh can be attained when upgrading the rest of the city-owned streetlighting.

As noted, while energy savings potential is significant, the redevelopment of facilities like Morley Sport & Rec and Maylands Waterland, as well as business-as-usual increases in energy use through higher service provision, may see increases in energy demand as well, even where new facilities are energy efficient through the adoption and implementation of best practice design standards for building efficiency. Future pool heating options for Bayswater Waves to achieve net zero emissions could see further increase in electricity demand. Hence the net savings potential is less than the figure estimated here.

Risks and mitigation

The risks associated with energy efficiency upgrades are generally low provided business cases, specification and contractor management processes are robust. Some of the main risks and mitigants will include:

- Designing effective measurement and verification at an affordable cost that provides useful feedback about the success of projects
- Persistence of energy savings – it is not uncommon, particularly for education initiatives and control settings to lapse in their performance and be changed back to poor practices or inefficient settings, and providing resources to sustain energy savings is also important

- Regular review processes for energy management is important. For example, design guidelines and procurement guidelines should stay at the level of development of new technologies, practices and services

Costs and benefits

Estimated costs and annual savings for energy efficiency is summarised in the appendices. There are three primary sources of information in the table:

- Energy audits performed on the City's largest energy-using sites
- Assumptions about the scale and cost-effectiveness of energy savings based on advice from stakeholders about current penetration of LED lighting and on the likelihood of air conditioning system upgrades / replacements in the next ten years, and
- Analysis of City of Bayswater's streetlighting inventory and calculation of energy savings potential based on advised wattage of current and approved LED lights

Efficiency plans and budgeting will be informed by regular auditing of facilities and equipment, and by Annual Budget planning and Corporate Business Plans that considers projects that will reduce City of Bayswater's carbon footprint.

6.11 Electric vehicles and plant

Description

Transport emissions for City of Bayswater are associated primarily with diesel used for the City's large truck, plant items and light commercial vehicles (LCVs, including Utes). Petrol consumption is for small plant, passenger cars and utility vehicles.

As reported in the baseline, the City's fuel use has declined in recent years, with a reported drop of 8.7% in diesel use and a much larger 28% drop in petrol consumption. It is understood that this can be mostly attributed to migration to a largely hybrid petrol fleet, its continued work to extend hybrids into utes, and upgrading larger plant to Euro v emissions standards.

City of Bayswater has now started to record and report data on vehicle efficiencies, which it can use to target further efficiencies.

The City has also purchased two electric vehicles with charging located at the Civic Centre. There are electric options for some small plant items up to street sweepers and ride-on mowers, but as yet there has been little uptake of these.

TABLE 7: TREND IN CITY OF BAYSWATER FUEL CONSUMPTION

Total	16/17	17/18	18/19	19/20
Unleaded Petrol	90,681 L	82,169 L	88,758 L	65,040 L
Diesel	285,969 L	269,352 L	278,259 L	260,732 L

A range of measures will or could continue to be developed by the City, such as:

- Increasing petrol fleet to hybrid vehicles (target to reach 80-90%) by replacing petrol vehicles with hybrid/EVs
- Reviewing and amending financial incentives to reduce the City's total fleet
- Review the functions performed by vehicles, with one outcome potentially being a change from some utes to hybrid or electric passenger vehicles
- Increase the number of EV charging points at City sites and the number of EVs in the fleet – e.g. in line with the State Government's targets
- Set long term and interim targets for migration of passenger and potentially utility vehicle fleet to electric and hybrids respectively
- Use of fleet fuel efficiency information to influence driver behaviour
- Keep abreast of utility vehicle trends including of the major manufacturers
- Continue to evaluate electric powered devices as well as their charging infrastructure and charging practices (e.g. back at base charging)
- Stay abreast of developments in electric technologies for heavier fleet, such as light trucks or buses
- Evaluate opportunities to increase utilisation of e-bike and public transport options for staff travelling to work or between City locations
- Continually review the case for EV charging to be installed at public facilities to meet future driver demand for electric vehicles

- Stay abreast of developments in EV incentives, policy and other support, and incorporate these in the City's planning process for its transport fleet
- Over the longer term, progressively migrate fleet to lower and zero emissions where it is technically and financially viable, including passenger vehicles, utes, commercial vans / buses and other operational plant

Availability of electric passenger vehicles in Australia

According to the Electric Vehicle Council[27], in 2020 there were 28 EV models available in Australia (both BEV and PHEV) from 11 manufacturers, and this was forecast to grow by a further 6 vehicles in 2021, with a continued shift towards battery electric vehicles (BEV). In addition, the EV Council reports the commitments by most major car manufacturers to develop EVs in coming years. For example:

- Ford: By 2025, will invest $11 billion with the aim of having 24 hybrid and 16 fully electric vehicles in its global model portfolio by 2022.
- General Motors: 20 BEVs by 2023
- Hyundai: By 2024, $20 billion investment in EVs, AVs and batteries
- Nissan: 8 BEVs by 2022, $10 billion investment in EV
- Toyota: 10,000 units planned for 2020 and 30,000 for 2021, first new BEVs by 2021, 10 models are expected by 2025
- Subaru: By 2030, a minimum 40% of global sales will be electric vehicles (EVs) or hybrid electric vehicles (HEVs)

Corporate and government fleets make up more than 50% of new EV sales, and many Councils are now developing long term transport strategies that explicitly include a shift in their fleet to low and ultimately zero-emissions fleet. Most prominent at this time is the ACT Government, which is switching its passenger fleet to EVs for all new leases from 2020-21 and has trialled electric buses with a view to shifting these to all-electric by 2040 as part of the ACT's carbon neutral commitment.

Availability of low emissions Light Commercial Vehicles in Australia

Light Commercial Vehicles (LCVs), including utility vehicles are common among Council fleets and often account for a sizeable proportion of total diesel fuel use. Over the medium term, most of the major ute manufacturers have plans in place to provide electric and hybrid electric options in their ute range. A short summary of the current status for several vehicles is provided below.

[27] https://electricvehiclecouncil.com.au/wp-content/uploads/2020/08/EVC-State-of-EVs-2020-report.pdf, p24

- Mitsubishi Triton[28]: in September 2019 Mitsubishi advised that the next-generation Mitsubishi Triton ute – due two years from now (~2022/23) – will have the option of hybrid power, with decisions still to be made whether this will be a PHEV or a paired electric battery with fuel engine.
- Toyota has committed to including electric options with all new vehicle models going forward, which will include utes[29]. Toyota is developing a hybrid version of its next-generation HiLux ute. It is expected this will be available from 2023. At this stage, Toyota has not committed to an all-electric model. A diesel-electric transmission is one of the options under consideration.
- Nissan is planning for an electric vehicle future, with a hybrid diesel-electric Nissan Navara ute potentially available by the mid-2020s[30]. Nissan also indicated that commercial vans were also candidates for electrification.
- Ford's next-generation Ranger and Everest models will include plug-in hybrid variants of both the dual-cab ute and off-road SUV, from 2022.

Most current activity and plans points to electric and hybrid electric utes being a medium term proposition, and day-to-day performance while carrying load, and charging infrastructure are key factors that will evolve in the next couple of years.

EV charging in City of Bayswater

Locations of DC and public chargers in the city of Bayswater are highlighted below (sourced from Plugshare[31]), where green pins denote public chargers and orange pins denote fast, or rapid chargers.

[28] https://www.caradvice.com.au/790317/mitsubishi-triton-to-get-hybrid-power-precede-nissan-navara-development/
[29] https://www.motoring.com.au/toyota-hilux-to-go-hybrid-121251/
[30] https://www.motoring.com.au/nissan-navara-e-power-hybrid-by-2025-119492
[31] https://www.plugshare.com/

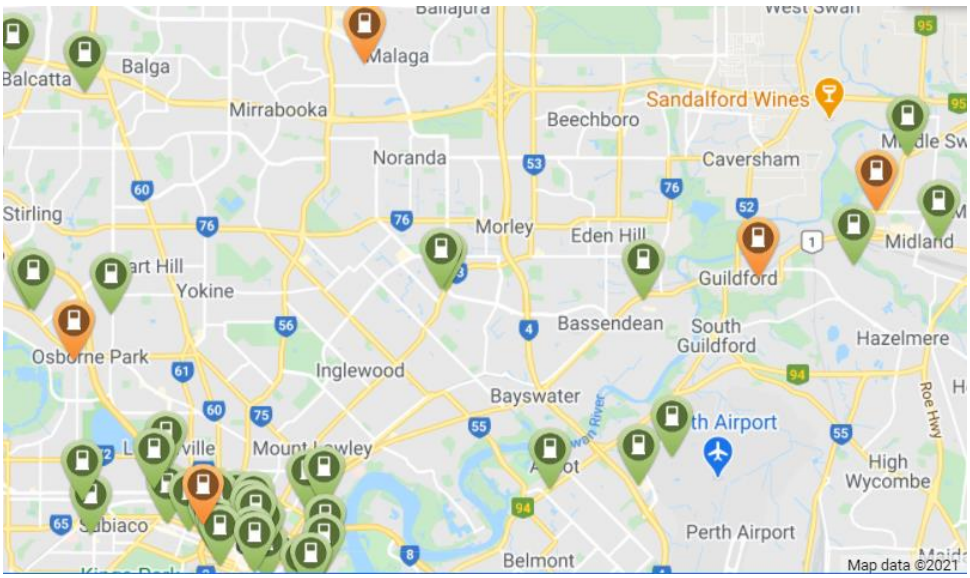


FIGURE 52: EV CHARGERS NEAR CITY OF BAYSWATER

Scope for abatement

The emissions savings achieved via the City's hybrid fleet strategy are a good success story, and evidences the achievements that can be made with targets, plans, resources and funding.

The long term scope for emissions reduction from fuel is equal to current emissions of around 903 t CO_2-e, assuming that in the long term all vehicles can be replaced with active transport and with renewable electric (or green hydrogen) replacements.

In the period to 2030 it is more likely that passenger vehicles, some utes and other LCVs and perhaps some small plant can migrate to electric technologies, but there may be a number of larger high-consumption diesel vehicles remaining in service. With the City's 2040 goal to be carbon neutral vehicle fuel may represent one of the areas of scope 1 and scope 2 emissions where there is a risk that there is a need to purchase offsets to meet this goal.

Risks and mitigation

City of Bayswater will continue to assess a range of factors influencing the uptake of EVs for different types of vehicle user – wholly owned or leased, salary-sacrificed by staff, or driven by contractors. Factors include:

- Price, incentives, resale and electricity v fuel price
- Range and charging infrastructure
- Fitness for purpose
- Availability, serviceability, warranties
- The role of other technologies such as hydrogen and autonomous vehicles in the City's long-term fleet strategy

Costs and benefits

The capital and lease cost premium for EVs and hybrid models that are fit for purpose for City requirements, as well as the future resale value will be assessed alongside fuel, registration, insurance and maintenance cost savings from time to time. A cost-neutral approach would see low-emission vehicles have comparable total cost-of-ownership to current fleet.

6.12 Behavioural change

Description

Among the measures that will be taken to address the challenge of climate change and other global pressures in coming years and decades, including technology solutions and policy and regulatory interventions, consumption behaviours of people must also change consistent with the rapid changes that will happen in this time.

As City of Bayswater works towards its targets for renewable energy and net zero emissions, it is important that it assesses the ways in which staff can be engaged to make changes to their practices and behaviours that are aligned with the achievement of these targets.

A behaviour change initiative should be about both systemic change and behavioural change[32], and needs to be part of the City's long term strategy to deliver the outcomes of the ERRE Plan. As such it is recommended that a baseline-informed, planned approach to behaviour change be developed. Based on research, routes to more sustainable consumer choices could include one or more of the following (SHIFT[33]):

- Social influence – following the actions of others, brand ambassadors
- Habits – break, and perhaps penalise bad habits, and/or make good habits easy to do, incentivise them and provide feedback
- Individual self – emphasise personal benefits and efficacy of choices, promote / encourage self-consistency to build on good practices
- Feelings and cognitions – people need to feel good about their choices / habits, guilt can induce negative responses. Providing correct information and education is important, such as well designed labels
- Tangibility – future consequences of climate change are intangible, so communication of local impacts is important – e.g. impact on local habitat and biodiversity, use of concrete examples

To identify the right strategies and action plans for City of Bayswater, the referenced AAEE guide, as an example, recommends the following approach:

- Develop a baseline on the status of problem/s to be tackled (carbon dioxide emissions, climate change and local impacts for example), and review what works or what research is available about target groups in City of Bayswater. Look at examples of how this has been addressed by others – e.g. Cities Power Partnership may provide good resources or case examples.
- Engage with staff to develop a better understanding of their experience and needs relating to climate change, including via interviews, focus

[32] https://www.aaeensw.org.au/sites/aaeensw/files/pages/files/paletteofpossibilitiesv1compact.pdf
[33] https://theconversation.com/5-ways-to-shift-consumers-towards-sustainable-behaviour-120883

groups, direct observation, do it yourself, codesign of initiatives (e.g. via workshops), and using surveys or questionnaires.

- Drawing on research and engagement, design and develop a range of systemic (changed environment or infrastructure) and behavioural strategies (that directly impact on people's choices) that can address the issues.
- Examples of systemic strategies can include:
    - Well placed 'binfrastructure' to reduce litter
    - End-of-trip facilities for cyclists to increase active travel choices
    - Effective road and pathway signage to promote desired behaviours (e.g. for stormwater(?), bike paths, etc)
    - Use of inspirational local art to encourage more walking / active travel by the community
    - Develop local groups to tackle important environmental issues such as bushland or wetland restoration and tree planting, repair / reuse hubs, community gardens, etc
    - Establish collaboration networks
    - Develop good data collection systems – e.g. City's emissions, tree planting rates, waste management indicators, urban heat
- Examples of behavioural strategies can include:
    - Familiarity by demonstrating the steps in doing an action, use of visual instructions, how-to prompts and modelling
    - Design or re-design actions so they are simple, faster and require little or less effort to implement
    - Find 'champions' within the organisation
    - Share stories / case examples of people adopting and implementing the practices you want to promote and see adopted
- The AAEE guide also recommends testing, review and reflection on measures implemented so that these can be revised and new approaches taken where needed

Many recent (2020/21) energy audit reports prepared for City of Bayswater highlight cultural / behavioural change as one of the opportunities available to the City to reduce its resource consumption and emissions.

A resourced, planned approach to long-term behavioural change that sees staff practices mirror the City's ambitious targets to respond to climate change, is an important element of the ERRE Plan.

Scope for abatement

The scope for abatement is not estimated. Technology and policy changes may have the greatest overall impact on emissions, however the impact of staff practices / behaviours can't be understated, and the wider benefit in the community may be much greater.

Risks and mitigation

A key risk associated with a behaviour change program is that it focuses mainly or solely on behaviour programs (e.g. newsletters, labels, education) and not on systemic strategies that enable change, or on targeted ongoing research and engagement that can help to embed sustainable practices.

There will also be risk in terms of costs and resources invested in measures that are ineffective and need to be modified or changed over time.

Costs and benefits

The main cost initially will be internal and potentially external resources to design and develop an effective behaviour change initiative aimed at being part of how City of Bayswater operates over the long term.

If systemic changes are required to enable sustainable practices these will be reflected in annual budgets and corporate business plans (e.g. active transport, bushland & wetlands restoration, staff public transport initiatives).

6.13 Sustainable procurement

Description

Opportunities for City of Bayswater to make step-changes in its energy use and emissions are described above in relation to solar PV and efficiency opportunities, sustainable transport, behaviour change and renewable energy power purchasing (PPA). Sustainable procurement processes underpin these opportunities, and can also incrementally reduce the City's emissions over time through multiple individually small purchasing decisions, such as for appliances, ICT equipment, etc. Sustainable purchasing can also reduce indirect upstream and downstream emissions in the value chain, referred to as Scope 3 emissions[34]. Three components to sustainable procurement include:

- Policy frameworks that incorporate a sustainable procurement focus
- Engagement and training of staff to drive use of a sustainable procurement framework in all aspects of City operations
- Continual review of equipment and services specifications, to identify opportunities to incorporate the sustainable procurement framework into the procurement and use of equipment and services

Sustainable procurement framework

A policy relating to sustainable procurement can set out the City's overall intent to procure products and services with consideration of its sustainability goals, such as emissions reduction, renewable energy and energy efficiency (among others). Alongside a policy, sustainable procurement guidelines should provide practical resources and templates to assist the integration of sustainability into procurement processes and decision making. Over time this policy and guidelines will evolve, and may become increasingly stringent as target dates for net zero emissions approach.

City of Bayswater

The City's Procurement Policy includes:

- Purpose: The policy provides for preference to be given wherever possible to sourcing of environmentally-sustainable products.
- The Procurement Policy is based on a WALGA model policy and reflects the legislative amendments introduced in October 2015.
- Among other objectives the policy seeks to ensure that:
    - Procurement activities progressively work towards embracing full sustainability and corporate social responsibility principles.
    - Wherever practicable, preference shall be given to sourcing of accredited environmentally sustainable products. Considerations may include water or energy efficiency ratings, levels of recycled or repurposed content, use of renewable sourced materials or ability to be powered by renewable energy. For contracted services, preference shall be given to sourcing of contractors that can provide evidence of

[34] Scope 3 GHG emissions are emissions upstream and downstream of the City's operations, and are associated with goods and services sourced for City activities. Refer to the Carbon Offsets section of this ERRE Plan for an overview of typical Scope 3 emissions sources.

sustainable land management practices including water efficiency and minimising the use of chemicals.

WA Local Government Association (WALGA) Guide

*WALGA Guide to Sustainable Procurement i*s a 2017 (October) publication that aims to provide guidance and toolkits to local governments' to help embed sustainability within all purchasing decisions. The guide highlights a 'quadruple bottom-line' approach including economic, social, environmental and governance systems, and outlines a sustainability procurement framework, integrating sustainability and value-for-money objectives, and includes a preferred supplier sustainability rating system that would consider the elements illustrated below.

Environmental Management		
	Environmental Certification	Supplier is ISO 14001 certified Environmental Management System, or equivalent industry standard
	Contains recycled content	Supplier is GECA certified. Products offered by supplier contain at least 30% post-consumer recycled content.
	Carbon neutral	Supplier possesses, or significantly progressing towards carbon neutral certification, issued by Department of the Environment and Energy.
	Energy Efficient	Supplier provides products with at least a 4 star energy efficiency rating, and/or actively demonstrates reduction of energy demand in its operations.
Ethical Leadership and Supply Chain Practice		
	Ethical Leadership	Supplier is a member of the Ethical Trading Initiative (ETI) or similar organisation, through the promotion and demonstration of ethical business practices both within its organization and of its supply chain.
Community Participation and Benefits		
	Aboriginal Business	Business listed on either the WA Aboriginal Business Directory, or an accredited Supply Nation supplier.
	Local Trade Supporter	Supplier is majority owned and/or sources employees and contractors within the region.
	Australian Made / Manufactured	Certification provided for products that are Australian manufactured and made and complies with Australian Standards.
	Community Benefit Supplier	Supplier demonstrates superior community benefits, such as registration as a social enterprise, or undertaking employment programs for long term unemployed, or demonstrates strong commitments to community engagement.
	Disability Enterprise	Supplier is a registered Australian Disability Enterprise.
Workplace Practices		
	Employer of Choice	Supplier demonstrates superior workforce management practices that ensures safety and wellbeing and fair work practices.
	Safe Work Methods	Supplier possesses AS/NZS 4801 Occupational Health and Safety Management Systems and has no recorded breaches registered with Worksafe WA in the last five years.

FIGURE 53: WALGA SUSTAINABLE SUPPLIER PERFORMANCE ASSESSMENT

For City of Bayswater a key priority for its policy and sustainable procurement framework is to periodically review and update its policy and evaluation frameworks, both to reflect the guidance offered by peak bodies such as WALGA, and to reflect the City's own renewable energy and emissions reduction targets. The current policy was adopted in February 2017, while WALGA's guidance was released in late 2017. With the PAAS to adopt ambitious targets for City operations, and given current global and State-level action (WA Climate Policy), a review of the current procurement policy to reflect the emerging environment may be warranted, with regular reviews.

Engagement & Training

Even with a policy and sustainable procurement framework in place, decisions to source services and products that deliver best practice sustainability

outcomes will happen when people who are buying these services and products take these decisions.

Underpinning this should be a program of continuing engagement, education and training of staff who procure services and products. This could encompass:

- Capital works staff involved in the design of new projects such as new / renovated community facilities, or new / renovated parks & reserves, where energy and water efficiency and onsite renewables and battery storage could be specified,
- Roads and pavement repair / maintenance teams who specify the types of materials to be used, where there may be opportunities to use more sustainable materials,
- Fleet procurement staff who assess plant and vehicle needs and specify new purchases and leases that will impact fuel use and other environmental performance measures for a number of years,
- Operational staff who may repair or replace equipment as it fails, such as appliances, air conditioners, lights, where there are opportunities to ensure that replacements are fit for purpose and energy efficient

Design, Equipment and Services Specifications

Engagement with many stakeholders highlights that levels of awareness and practices regarding selection of energy efficient solutions is high. Policy, procurement frameworks and education / training should ultimately lead to the specifications that Bayswater develops for services and works / products being continually improved to include the City's requirements for efficiency and renewables where applicable – i.e. 100% renewables and net zero emissions targets may call for more and more low and zero grid-energy solutions to be implemented.

In addition, the evaluation criteria and weighting of responses to tenders and quotes should be periodically revised to evaluate and weight performance against these updated renewable energy and net zero emission requirements, while achieving the other key goals of the City's procurement policy. Products and services where Bayswater could continually update specifications include:

- **Road and pavement construction**: look to source low embodied emissions materials and encourage or require potential suppliers to reduce emissions in their materials.
- **Building design policies:** Energy efficiency performance requirements are set out in Section J of the Building Code of Australia (BCA). Improvements made to the Code and applied from mid-2019 will see energy efficiency / demand reductions of at least 25% compared with the 2016 requirements. City of Bayswater can go further than this, for example by setting targets for new buildings to be say 6-Star Green Star (design and as-built) and having a pathway for ongoing improvement in its design requirements to work towards the implementation of 'net-zero buildings'.
- **Business Services**: procurement of services is typically a significant source of emissions in a local government's value chain. By requiring that suppliers of services to the City lower their own emissions (e.g. by

being certified Climate Active carbon neutral), the City's scope 3 emissions can be significantly reduced.

- **Building lighting:** design and replacement with LED and smart controls together with passive measures to reduce demand for lighting.
- **HVAC:** many facilities will see air conditioning replaced over the next ten years, providing opportunities to improve passive heating and cooling, specify efficient fit-for-purpose technologies and smart controls, and specify low and zero-emissions refrigerant gases.
- **Power & appliances:** Power and appliances represent a fairly modest % of the City's electricity use, including servers that run 24/7, office equipment such as computers, copiers and printers, and appliances like fridges, boiling water units, microwaves, dishwashers and televisions. Efficient appliances and 'green IT' options are available and many are already being pursued, and specifications can be developed that ensures all equipment such as these is energy efficient when purchased.
- **Irrigation pumps** are upgraded or rebuilt from time to time. Upgrades offer opportunities to assess system design, evaluate VSD opportunities and improve control systems, such as moisture sensors.
- **Public park and reserve lighting:** LED and solar lighting have emerged as the default technologies here for the City.
- **Sporting oval lighting:** it is increasingly common to select LED as the default technology for new sporting oval lighting. Smart controls can both centralise oversight and provide users with control and incentives to manage their use of sports lighting.

Scope for abatement

The scope for abatement from sustainable procurement is sizeable, with incremental gains made via all purchased goods and services over the long term complementing potentially large abatement from the procurement of solar panels across City sites and the procurement of electricity from renewables via supply agreements. City of Bayswater also has the capacity to influence emissions reduction by its suppliers and contractors, and this may be increasingly important in future years in the context of reducing value chain emissions to reach net zero emissions.

Risks and mitigation

An assessment of risks and mitigation strategies would be part of any periodic review of procurement policies and processes for goods and services.

Costs and benefits

A robust sustainable procurement approach would see sustainable services and goods sourced on a whole-of-life cost basis, which will tend to favour efficiency and lower lifetime cost. Similarly, contractors and suppliers who are sustainable in their own operations are likely to have lower, not higher costs.

7 Emissions Reduction and Renewable Energy Roadmap

In order to achieve deep cuts in its energy use, increase renewable energy and reduce carbon emissions, City of Bayswater will need to commit time, resources and initial financial support to a multi-year program of work that will implement measures identified in this plan that reduce emissions. The focus will be first and foremost on works that have a return on investment within 10 years making them financially attractive solutions. This program of works should be reflected in:

- Corporate Business Plans,
- Annual Budgets, and
- Resourcing Strategy (encompassing long-term financial plan, asset management plan and workforce plans)

A key priority in this should be to invest in measures that also improve City of Bayswater's bottom line.

This plan and roadmap is comprised of three parts:

1. Firstly, time-based, quantified, specific actions are highlighted and included in a roadmap towards 100% renewable electricity by 2025, 100% renewables + offsets by 2030, and net zero emissions (including value chain emissions) by 2040 respectively.
2. Secondly, estimated time-based costs for implementation of measures included in the roadmap is tabulated. Note that costs have been estimated for some measures such as solar PV, energy efficiency, streetlight upgrades, etc where there is a tangible or known scope of work. For other measures such as behavioural change, sustainable procurement and the like cost estimates have not been developed. For significant measures such as renewable energy power purchasing, an assumption is that this is feasible at a lower cost than the City's current regular tariff prices.
3. Thirdly, short and medium term management action plans are developed, setting out the management actions and processes that will need to be in place to support the implementation of measures that achieve the City's targets.

7.1 Roadmaps to 2030 and 2040

7.1.1 Roadmap to 100% renewable energy + offsets by 2030

This scenario is built with the pathway described below. Note that the intent is to illustrate a possible pathway that achieves the City's targets, and it is acknowledged that the actual timing and scale of implementation may differ from this roadmap over time.

- Energy efficiency
    - Building air conditioning and lighting opportunities with less than or equal to 10 years payback in the energy audit reports will be implemented from FY2022/23 to FY2025/26, at 25% of the estimated combined savings per year over four years.
    - Building air conditioning and lighting opportunities for non-energy audit sites will be implemented progressively from FY2022/23. The per-site average energy reduction for air conditioning and lighting upgrades across all non-audit sites was estimated, and it was then assumed that eight sites per year will be upgraded until the full potential has been achieved.

    - Western Power-owned streetlighting upgrade to LED is assumed to be implemented during FY2026/27. 50% of the annualised savings are taken to be realised in that year, with the full savings seen from FY2027/28.
    - City-owned streetlighting upgrade to LED is assumed to have the same implementation schedule as the Western Power-owned streetlighting. As some city-owned lights have already been upgraded to LED, just two-thirds of estimated energy use is taken to be subject to this upgrade.
- Rooftop solar PV
    - Implementation of the following solar PV system projects in the short-term
        - 10 kW at Senior Citizens
        - Increase to 100 kW at Bayswater Waves and The RISE
        - 40 kW at Morley Sport and Recreation
    - Implementation of the following solar PV system projects in the medium-term
        - Expansion to LGC size for Bayswater Waves, the Civic Centre and The RISE by end of the next Corporate Business Plan period.
        - Implementation of at least 10% of the small sites solar.
    - Implementation of the following solar PV system projects in the long-term plan
        - Implementation of all identified small sites solar out to 2030 at an even rate per year.
- Renewable energy power purchase agreement (PPA)
    - The City enters into a three-year initial renewable energy PPA from April 2022 which is 100% renewable in the final year of the agreement (excludes streetlighting). Subsequent 3-year agreements will be 100% renewables.
    - From July 2028 the city's streetlights are assumed to be powered with renewable energy.
- Hybrid vehicle and electric vehicle (EV) uptake
    - Increase of hybrid vehicles from 60% to 90% for passenger vehicles to 2023/24
    - Transition from hybrid to electric vehicle for passenger fleet starting from FY2024/25 to 2030
    - Upgrade of utes and light commercial vehicles to hybrid vehicles from 2025 to 2035
    - Upgrade of small plant items to electric from 2025 to 2030 at an even rate per year
- Carbon offsets
    - Carbon offsets purchased for the balance of gas and transport fuel in 2030.

Implementation of this scenario would see the following outcome in terms of the City's energy use and associated greenhouse gas emissions to 2030.

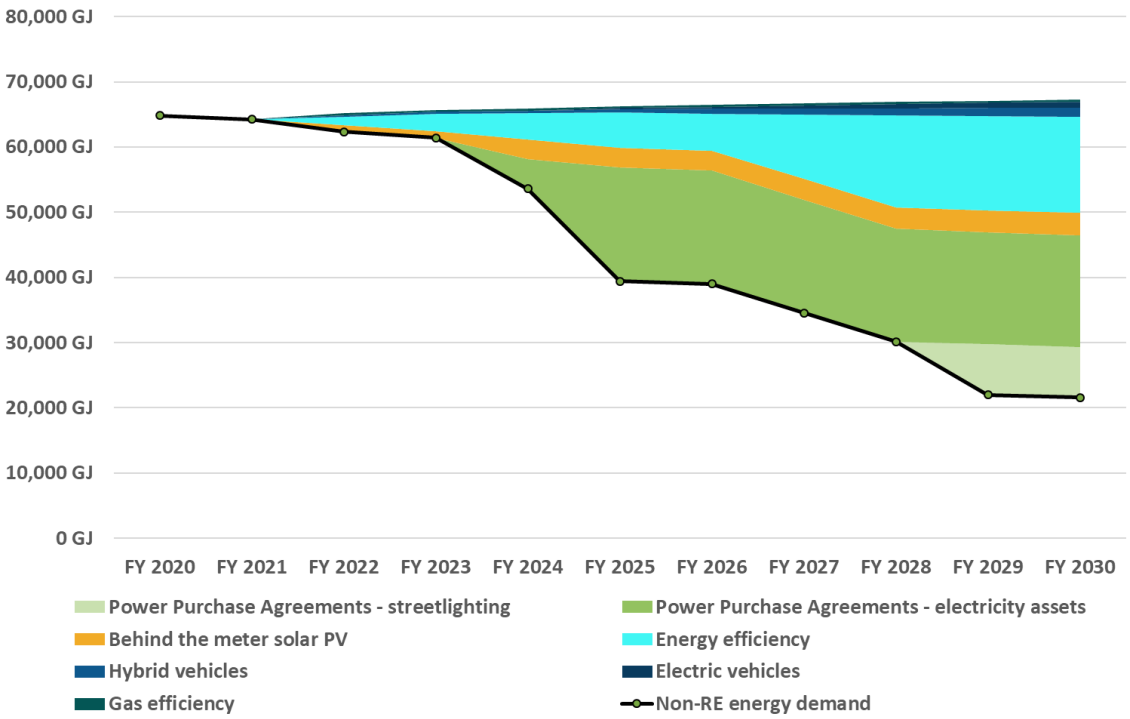


FIGURE 54: CITY OF BAYSWATER ENERGY ROADMAP TO 2030

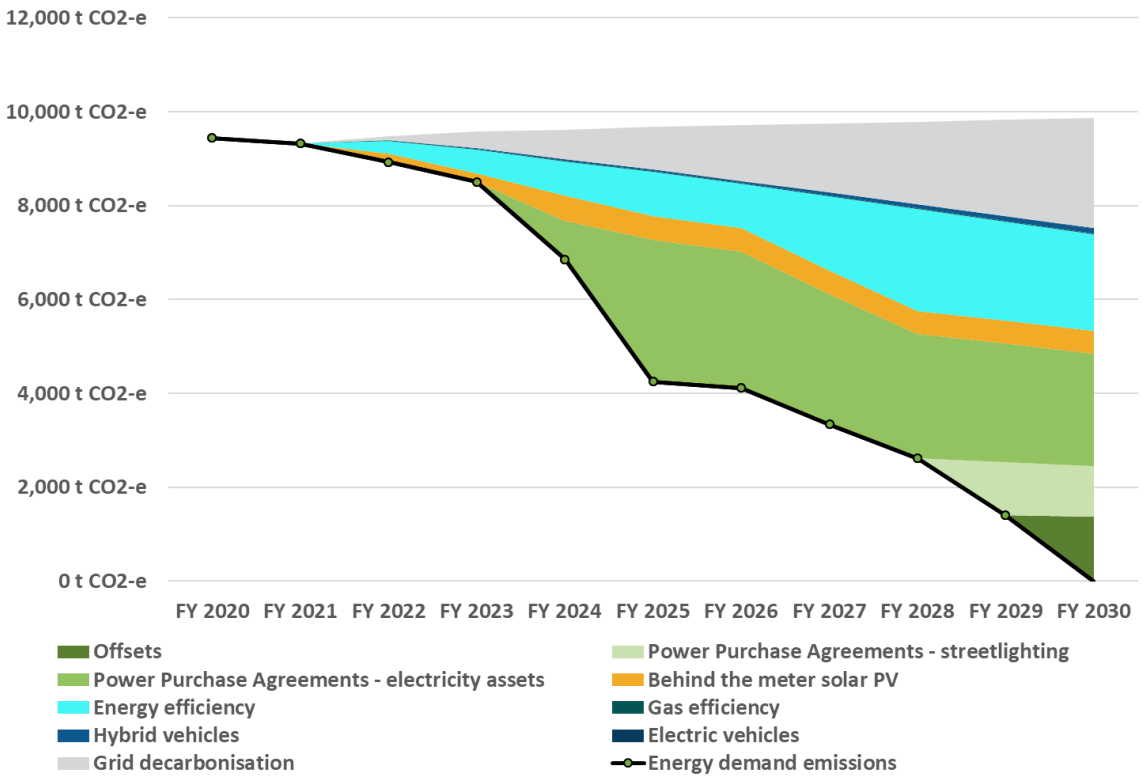


FIGURE 55: CITY OF BAYSWATER CARBON FOOTPRINT ROADMAP TO 2030

7.1.2 Roadmap to net zero emissions by 2040

The scenario for how City of Bayswater will reach net zero emissions for all City activities, including energy-related and value chain emissions builds on the above 2030 scenario, with the following additional abatement measures.

- Rooftop solar PV
  - Expansion with carport solar at Bayswater Waves, the Civic Centre and The RISE (potentially with battery storage if applicable).
  - Additional 116.2 kW at Depot and Dog Pound
- Hybrid vehicle and electric vehicle (EV) uptake
  - Continued upgrade of utes and light commercial vehicles to hybrid vehicles to 2035, then switch to electric vehicles from 2035 to 2040
  - Upgrade of half of heavy plant items to electric from 2035 to 2040 at an even rate per year
- Fuel switching
  - Pool heating technology for Bayswater Waves will be upgraded to electric heat pumps from 2037 (20-year asset life) which will result in a 95% reduction in natural gas consumption for this site
  - Gas use by other City sites is immaterial; for simplicity all other sites' gas use is assumed to be converted to electric heating by 2037 as well
- Carbon offsets
  - Carbon offsets will be purchased for residual energy emissions in 2030, and this purchase will continue from 2031 to 2040, taking into account reduced emissions through ongoing fuel switching
  - City of Bayswater will implement measures through its procurement processes that will see value chain emissions reduced by 50% by 2040, from 2022[35].
  - Additional carbon offsets will be purchased for the residual carbon emissions in 2040 to achieve carbon neutrality aligned with the Climate Active standard, based on an assumed emissions footprint of 15,000 t CO_2-e in the base year including value chain emissions

Implementation of this scenario would see the following outcome in terms of the City's energy use and greenhouse gas emissions to 2040, inclusive of value chain emissions.

[35] This estimate is indicative, though based on State-level goals to reach net zero emissions by 2050 this should be a fairly conservative projection that balances relatively easy goals for service providers' power to be sourced from renewable energy with more challenging abatement such as sourcing road and pavement construction materials from low-emissions sources and suppliers.

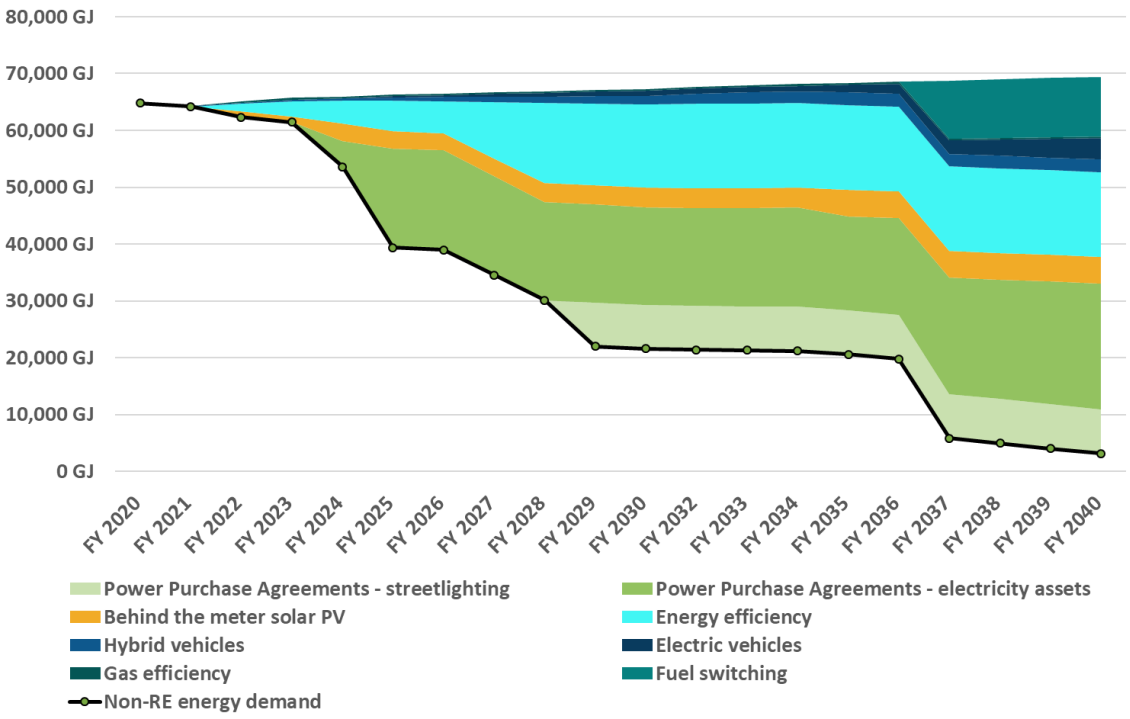


FIGURE 56: CITY OF BAYSWATER ENERGY ROADMAP TO 2040

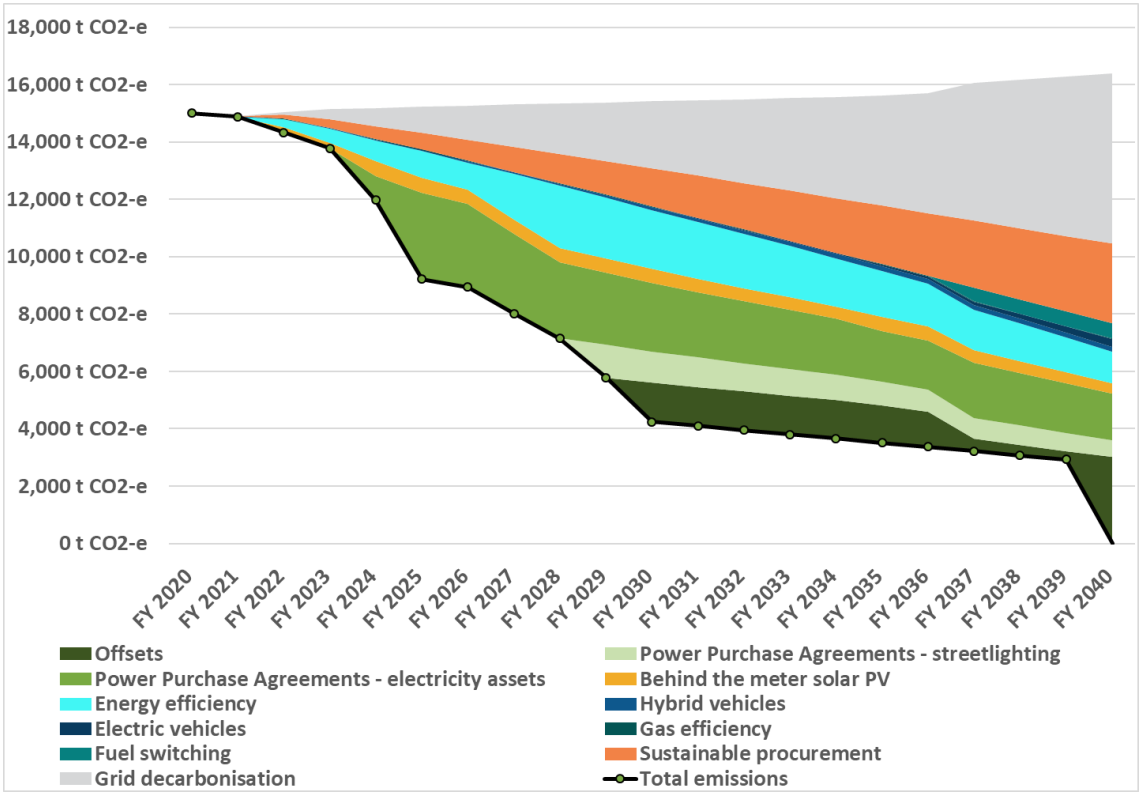


FIGURE 57: CITY OF BAYSWATER CARBON FOOTPRINT ROADMAP TO 2040

7.2 ERRE Plan actions, timing, cost estimates and abatement

The above roadmaps for the achievement of 100% renewable energy and emissions reduction were developed based on implementation of abatement measures as described. These measures are tabulated below, including the timing, abatement estimates and cost estimates.

TABLE 8: POTENTIAL COSTS OF MEASURES TO REACH CITY OF BAYSWATER'S 2030 TARGET

Abatement category	Measure	Year	Estimated cost
Energy efficiency	Building air conditioning and lighting opportunities for energy audited sites with payback <=10years.	FY 2021/22 to FY 2024/25	$1,447,954
	Building air conditioning opportunities for non-energy audited sites (8 sites per year)	FY 2021/22 to FY 2029/30	$1,688,135
	Building lighting opportunities for non-energy audited sites (8 sites per year)	FY 2021/22 to FY 2029/30	$532,871
	Gas efficiency opportunities implementation	FY 2021/22	$1,651
	Western Power-owned streetlighting upgrade	FY 2026/27	$3,736,200
	City-owned streetlighting upgrade	FY 2026/27	No cost estimates available at this time (streetlighting data still being audited)
On-site solar PV	Expansion of solar PV systems to 100 kWp for Waves and the RISE	FY 2022/23	$124,500
	Installation of 40 kW solar PV system at Morley Sport and Recreation	FY 2022/23	$51,740
	Installation of 10 kW solar PV system at Senior Citizens	FY 2022/23	$13,000
	Installation of 140.7 kWp solar PV system at Waves	FY 2024/25	$211,050
	Installation of 116.6 kWp solar PV system at the RISE	FY 2024/25	$174,900
	Installation of 150.2 kWp solar PV system at Civic Centre	FY 2024/25	$225,300
	Staggered installation of solar PV systems at small sites	FY 2024/25 to FY 2029/30	$168,033
Renewable energy power purchasing	3-year PPA for the City assets that becomes fully green in the last year	FY 2022/23 to FY 2024/25	Costs developed by WALGA
	Renewed 100% renewable electricity PPA for City assets	FY 2025/26 to FY 2029/30	No cost estimates available at this time
	Streetlighting to be powered by renewable energy	FY28/29 to FY2029/30	No cost estimates available at this time
	Increase hybrid vehicles percentage for passenger vehicles from 60% to 90%	FY 2020/21 to FY 2023/24	Part of the City's current plans

Abatement category	Measure	Year	Estimated cost
Electric vehicles and plant	Upgrade the passenger vehicles (90% hybrid and 10% petrol) to electric	FY 2024/25 to FY 2029/30	Business case to be developed by City
	Upgrade of utes and LCVs to hybrid vehicle	FY 2024/25 to FY 2029/30	Business case to be developed by City
	Upgrade of small plant items to electric	FY 2024/25 to FY 2029/30	Business case to be developed by City
Carbon offsets	Purchase carbon offsets for residual carbon emissions	FY 2029/30	~$5,000 to $20,000

TABLE 9: ANNUAL EMISSIONS AND ABATEMENT TO REACH 100% RENEWABLES FOR ENERGY WITH OFFSETS BY 2030

Financial year	Business-as-usual emissions	Total emissions reduction	*(of which) grid decarbonisation*	Residual emissions
FY 2020	9,441 t CO2-e	0 t CO2-e	0 t CO2-e	9,441 t CO2-e
FY 2021	9,331 t CO2-e	7 t CO2-e	0 t CO2-e	9,324 t CO2-e
FY 2022	9,401 t CO2-e	480 t CO2-e	82 t CO2-e	8,922 t CO2-e
FY 2023	9,230 t CO2-e	723 t CO2-e	353 t CO2-e	8,506 t CO2-e
FY 2024	8,986 t CO2-e	2,131 t CO2-e	625 t CO2-e	6,855 t CO2-e
FY 2025	8,772 t CO2-e	4,523 t CO2-e	905 t CO2-e	4,248 t CO2-e
FY 2026	8,524 t CO2-e	4,410 t CO2-e	1,186 t CO2-e	4,114 t CO2-e
FY 2027	8,275 t CO2-e	4,936 t CO2-e	1,471 t CO2-e	3,338 t CO2-e
FY 2028	8,024 t CO2-e	5,409 t CO2-e	1,760 t CO2-e	2,615 t CO2-e
FY 2029	7,772 t CO2-e	6,375 t CO2-e	2,052 t CO2-e	1,396 t CO2-e
FY 2030	7,518 t CO2-e	7,518 t CO2-e	2,348 t CO2-e	0 t CO2-e

TABLE 10: ADDITIONAL MEASURES TO ACHIEVE NET ZERO EMISSIONS TARGET BY 2040

Abatement category	Measure	Year	Estimated cost
On-site solar PV	Installation of 116.2 kWp solar PV system at Depot	FY 2034/35	$151,060
	Installation of 99.6 kWp solar carport at Bayswater Waves	FY 2034/35	$328,680
	Installation of 87.2 kWp solar carport with 300 kWh battery at The RISE	FY 2034/35	$557,760
	Installation of 36.1 kWp solar carport with 150 kWh battery at Civic Centre	FY 2034/35	$254,130
Energy Efficiency / Fuel Switching	Pool heating technology upgrade from natural gas to heat pump at Bayswater Waves and other gas-using sites	FY 2036/37	Dependent on technology at the time
	Upgrading the remaining gas equipment in all sites to electric heating	FY 2036/37	Dependent on technology at the time

Renewable energy purchasing	Renewed 100% renewable PPA for City assets, and 100% renewables continues for streetlighting	FY 2030/31 to FY 2039/40	No cost estimates available at this time
Electric vehicles and plant	Upgrade of hybrid utes and LCVs to electric	FY 2034/35 to FY 39/40	Dependant on technology at the time
	Upgrade of heavy plant equipment to electric	FY 2034/35 to FY 2043/44	Dependant on technology at the time
Sustainable Procurement	Reduce value chain emissions progressively	FY 2022/23 to FY 2039/40	Varies based on actions taken
Carbon offsets	Purchase carbon offsets for residual carbon emissions	FY 2039/40	~ $8,000 to $146,000

TABLE 11: ANNUAL EMISSIONS AND ABATEMENT TO ACHIEVE NET ZERO EMISSIONS FOR SCOPE 1, 2, 3 BY 2040[36]

Financial year	Business-as-usual emissions	Total emissions reduction	*(of which) grid decarbonisation*	Residual emissions
FY 2020	~15,000 t CO2-e	0 t CO2-e	0 t CO2-e	15,000 t CO2-e
FY 2021	14,890 t CO2-e	7 t CO2-e	0 t CO2-e	14,883 t CO2-e
FY 2022	14,961 t CO2-e	626 t CO2-e	82 t CO2-e	14,335 t CO2-e
FY 2023	14,789 t CO2-e	1,016 t CO2-e	353 t CO2-e	13,773 t CO2-e
FY 2024	14,545 t CO2-e	2,569 t CO2-e	625 t CO2-e	11,976 t CO2-e
FY 2025	14,331 t CO2-e	5,109 t CO2-e	905 t CO2-e	9,222 t CO2-e
FY 2026	14,083 t CO2-e	5,141 t CO2-e	1,186 t CO2-e	8,942 t CO2-e
FY 2027	13,834 t CO2-e	5,814 t CO2-e	1,471 t CO2-e	8,020 t CO2-e
FY 2028	13,583 t CO2-e	6,433 t CO2-e	1,760 t CO2-e	7,150 t CO2-e
FY 2029	13,331 t CO2-e	7,546 t CO2-e	2,052 t CO2-e	5,785 t CO2-e
FY 2030	13,077 t CO2-e	8,835 t CO2-e	2,348 t CO2-e	4,243 t CO2-e
FY 2031	12,822 t CO2-e	8,726 t CO2-e	2,638 t CO2-e	4,096 t CO2-e
FY 2032	12,565 t CO2-e	8,615 t CO2-e	2,930 t CO2-e	3,950 t CO2-e
FY 2033	12,307 t CO2-e	8,503 t CO2-e	3,224 t CO2-e	3,804 t CO2-e
FY 2034	12,046 t CO2-e	8,389 t CO2-e	3,520 t CO2-e	3,657 t CO2-e
FY 2035	11,785 t CO2-e	8,274 t CO2-e	3,833 t CO2-e	3,511 t CO2-e
FY 2036	11,521 t CO2-e	8,157 t CO2-e	4,173 t CO2-e	3,365 t CO2-e
FY 2037	11,256 t CO2-e	8,038 t CO2-e	4,804 t CO2-e	3,219 t CO2-e
FY 2038	10,990 t CO2-e	7,918 t CO2-e	5,179 t CO2-e	3,072 t CO2-e
FY 2039	10,721 t CO2-e	7,795 t CO2-e	5,563 t CO2-e	2,926 t CO2-e
FY 2040	10,451 t CO2-e	10,451 t CO2-e	5,954 t CO2-e	0 t CO2-e

[36] Noting that the 2040 target uses the City's wider supply / value chain scope 1 and 3 emissions in addition to energy-related emissions

7.3 Emission Reduction and Renewable Energy (Management Systems) Plan

It is recommended that a management action plan accompany the abatement plan and roadmap to help ensure the success of the ERRE Plan. The viability of identified abatement actions, new abatement opportunities, the City's future capital works, new and different staff resources, the availability of internal and external funding to slow or accelerate implementation of abatement measures, and other factors will lead to changes in when and how the ERRE Plan is implemented. A robust management action plan can help to ensure that City of Bayswater's adopted targets for renewable energy and emissions reduction are able to be progressed and achieved through the City's Annual budget and Corporate Business Plan processes.

Detailed recommended short (next 1-2 years) and medium term (to end of the next Corporate Business Plan cycle) management action plans are tabled below. These outline actions in each management and abatement area that will help to drive the Plan, and suggest responsibilities and targets or metrics that can be allocated and adopted to implement and track success. Management action plans are not costed in detail, and costs or resources are estimated to be low, moderate or high. A long term management action plan is not included, and it is anticipated that a revised ERRE Plan leading up to the City's Corporate Business Plan cycle from 2025 would look to review and reset management priorities for the following cycle.

7.3.1 Short term ERRE management action plan

TABLE 12: SHORT-TERM ERRE MANAGEMENT ACTION PLAN

#	Action	Action category	Responsibility	Target or metric	**Resources required** Neutral to low / Moderate / High	**Priority (High, Medium, Low)**
S1	Work with Azility and retailers as required to incorporate all of the City's energy-using sites into their platform, so that accurate and timely reports of the City's energy use, cost and greenhouse gas emissions can be readily produced	Management of City of Bayswater's ERRE Plan	Sustainability and Environment	% completeness and accuracy of the City's carbon footprint	Moderate, reducing to low	Medium

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
S2	Review the staff resources required to coordinate the implementation of the ERRE Plan to ensure that City of Bayswater's targets can be achieved, with consideration of internal and external and peer network engagement, management and reporting, capacity building and implementation of behaviour change measures	Management of the City's ERRE Plan	Corporate	FTE required to implement the Plan	Moderate	High
S3	Establish accountabilities for achievement of the City's targets in key positions such as at executive and senior management levels, including in position descriptions.	Management of City of Bayswater's ERRE Plan	Corporate	Targets and accountabilities, KPIs in position descriptions	Low	High
S4	Establish a leadership group that brings together key stakeholders at executive, Major Projects and Operational Leadership (OLT), to provide strategic direction and governance	Management of City of Bayswater's ERRE Plan	Corporate	Leadership group, meeting minutes	Low	High
S5	Review current funds available to implement efficiency and renewable energy projects, and compare this with ERRE Plan funding needs, through	Financing / funding of the Plan	Sustainability and Environment	Completed funding 'gap analysis'	Low	Medium

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
	engagement with each functional area, to understand gaps in funding					
S6	Evaluate funding options available to the City to progress with measures that will help it achieve its targets, including grant, internal budgets, a Revolving Energy Fund (REF), borrowing and third-party offers such as onsite solar Power Purchasing Agreements (solar PPAs).	Financing / funding of the Plan	Sustainability and Environment, Finance	Completed funding options review and decisions on options to be progressed	Moderate	Medium
S7	Identify and scope current and planned grant funding opportunities at State and Commonwealth levels and track key sources regarding new grant opportunities. For example the Clean Energy Future Fund	Financing / funding of the Plan	Sustainability and Environment	Grant funding opportunities reports – e.g. 6-monthly	Low	High
S8	Plan and budget for new solar PV (and battery) systems in budget and business plan processes that are aligned with achieving the City's targets (e.g. as per the roadmap in the ERRE Plan)	On-site solar PV	Multiple Sections	Annual Budget, corporate Business Plan funded initiatives	Moderate	High
S9	Stay abreast of developments in mid-scale renewable energy generation in the WA market	Mid-scale renewable generation	Sustainability and Environment	NA	Low	Low

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
S10	Engage with peer Councils, representative bodies and others to include the identification of possible mid-scale RE (solar, wind, bioenergy / biomethane) opportunities that could be developed in future.	Mid-scale renewable generation	Sustainability and Environment	NA	Low	Low
S11	Continue to collaborate with WALGA and other local councils to develop the case for a renewable energy power purchase agreement that can meet part or all of the City's electricity demand. Subject to the outcome of this process participate in any subsequent market approach to determine if a PPA can be achieved at a price comparable to 'regular' grid power	Renewable energy power purchasing	Sustainability and Environment, Finance	Feasibility assessment report and plan Outcome of market approach for PPA v 'regular' grid agreement	Moderate to High	High
S12	Stay abreast of PPA product development and deliver or continue to deliver internal advice and education to build literacy in and confidence in a renewable energy PPA as a key part of meeting the City's targets	Renewable energy power purchasing	Sustainability and Environment	NA	Moderate	Low

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
S13	Include information and data (if available) on tree planting and wetlands in reporting on ERRE Plan progress so that sequestration measures are part of the City's climate change response narrative	Sequestration	Sustainability and Environment	Annual data on tree coverage, wetlands management	Low to moderate	Low
S14	Work with Western Power and other stakeholders to progress City of Bayswater's case for lights in Bayswater to be upgraded to LED (non-decorative, smart control-enabled to be decided)	Energy efficiency	Sustainability and Environment, Finance	Periodic update on status and WP rollout plan	Low	High
S15	Develop a short term implementation plan for energy efficiency initiatives, prioritising high return measures from the EMRC-funded energy audit program as well as planned building upgrades (as per the roadmap action plan)	Energy efficiency	Multiple Sections	Agreed plan and timeline	Moderate	High
S16	Plan and budget for new energy efficiency projects in budget and business plan processes that are aligned with achieving the City's targets (as per the roadmap action plan)	Energy efficiency	Multiple Sections	Annual Budget, corporate Business Plan funded initiatives	Moderate	Medium

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
S17	Ensure best practice energy efficiency (and renewable energy generation or design provision) is incorporated into all capital works projects (for example Morley Sport and Recreation Centre and Maylands Waterland). Develop a design guide or standard for future projects	Energy efficiency	Major projects	Reported ESD inclusions and RE provisions	Low	Low
S18	Progress with the City's current approach that will achieve ~90% hybrid passenger vehicles, a small number of EVs and an optimised passenger / utility fleet size	Electric vehicles and plant	Fleet	% of hybrid passenger cars, number of EVs, total passenger fleet size	Low	High
S19	Use fleet fuel efficiency information to influence driver behaviour and inform vehicle needs	Electric vehicles and plant	Fleet	Fleet utilisation reports and actions	Moderate	Medium
S20	Conduct research to identify the key areas, emissions sources, behaviours that will be most effective at reducing emissions sustainably	Behavioural change	Sustainability and Environment	Research report	High	Low
S21	Identify and plan the implementation of high priority systemic and behavioural changes that will yield the	Behavioural change	Sustainability and Environment	Action plan	High	Low

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
	greatest benefit in emissions savings and staff engagement					
S22	Review the City's procurement policy to align with best practice in sustainable procurement, and to specifically include the City's renewable energy and emissions reduction targets in evaluation criteria for supplier offers	Sustainable procurement	Procurement	Revised procurement policy	Low	Medium
S23	Review the City's current range of specifications used to procure services and equipment across operational and capital expenditure, and current awareness of and use of sustainability provisions of existing procurement. Progressively update specifications to align with best practice in sustainable procurement and the City's targets, and provide education / training to City staff	Sustainable procurement	Procurement	Database of current specs, gap analysis v good practice for sustainable procurement	High	Low

7.3.2 Medium term ERRE management action plan

TABLE 13: MEDIUM-TERM ERRE MANAGEMENT ACTION PLAN

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
M1	Continue to monitor and re-evaluate targets for the City for emissions reduction and renewable energy, including scale, timing and any interim targets	Management of City of Bayswater's ERRE Plan	Sustainability and Environment	Confirmed or revised targets or interim targets	Moderate	Medium
M2	Integrate the ERRE Plan and the City's targets into the Annual Budget and Corporate Business Plan process for all of the City's functional areas	Management of City of Bayswater's ERRE Plan	Corporate	Effective integration into plans based on budget and business plan review	High	High
M3	Implement suitable measurement and verification systems, including M&V of significant abatement projects such as LED streetlighting, large onsite solar PV projects and renewable energy PPAs, and annual analysis of the City's overall energy use and emissions from Azility	Management of City of Bayswater's ERRE Plan	Sustainability and Environment	Reported large project performance	Moderate	Medium
M4	Develop communication, engagement and capacity-building plans that identify key staff, identify communication channels, report progress against the City's goals,	Management of City of Bayswater's ERRE Plan	Sustainability and Environment	City's RE and NZ targets are established in induction, training and awareness materials	High	Low

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
	identify and develop training, induction and awareness materials, and solicit input that increases awareness, recognition and buy-in			and communication plans		
M5	Stay abreast of grant funding and other incentive opportunities that can help to fund elements of the ERRE Plan. Aim to have 2 to 3 'shovel-ready' projects that the City would implement with grant funds.	Financing / funding of the Plan	Sustainability and Environment	Up-to-date grant funding lists, number of projects that are 'shovel ready'	Low	High
M6	Review and update the City's solar PV business cases and plans for rooftop, carport and battery energy storage systems, based on changes in technologies, costs and energy rates	On-site solar PV	Sustainability and Environment, all functional areas	Updated solar PV business cases, annual budgeted projects	Low to moderate	Medium
M7	Continue to stay abreast of developments in mid-scale renewable energy generation in the WA market, and engage with peer Councils, representative bodies and others on these opportunities, as well as emerging opportunities for bioenergy / biomethane	Mid-scale renewable generation	Sustainability and Environment	NA	Low	Low

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
M8	Participate in ongoing market approaches to secure or renew renewable energy PPAs through the City's energy procurement process	Renewable energy power purchasing	Sustainability and Environment, Finance	Outcome of market approach for PPA v 'regular' grid agreement	High	High
M9	Continue to monitor the City's carbon footprint aligned with its net zero emissions boundary	Carbon offsets	Sustainability and Environment	Reported GHG emissions	Moderate	Medium
M10	Collect data on both tree plantings and wetlands condition as part of overall data collection and reporting as part of the ERRE Plan	Sequestration	Sustainability and Environment	Annual data on tree coverage, wetlands management	Low to moderate	Low
M11	Continue to work with Western Power and other stakeholders to progress the City's case for lights in Bayswater to be upgraded to LED (non-decorative, smart control-enabled to be decided), with a goal for implementation in the next Business plan cycle	Energy efficiency	Sustainability and Environment, Finance	Implemented or commitment rollout project	High	High
M12	Revise short-term energy efficiency plans every 1-2 years to schedule implementation of the next group of priority projects, and plan for these as part of the City's normal budget process	Energy efficiency	Sustainability and Environment	Revised energy efficiency plan	Moderate	Medium

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
M13	Develop or update plans for the City's fleet fuel transition to hybrid and electric vehicles across all vehicle categories	Electric vehicles and plant	Fleet	Updated fleet plan	High	Medium
M14	Develop a plan for EV charging infrastructure for the City's EVs as well as at community facilities (including potential increase in energy demand)	Electric vehicles and plant	Fleet	EV charging plan	Moderate	Medium
M15	Stay abreast of developments in electric technologies for heavier fleet, such as light trucks or buses. Continue to evaluate electric powered small plant devices as well as their charging infrastructure and charging practices	Electric vehicles and plant	Fleet	NA	Moderate	Medium
M16	Continue to trial and implement behavioural change initiatives in City of Bayswater to achieve sustained engagement and sustained emissions reduction	Behavioural change	Sustainability and Environment	Report on behaviour change initiatives	High	Low
M17	Progressively update specifications to reflect the City's emissions and renewable energy targets, train staff and continue to collate examples of	Sustainable procurement	Procurement	NA	Moderate	Medium

#	Action	Action category	Responsibility	Target or metric	Resources required Neutral to low / Moderate / High	Priority (High, Medium, Low)
	good practice that can be used in other procurement					
M18	Review the City's procurement policy at regular intervals – e.g. 3 years	Sustainable procurement	Procurement	Procurement policy	Moderate	Medium

Appendix A: Solar PV and Energy Efficiency potential in City of Bayswater

TABLE 14: ESTIMATED COSTS AND SAVINGS FOR SOLAR PV FOR SMALL SITES

Site	Estimated or modelled PV size	Capital cost	Cost savings	Payback	Solar yield (kWh)	Emissions reduction (t CO_2-e)	Source
Drill Hall	5.00 kW	$8,000	$677	<15	7,000	4.90 t CO2-e	Energy audit
Morley Sports and Recreation Centre	39.80 kW	$51,740	$17,221	3.00 years	64,178	41.69 t CO2-e	100%RE (City advised size)
Depot and Dog Pound	116.20 kW	$151,060	$13,831	10.92 years	162,680	23.67 t CO2-e	100%RE (max roof capacity)
Maylands Sports and Recreation Club 1 (8001560804)	4.44 kW	$5,771	$1,138	3.63 years	6,215	3.48 t CO2-e	100%RE
Maylands Sports and Recreation Club 2 (8001226410)	4.31 kW	$5,607	$822	6.82 years	6,039	3.38 t CO2-e	100%RE
Roxy Lane Theatre	1.40 kW	$1,820	$415	4.39 years	1,961	1.10 t CO2-e	100%RE
Bayswater Activity Centre	1.61 kW	$2,092	$492	4.25 years	2,253	1.26 t CO2-e	100%RE
Bayswater Morley Youth Club	7.02 kW	$9,123	$1,723	5.30 years	9,824	5.50 t CO2-e	100%RE
Bayswater Community Centre	10.00 kW	$13,000	$2,786	4.67 years	15,229	8.53 t CO2-e	100%RE (City advised size)
Beaufort Park Scout Hall	3.12 kW	$4,053	$772	5.25 years	4,365	2.44 t CO2-e	100%RE
Carrama Community Centre	1.53 kW	$1,990	$474	4.20 years	2,143	1.20 t CO2-e	100%RE
Elderly Community Help Organisation (ECHO)	4.67 kW	$6,077	$1,201	5.06 years	6,544	3.66 t CO2-e	100%RE
Filipino Assoc	1.18 kW	$1,539	$359	4.29 years	1,657	0.93 t CO2-e	100%RE
Hillcrest Pre School	8.81 kW	$11,453	$3,329	3.44 years	12,334	6.91 t CO2-e	100%RE
Noranda Sports Club	1.22 kW	$1,588	$321	4.94 years	1,711	0.96 t CO2-e	100%RE
Peninsula Golf Course 1 (8001006294)	12.21 kW	$15,875	$3,867	4.11 years	17,097	9.57 t CO2-e	100%RE
Peninsula Golf Course 2 (8001406711)	8.28 kW	$10,770	$2,817	3.82 years	11,599	6.50 t CO2-e	100%RE

Matthew McVeigh - Maylands Interpretive Centre	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Angelhands Inc (1) - The Rise Office 1	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Association For The Welfare Of Migrant Families - 411 Guildford Road	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
North East Regional Training Association - T/as Morley Training Centre (NERTA)	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
WA Youth Jazz Orchestra (WAYJO) - Maylands Hall	6.80 kW	$8,846	$1,998	4.43 years	9,526	5.33 t CO2-e	100%RE
Maylands Yacht Club - Bardon Park	1.32 kW	$1,711	$386	4.43 years	1,843	1.03 t CO2-e	100%RE
Association of United Sri Lankan Muslims of Western Australia (AUSLAMWA)	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
West Coast Model RC Inc - Moojebing Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bayswater City Soccer Club Inc - Frank Drago Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bayswater Croquet Club Incorporated - Frank Drago Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bulgarian Association Rodina Inc - Hampton Park Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
1st Hampton Park Scouts Group - Hampton Park Reserve	1.25 kW	$1,621	$366	4.43 years	1,746	0.98 t CO2-e	100%RE
Bayswater SES - Bayswater State Emergency Service (Inc) (Ses)	1.68 kW	$2,185	$493	4.43 years	2,353	1.32 t CO2-e	100%RE
Perth Bayswater Rugby Union Club - Pat O`Hara	4.59 kW	$5,971	$1,348	4.43 years	6,430	3.60 t CO2-e	100%RE
Bedford Junior Cricket Club - Grand Promenade Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
COB Child Care Association - Roberts Street Pre-School Centre	1.02 kW	$1,328	$300	4.43 years	1,430	0.80 t CO2-e	100%RE

Department of Education - Maylands Primary School - Gibbney Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Football West - Gibbney Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
COB Child Care Association - Silverwood Child Care Centre	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bayswater Paddlesports Club - Hinds Reserve Boat Shed Bay 5	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Morley Sporting Club Incorporated - RA Cook Pavilion	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Department of Education - Inglewood Kindergarten Centre	1.81 kW	$2,356	$532	4.43 years	2,537	1.42 t CO2-e	100%RE
Bayswater Organisation Loan of Toys	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Western Australian Rogaining Association - Hampton Park Reserve	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bayswater Lacrosse Club - Halliday Park	2.56 kW	$3,333	$753	4.43 years	3,589	2.01 t CO2-e	100%RE
West Australian Ballet Inc - 134 Whatley Crescent, Maylands	1.82 kW	$2,370	$535	4.43 years	2,552	1.43 t CO2-e	100%RE
Minister of Education - Noranda Primary School - Deschamp Reserve Noranda	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Bayswater Childcare Assoc Inc - Derrick Ernst Neighbourhood Centre (Tara)	2.41 kW	$3,135	$708	4.43 years	3,376	1.89 t CO2-e	100%RE
Chabad Lubavitch Of Western Australia - Garson Court	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Morley Eagles Baseball Club - Crimea Park	1.90 kW	$2,471	$558	4.43 years	2,661	1.49 t CO2-e	100%RE
Total	**294.10 kW**	**$383,833**	**$70,825**	**5.42 years**	**421,430**	**175.30 t CO2-e**	

The analysis of solar opportunities was performed with the following inputs and parameters:

- Solar modelling software (Helioscope with Nearmap / Six maps) was used for selected modelled installations, with capacity for non-modelled systems estimated based on discussions, aerial map analysis and energy demand.

- The City's energy billing data was used to estimate solar array sizes
- For all exported energy a feed-in rate of $0.0/kWh was assumed since currently there are no tariffs available to non-residential solar connections.
- Sites with solar opportunities in their energy audit reports were used as advised in the reports
- Solar capacity was based on 25% of sites energy use.
- An export rate of 20% was assumed for most sites, with the exception being the depot where the maximum system size was modelled.
- Benchmark pricing for solar PV systems and inverters was assumed to be $1.3/W regardless of the system type.
- Emissions reduction is based on the consumed solar energy only, so sites with high export levels (e.g. Depot) will show lower emissions savings.

TABLE 15: SUMMARY OF ESTIMATED COSTS AND SAVINGS FOR ENERGY EFFICIENCY FOR CITY-OPERATED SITES (AS PER THE ENERGY AUDITS)

Opportunity type	Estimated cost	Annual savings	Payback (years)	Resource savings (MWh pa)	Emissions reduction (t CO2-e pa)
Culture of energy saving awareness	$25,000	$59,074	0.4	219.2 MWh	153.5 t CO2-e
Lighting	$838,675	$105,267	8.0	416.0 MWh	291.2 t CO2-e
Lighting controls	$150,000	$41,699	3.6	200.9 MWh	140.7 t CO2-e
HVAC upgrades / replacement	$44,000	$25,243	1.7	90.9 MWh	63.7 t CO2-e
BMS Strategies	$300,000	$6,226	48.2	30.0 MWh	21.0 t CO2-e
BMS upgrade	$22,000	$350	62.9	1.1 MWh	0.8 t CO2-e
Energy efficiency building tuning	$372,635	$70,988	5.2	253.6 MWh	177.5 t CO2-e
Electronically Commutated (EC) plug fan upgrade	$329,771	$32,977	10.0	145.7 MWh	102.0 t CO2-e
Submetering and energy monitoring	$1,651	$1,651	1.0	189.9 GJ	10.6 t CO2-e
Voltage optimisation	$393,188	$26,213	15.0	115.8 MWh	81.1 t CO2-e
Hot Water	$2,074,770	$158,414	13.1	626.6 MWh	438.6 t CO2-e
VSD optimisation	$0	$3,435	0.0	15.2 MWh	10.6 t CO2-e
Demand side management	$0	$25,000	0.0	50.0 kW	0.0 t CO2-e
Operational strategy update - electricity	$0	$5,111	0.0	22.6 MWh	15.8 t CO2-e
Operational strategy update - gas	$0	$4	0.0	115.9 GJ	6.4 t CO2-e
Streetlighting	$3,736,200	$474,091	7.9	2,093.7 MWh	1,465.6 t CO2-e
Totals	**$8,287,891**	**$1,035,743**	**8.0**	**4,231.0 MWh** **50 kW** **306 GJ**	**2,979.1 t CO2-e**

Streetlighting LED upgrade – costs and savings analysis

The Western Power-owned streetlighting opportunity was assessed based on the inventory available in billing and information from Western Power's LED upgrade program. The actual load of lamps was extracted from the NEM load table[37]. The table below summarises the analysis for the LED upgrade.

TABLE 16: ESTIMATED ANNUAL ENERGY CONSUMPTION AND COST OF EXISTING STREETLIGHTING

SL asset type	No. of lamps	Wattage	Wattage w/ lamp ballast	Estimated consumption	Estimated energy cost
125W Mercury Vapour - C	1083	125	142.00	673,583 kWh	$218,835.31
150W High Pressure Sodium - C	93	150	173.00	70,470 kWh	$21,022.14
150W Metal Halide - C	29	150	173.00	21,974 kWh	$8,996.19
160W LED RF - C	13	160		9,110 kWh	$2,456.96
170W LED RF - C	25	170		18,615 kWh	$4,892.83
20W LED RG - C	49	20		4,292 kWh	$4,414.02
22W LED - C	1	22		96 kWh	$100.70
250W High Pressure Sodium - A	1	250	273.00	1,196 kWh	$222.94
250W High Pressure Sodium - C	1817	250	273.00	2,172,660 kWh	$522,605.54
250W Mercury Vapour - C	71	250	270.00	83,965 kWh	$22,209.16
250W Metal Halide - C	24	250	286.00	30,064 kWh	$8,922.94
36W LED RG - C	5	36		788 kWh	$504.25
42W CFL BH - C	2	42	46.40	406 kWh	$306.16
42W CFL SE - C	937	42	46.40	190,428 kWh	$137,862.22
42W CFL SE - M	1	42	46.40	203 kWh	$133.41
42W LED BH - C	1	42		184 kWh	$148.15
53W LED RG - C	15	53		3,482 kWh	$1,690.13
70W High Pressure Sodium - C	6	70	86.00	2,260 kWh	$906.44
70W Metal Halide - C	26	70	81.50	9,281 kWh	$6,116.31
80W LED RF - C	10	80		3,504 kWh	$1,303.42
80W Mercury Vapour - A	1	80	95.80	420 kWh	$136.69
80W Mercury Vapour - C	1657	80	95.80	695,284 kWh	$260,791.92
Total	**5867**			**3,992,267 kWh**	**$1,224,577.81**

[37] AEMO: https://aemo.com.au/en/energy-systems/electricity/national-electricity-market-nem/market-operations/retail-and-metering/metrology-procedures-and-unmetered-loads

TABLE 17: ESTIMATED ENERGY AND FINANCIAL IMPLICATIONS WHEN UPGRADING TO LED STREETLIGHTS

Streetlight asset type	Estimated total cost of replacement	LED Upgrade	LED Wattage	Estimated consumption after LED upgrade	Estimated savings from LED upgrade	Estimated energy cost after LED upgrade	Estimated energy cost savings from LED upgrade
125W Mercury Vapour - C	$703,950.00	36W LED RG	36	170,767 kWh	502,815 kWh	$109,220.01	$109,615.30
150W High Pressure Sodium - C	$60,450.00	53W LED RG	53	21,589 kWh	48,881 kWh	$10,478.82	$10,543.32
150W Metal Halide - C	$18,850.00	80W LED RF	80	10,162 kWh	11,813 kWh	$3,779.90	$5,216.29
160W LED RF - C	$0.00			9,110 kWh	0 kWh	$2,456.96	$0.00
170W LED RF - C	$0.00			18,615 kWh	0 kWh	$4,892.83	$0.00
20W LED RG - C	$0.00			4,292 kWh	0 kWh	$4,414.02	$0.00
22W LED - C	$0.00			96 kWh	0 kWh	$100.70	$0.00
250W High Pressure Sodium - A	$650.00	170W LED RF	170	745 kWh	451 kWh	$195.71	$27.23
250W High Pressure Sodium - C	$1,181,050.00	170W LED RF	170	1,352,938 kWh	819,721 kWh	$355,610.52	$166,995.02
250W Mercury Vapour - C	$46,150.00	170W LED RF	170	52,867 kWh	31,098 kWh	$13,895.62	$8,313.53
250W Metal Halide - C	$15,600.00	160W LED RF	160	16,819 kWh	13,245 kWh	$4,535.93	$4,387.01
36W LED RG - C	$0.00			788 kWh	0 kWh	$504.25	$0.00
42W CFL BH - C	$1,300.00	20W LED	20	175 kWh	231 kWh	$180.16	$126.00
42W CFL SE - C	$609,050.00	20W LED	20	82,081 kWh	108,347 kWh	$84,406.83	$53,455.38
42W CFL SE - M	$650.00	20W LED	20	88 kWh	116 kWh	$90.08	$43.33
42W LED BH - C	$0.00			184 kWh	0 kWh	$148.15	$0.00
53W LED RG - C	$0.00			3,482 kWh	0 kWh	$1,690.13	$0.00
70W High Pressure Sodium - C	$3,900.00	36W LED RG	36	946 kWh	1,314 kWh	$605.10	$301.34
70W Metal Halide - C	$16,900.00	36W LED RG	36	4,100 kWh	5,182 kWh	$2,622.09	$3,494.22
80W LED RF - C	$0.00			3,504 kWh	0 kWh	$1,303.42	$0.00
80W Mercury Vapour - A	$650.00	20W LED RG	20	88 kWh	332 kWh	$90.08	$46.61
80W Mercury Vapour - C	$1,077,050.00	20W LED RG	20	145,153 kWh	550,131 kWh	$149,265.87	$111,526.04
Total	**$3,736,200.00**			**1,898,590 kWh**	**2,093,677 kWh**	**$750,487.19**	**$474,090.62**
				% energy reduction	52%	**% cost reduction**	39%

TABLE 18: BUSINESS CASE SUMMARY FOR LED STREETLIGHTING UPGRADE

Financial analysis	
Estimated total cost	$3,736,200.00
Estimated annual energy savings	2,093,677 kWh
Estimated emissions reduction	1466 t CO_2-e
Estimated annual cost savings	$474,090.62
Simple payback	7.9 years

Upgrading the remaining non-LED streetlights will require a CAPEX of around $3,736,200 and will result in an annual energy reduction of 2,093,677 kWh (52% energy reduction) which will result in annual cost savings of around $474,091 (39% cost reduction which factors in energy charges and maintenance costs). This opportunity has a 7.9 years simple payback and will also result in emissions reduction of around 1,466 t CO_2-e[38].

[38] The final turnkey price to deliver the streetlighting upgrade and the final scope in terms of number of luminaires to be replaced, will be re-assessed at the time a decision to proceed is made, as pricing and luminaire numbers will change over time. The pricing and scope here reflect information at the time the ERRE Plan was developed.

TABLE 19: ESTIMATED COSTS AND SAVINGS FOR ENERGY EFFICIENCY FOR CITY-OPERATED SITES

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Civic Centre and Council Chambers	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$13,900	0.07	66,977	10.00%	46.88	Energy audit
	Subscription to basic cloud-based energy monitoring	Submetering and monitoring	$1,500						Energy audit
	Replacement of existing fluorescent lighting fixtures to LEDs.	Lighting	$75,891	$18,973	4.00	91,423	13.65%	64.00	Energy audit
	Optimisation of HVAC systems	BMS Strategies	$150,000	$41,699	3.00	200,930	30.00%	140.65	Energy audit
	Regular analyses and rectification work dedicated to the energy efficiency of the BMS to ensure plant operation at optimal performance, to reduce current and to avoid future operational costs.	Energy efficiency building tuning	$20,000	$10,425	1.92	50,233	7.50%	35.16	Energy audit
	Supply air fan upgrades	EC plug fan upgrade	$300,000	$6,226	10.00	30,000	4.48%	21.00	Energy audit
Depot and Dog Pound (shares with Rangers and Security)	Energy Saving education workshops for staff and public awareness.	Culture of energy saving awareness	$4,000	$1,100	3.00	3,450	7.33%	2.42	Energy audit
	Submetering solution to determine energy consumption of the depot and Rangers & Security separately.	Submetering and monitoring	$20,000	$840	>20	2,600	5.53%	1.82	Energy audit
	Upgrade lights to LED	Lighting	$40,000	$850	>20	2,655	5.64%	1.86	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
	Install lighting controls	Lighting controls	$22,000	$350	>20	1,100	2.34%	0.77	Energy audit
The RISE	Energy Saving education workshops for staff awareness. Annual 4-hour workshop, conducted by external consultant.	Culture of energy saving awareness	$4,000	$11,246	0.40	37,159	7.50%	26.01	Energy audit
	Energy Saving education workshops for public. Annual 4-hour workshop, conducted by external consultant.	Included above							
	Install an energy monitoring system	Submetering and monitoring	$70,000	$12,031	5.80	28,442	5.74%	19.91	Energy audit
	Upgrade lights to LED	Lighting	$80,000	$2,705	>20	13,341	2.69%	9.34	Energy audit
	Regular analyses and rectification work dedicated to the energy efficiency of the BMS to ensure plant operation at optimal performance, to reduce current and to avoid future operational costs.	Energy efficiency building tuning	$15,000	$9,312	1.60	22,014	4.44%	15.41	Energy audit
Drill Hall	Energy Saving education workshops for staff and public awareness.	Culture of energy saving awareness	$2,000	$580	3.44	1,800	11.34%	1.26	Energy audit
	Ne Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$4,000	$405	>15	1,300	8.19%	0.91	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Morley Sports and Recreation Centre	Energy Saving education workshops for staff and public awareness.	Culture of energy saving awareness	$4,000	$12,550	0.30	28,076	10.39%	19.65	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$22,250	$9,613	2.10	21,507	7.96%	15.05	Energy audit
	Upgrade lights to LED	Lighting	$80,000	$2,424	>20	5,422	2.01%	3.80	Energy audit
Morley Noranda Recreation Club incl of Netball	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$6,349	0.16	21,058	10.00%	14.74	Energy audit
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$2,155	1.00	7,696	3.65%	5.39	Energy audit
	Submetering solution to determine energy consumption of the club and netball separately.	Submetering and monitoring	$6,000	$2,787	2.00	9,952	4.73%	6.97	Energy audit
Morley Library (shares with Les Hansman Comm Centre	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$1,359	0.74	4,543	10.00%	3.18	Energy audit
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$779	2.00	2,359	5.19%	1.65	Energy audit
	Submetering solution to determine energy consumption of the library and community centre separately.	Submetering and monitoring	$7,500	$1,670	7.00	5,963	13.13%	4.17	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Les Hansman Comm Centre (shares with Morley Library)	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$751	1.33	2,508	10.00%	1.76	Energy audit
	Upgrade lights to LED	Lighting	$3,700	$600	6.00	1,819	7.25%	1.27	Energy audit
	Submetering solution to determine energy consumption of the library and community centre separately.	Submetering and monitoring	$6,000	$922	7.00	3,292	13.13%	2.30	Energy audit
Bayswater Senior Citizens 1	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$591	1.69	2,587	10.00%	1.81	Energy audit
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$355	4.00	1,197	4.63%	0.84	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$6,000	$434	14.00	1,548	5.98%	1.08	Energy audit
Bayswater Bowling and Recreation Club	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$1,233	0.81	4,410	10.00%	3.09	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$7,500	$1,842	4.00	6,579	14.92%	4.61	Energy audit
Bayswater Library	Energy Saving education workshops for staff and public	Culture of energy saving awareness	$1,000	$1,327	0.75	4,237	10.00%	2.97	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
	awareness. Annual session led by an external consultant.								
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$570	3.00	2,036	4.80%	1.43	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$6,000	$205	>20	731	1.73%	0.51	Energy audit
Lightning Park Recreation Centre	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$2,780	0.36	10,604	10.00%	7.42	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$6,000	$4,000	2.00	14,285	13.47%	10.00	Energy audit
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$881	1.00	2,671	2.52%	1.87	Energy audit
Maylands Sport and Recreation Club	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$834	1.20	4,902	10.00%	3.43	Energy audit
	Submetering solution can be implemented to understand consumption of specific areas.	Submetering and monitoring	$7,500	$2,272	3.00	8,166	16.66%	5.72	Energy audit
Rangers and Security (shares with Depot and Dog Pound)	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$1,470	0.68	4,340	10.00%	3.04	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
	Optimisation of HVAC systems	Energy efficiency building tuning	$1,500	$766	2.00	2,734	6.30%	1.91	Energy audit
	Submetering solution to determine energy consumption of the depot and Rangers & Security separately.	Submetering and monitoring	$7,500	$990	6.00	3,536	8.15%	2.48	Energy audit
Bayswater Waves Aquatic Centre	Energy Saving education workshops for staff and public awareness. Annual session led by an external consultant.	Culture of energy saving awareness	$1,000	$2,462	0.41	18,504	1.00%	12.95	Energy audit
	Recommissioning of sub-metering system to facilitate correct operation and new subscription to data visualisation and analytics platform.	Submetering and monitoring	$30,000						Energy audit
	Upgrade lights to LED	Lighting	$26,213	$13,106	2.00	57,916	2.56%	40.54	Energy audit
	Implementation of energy monitoring system	Submetering and monitoring	$164,885	$32,977	5.00	145,723	6.45%	102.01	Energy audit
	Install a VO unit	Voltage optimisation	$329,771	$32,977	10.00	145,723	6.45%	102.01	Energy audit
	Insulation of hot water piping	Hot water	$1,651	$1,651	1.00	190	1.64%	10.57	Energy audit
	Upgrade existing BMS	HVAC	$393,188	$26,213	15.00	115,831	5.13%	81.08	Energy audit
	Fix AHU water and air leakages	HVAC	$13,106	$6,553	2.00	28,958	1.28%	20.27	Energy audit
	Replace AHUs with ERVs	HVAC	$294,891	$19,659	15.00	86,873	3.85%	60.81	Energy audit
	Rectify the control issues with ducted system in the Gym	HVAC	$13,106	$6,553	2.00	28,958	1.28%	20.27	Energy audit

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
	Pump flow reduction	VSD optimisation	$0	$3,435	0.00	15,179	0.67%	10.63	Energy audit
	Implement demand side management	Demand side management	$0	$25,000	0.00	50 kW	0.00%	0	Energy audit
	Chiller efficiency improvement	HVAC	$65,531	$13,106	5.00	57,916	2.56%	40.54	Energy audit
	Update operational strategy	Operational strategy update - Electricity	$0	$4,188	0.00	22,587	1.00%	12.95	Energy audit
	Update operational strategy	Operational strategy update - Gas	$0	$4	0.00	116 GJ	1.00%	6.45	Energy audit
Unmetered streetlighting	Streetlighting LED upgrade	Streetlighting	$3,736,200	$474,091	7.88	2,093,677	52.44%	1,465.57	100%RE
Bayswater Library	Upgrade lights to LED	Lighting	$4,300	$538	8.00	1,716	4.05%	1.20	100%RE
Maylands Sports and Recreation Club 2 (8001226410)	Upgrade lights to LED	Lighting	$1,331	$166	8.00	978	4.05%	0.68	100%RE
Maylands Sports and Recreation Club 1 (8001560804)	Upgrade lights to LED	Lighting	$7,371	$921	8.00	4,027	16.20%	2.82	100%RE
Morley Noranda Recreation Club incl of Netball	Upgrade lights to LED	Lighting	$76,194	$9,524	8.00	31,587	15.00%	22.11	100%RE
Bayswater Bowling and	Upgrade lights to LED	Lighting	$11,236	$1,405	8.00	5,358	12.15%	3.75	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Recreation Club (Frank Drago Reserve)									
Autumn Centre	Upgrade lights to LED	Lighting	$3,983	$498	8.00	1,882	24.00%	1.32	100%RE
Bayswater Activity Centre	Upgrade lights to LED	Lighting	$4,721	$590	8.00	2,163	24.00%	1.51	100%RE
Bayswater Morley Youth Club	Upgrade lights to LED	Lighting	$16,539	$2,067	8.00	9,431	24.00%	6.60	100%RE
Beaufort Park Scout Hall	Upgrade lights to LED	Lighting	$7,408	$926	8.00	4,190	24.00%	2.93	100%RE
Carrama Community Centre	Upgrade lights to LED	Lighting	$4,550	$569	8.00	2,057	24.00%	1.44	100%RE
Elderly Community Help Organisation (ECHO)	Upgrade lights to LED	Lighting	$8,645	$1,081	8.00	4,712	18.00%	3.30	100%RE
Ellis House	Upgrade lights to LED	Lighting	$1,972	$247	8.00	883	24.00%	0.62	100%RE
Embleton Pre-School and Child Health Centre	Upgrade lights to LED	Lighting	$1,846	$231	8.00	721	24.00%	0.51	100%RE
Filipino Assoc	Upgrade lights to LED	Lighting	$861	$108	8.00	398	6.00%	0.28	100%RE
Halliday House	Upgrade lights to LED	Lighting	$934	$117	8.00	293	24.00%	0.21	100%RE
Hampton Square Pre School and Child Health	Upgrade lights to LED	Lighting	$1,386	$173	8.00	511	18.00%	0.36	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Hillcrest Pre School	Upgrade lights to LED	Lighting	$31,961	$3,995	8.00	11,840	24.00%	8.29	100%RE
Kindergarten	Upgrade lights to LED	Lighting	$146	$18	8.00	49	24.00%	0.03	100%RE
Maylands Library	Upgrade lights to LED	Lighting	$18,357	$2,295	8.00	6,939	24.00%	4.86	100%RE
Maylands Police Station	Upgrade lights to LED	Lighting	$2,160	$270	8.00	857	24.00%	0.60	100%RE
Noranda Infant Health Centre	Upgrade lights to LED	Lighting	$2,074	$259	8.00	844	24.00%	0.59	100%RE
Noranda Sports Club	Upgrade lights to LED	Lighting	$3,761	$470	8.00	2,001	29.25%	1.40	100%RE
Nursery Reserve	Upgrade lights to LED	Lighting	$550	$69	8.00	262	39.00%	0.18	100%RE
Olive Tree House	Upgrade lights to LED	Lighting	$2,490	$311	8.00	1,135	18.00%	0.79	100%RE
Peninsula Golf Course 1 (8001006294)	Upgrade lights to LED	Lighting	$37,123	$4,640	8.00	16,413	24.00%	11.49	100%RE
Peninsula Golf Course 2 (8001406711)	Upgrade lights to LED	Lighting	$27,046	$3,381	8.00	11,135	24.00%	7.79	100%RE
Whatley Hall	Upgrade lights to LED	Lighting	$523	$65	8.00	250	24.00%	0.17	100%RE
Matthew McVeigh - Maylands Interpretive Centre	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Jade Lewis And Friends Inc - 96	Upgrade lights to LED	Lighting	$1,210	$151	8.00	577	24.00%	0.40	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Slade Street Bayswater									
Angelhands Inc (1) - The Rise Office 1	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Angelhands Inc (6) - The Rise Office 6	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Association For The Welfare Of Migrant Families - 411 Guildford Road	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
North East Regional Training Association - T/as Morley Training Centre (NERTA)	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
WA Youth Jazz Orchestra (WAYJO) - Maylands Hall	Upgrade lights to LED	Lighting	$19,178	$2,397	8.00	9,145	24.00%	6.40	100%RE
Bayswater Morley District Cricket Club - Hillcrest Reserve	Upgrade lights to LED	Lighting	$9,219	$1,152	8.00	4,396	24.00%	3.08	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Regional Development Australia Perth Committee Inc - The Rise Office 2	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Organ Donation & Transplant Foundation Of WA - The Rise Office 5	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Russian Social Club Of WA Inc - The Rise Office 8	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Casa Mia Montessori Playgroup - Hudson St Playgroup	Upgrade lights to LED	Lighting	$2,423	$303	8.00	1,155	24.00%	0.81	100%RE
Bayswater Community Men's Shed	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Maylands Yacht Club - Bardon Park	Upgrade lights to LED	Lighting	$928	$116	8.00	442	6.00%	0.31	100%RE
Maylands Yacht Club - Maylands Jetty Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Association of United Sri Lankan Muslims of Western Australia (AUSLAMWA)	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
West Coast Model RC Inc - Moojebing Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Bayswater City Soccer Club Inc - Frank Drago Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
People & Animal Welfare Society Inc (Paws)	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Bulgarian Association Rodina Inc - Hampton Park Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Environment House Incorporated - King William St Bayswater	Upgrade lights to LED	Lighting	$2,611	$326	8.00	1,245	24.00%	0.87	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
The Australian Model Railway Association - Moojebing Reserve	Upgrade lights to LED	Lighting	$1,985	$248	8.00	947	24.00%	0.66	100%RE
Bayswater SES - Bayswater State Emergency Service (Inc)	Upgrade lights to LED	Lighting	$5,921	$740	8.00	2,824	30.00%	1.98	100%RE
Perth Bayswater Rugby Union Club - Pat O`Hara	Upgrade lights to LED	Lighting	$12,945	$1,618	8.00	6,173	24.00%	4.32	100%RE
Bedford Junior Cricket Club - Grand Promenade Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
COB Child Care Association - Roberts Street Pre-School Centre	Upgrade lights to LED	Lighting	$2,880	$360	8.00	1,373	24.00%	0.96	100%RE
Football West - Gibbney Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Interchange Inc - aka Olive Tree House	Upgrade lights to LED	Lighting	$3,079	$385	8.00	1,468	24.00%	1.03	100%RE
COB Child Care Association - Richard Street	Upgrade lights to LED	Lighting	$2,416	$302	8.00	1,152	24.00%	0.81	100%RE
Bayswater Paddlesports Club - Hinds Reserve Boat Shed Bay 5	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Morley Sporting Club Incorporated - RA Cook Pavilion	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Department of Education - Inglewood Kindergarten Centre	Upgrade lights to LED	Lighting	$5,108	$639	8.00	2,436	24.00%	1.71	100%RE
1st Bayswater Sea Scouts Group - Hinds Reserve	Upgrade lights to LED	Lighting	$1,538	$192	8.00	733	18.00%	0.51	100%RE
Bayswater Organisation Loan of Toys	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Bedford Bowling Club -	Upgrade lights to LED	Lighting	$15,895	$1,987	8.00	7,580	24.00%	5.31	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Grand Prom Reserve									
COB Child Care Association - Noranda Child Care Centre	Upgrade lights to LED	Lighting	$1,495	$187	8.00	713	24.00%	0.50	100%RE
ED Connect - Unit 4 The Rise	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
EdConnect Unit 3	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Western Australian Rogaining Association - Hampton Park Reserve	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
ECHO Community Services, Brand Place	Upgrade lights to LED	Lighting	$1,268	$159	8.00	605	24.00%	0.42	100%RE
Bayswater Lacrosse Club - Halliday Park	Upgrade lights to LED	Lighting	$7,226	$903	8.00	3,446	24.00%	2.41	100%RE
West Australian Ballet Inc - 134 Whatley Crescent, Maylands	Upgrade lights to LED	Lighting	$5,138	$642	8.00	2,450	24.00%	1.71	100%RE
Minister of Education -	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Noranda Primary School - Deschamp Reserve Noranda									
Rowing WA - Hinds Reserve	Upgrade lights to LED	Lighting	$1,267	$158	8.00	604	12.00%	0.42	100%RE
Bayswater Childcare Assoc Inc - Derrick Ernst Neighbourhood Centre (Tara)	Upgrade lights to LED	Lighting	$6,796	$850	8.00	3,241	24.00%	2.27	100%RE
Morley Windmills Club Inc - Wotton Reserve	Upgrade lights to LED	Lighting	$3,586	$448	8.00	1,710	6.00%	1.20	100%RE
Chabad Lubavitch Of Western Australia - Garson Court	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Morley Eagles Baseball Club - Crimea Park	Upgrade lights to LED	Lighting	$5,357	$670	8.00	2,555	24.00%	1.79	100%RE
Bayswater Senior Citizens 1 (8001490084)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$5,146	$343	15.00	1,500	5.80%	1.05	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Civic Centre and Council Chambers	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$351,832	$23,455	15.00	113,023	16.88%	79.12	100%RE
Depot and Dog Pound	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$82,697	$5,513	15.00	16,280	18.00%	11.40	100%RE
Drill Hall	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$12,492	$833	15.00	3,365	7.63%	2.36	100%RE
Les Hansman Community Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$72,160	$4,811	15.00	16,076	22.80%	11.25	100%RE
Maylands Sports and Recreation Club 2 (8001226410)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,150	$477	15.00	2,802	11.60%	1.96	100%RE
Maylands Sports and Recreation Club 1 (8001560804)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$19,793	$1,320	15.00	5,768	23.20%	4.04	100%RE
Morley Noranda Recreation Club incl of Netball	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$190,485	$12,699	15.00	42,116	20.00%	29.48	100%RE
The RISE	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$321,158	$21,411	15.00	66,873	13.50%	46.81	100%RE
Bayswater Bowling and Recreation Club	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$40,228	$2,682	15.00	10,231	23.20%	7.16	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
(Frank Drago Reserve)									
Morley Sport & Recreation	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$63,781	$4,252	15.00	16,221	6.00%	11.35	100%RE
Roxy Lane Theatre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,667	$311	15.00	1,176	15.00%	0.82	100%RE
Bayswater Activity Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,377	$492	15.00	1,803	20.00%	1.26	100%RE
Bayswater Library	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$34,640	$2,309	15.00	7,373	17.40%	5.16	100%RE
Bayswater Morley Youth Club	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$25,841	$1,723	15.00	7,859	20.00%	5.50	100%RE
Bayswater Senior Citizens 2 (8001995588)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$21,558	$1,437	15.00	6,386	15.00%	4.47	100%RE
Beaufort Park Scout Hall	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,681	$579	15.00	2,619	15.00%	1.83	100%RE
Carrama Community Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,109	$474	15.00	1,714	20.00%	1.20	100%RE
Elderly Community Help	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,503	$300	15.00	1,309	5.00%	0.92	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Organisation (ECHO)									
Ellis House	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$1,541	$103	15.00	368	10.00%	0.26	100%RE
Embleton Pre-School and Child Health Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,885	$192	15.00	601	20.00%	0.42	100%RE
Filipino Assoc	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$5,384	$359	15.00	1,326	20.00%	0.93	100%RE
Halliday House	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$1,460	$97	15.00	244	20.00%	0.17	100%RE
Hampton Scout Hall	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,676	$245	15.00	765	20.00%	0.54	100%RE
Hampton Square Pre School and Child Health	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,888	$193	15.00	567	20.00%	0.40	100%RE
Hillcrest Pre School	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$24,970	$1,665	15.00	4,934	10.00%	3.45	100%RE
Kindergarten	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$228	$15	15.00	41	20.00%	0.03	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Maylands Library	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$28,683	$1,912	15.00	5,783	20.00%	4.05	100%RE
Maylands Police Station	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$844	$56	15.00	178	5.00%	0.12	100%RE
Noranda Infant Health Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,241	$216	15.00	703	20.00%	0.49	100%RE
Noranda Sports Club	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$362	$24	15.00	103	1.50%	0.07	100%RE
Olive Tree House	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,594	$173	15.00	630	10.00%	0.44	100%RE
Peninsula Golf Course 1 (8001006294)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$5,800	$387	15.00	1,368	2.00%	0.96	100%RE
Peninsula Golf Course 2 (8001406711)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,226	$282	15.00	928	2.00%	0.65	100%RE
Whatley Hall	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$613	$41	15.00	156	15.00%	0.11	100%RE
Matthew McVeigh - Maylands Interpretive Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Jade Lewis And Friends Inc - 96 Slade Street Bayswater	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$1,418	$95	15.00	361	15.00%	0.25	100%RE
Angelhands Inc (1) - The Rise Office 1	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
Angelhands Inc (6) - The Rise Office 6	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
North East Regional Training Association - T/as Morley Training Centre (NERTA)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
WA Youth Jazz Orchestra (WAYJO) - Maylands Hall	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$29,966	$1,998	15.00	7,621	20.00%	5.33	100%RE
Bayswater Morley District Cricket Club - Hillcrest Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$14,404	$960	15.00	3,663	20.00%	2.56	100%RE
Regional Development Australia Perth Committee Inc -	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
The Rise Office 2									
Arena Arts - Roxy Theatre - 55 Ninth Ave, Maylands	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,158	$477	15.00	1,820	20.00%	1.27	100%RE
Organ Donation & Transplant Foundation Of WA - The Rise Office 5	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
Russian Social Club Of WA Inc - The Rise Office 8	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
1st Morley Scouts Group - Pat O`Hara	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,208	$147	15.00	562	20.00%	0.39	100%RE
Casa Mia Montessori Playgroup - Hudson St Playgroup	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,786	$252	15.00	963	20.00%	0.67	100%RE
Bayswater Community Men's Shed	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Maylands Yacht Club - Bardon Park	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,348	$290	15.00	1,106	15.00%	0.77	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Association of United Sri Lankan Muslims of Western Australia (AUSLAMWA)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,185	$279	15.00	1,064	10.00%	0.75	100%RE
West Coast Model RC Inc - Moojebing Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Bayswater City Soccer Club Inc - Frank Drago Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Bayswater Croquet Club Incorporated - Frank Drago Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,093	$140	15.00	532	5.00%	0.37	100%RE
Bayswater Waves Cafe	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,093	$140	15.00	532	5.00%	0.37	100%RE
Bulgarian Association Rodina Inc - Hampton Park Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
1st Hampton Park Scouts Group - Hampton Park Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,746	$183	15.00	698	10.00%	0.49	100%RE
Environment House Incorporated - King William St Bayswater	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,080	$272	15.00	1,038	20.00%	0.73	100%RE
The Australian Model Railway Association - Moojebing Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,102	$207	15.00	789	20.00%	0.55	100%RE
Bayswater SES - Bayswater State Emergency Service (Inc) (Ses)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$740	$49	15.00	188	2.00%	0.13	100%RE
Perth Bayswater Rugby Union Club - Pat O`Hara	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$20,227	$1,348	15.00	5,144	20.00%	3.60	100%RE
Bedford Junior Cricket Club - Grand	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE

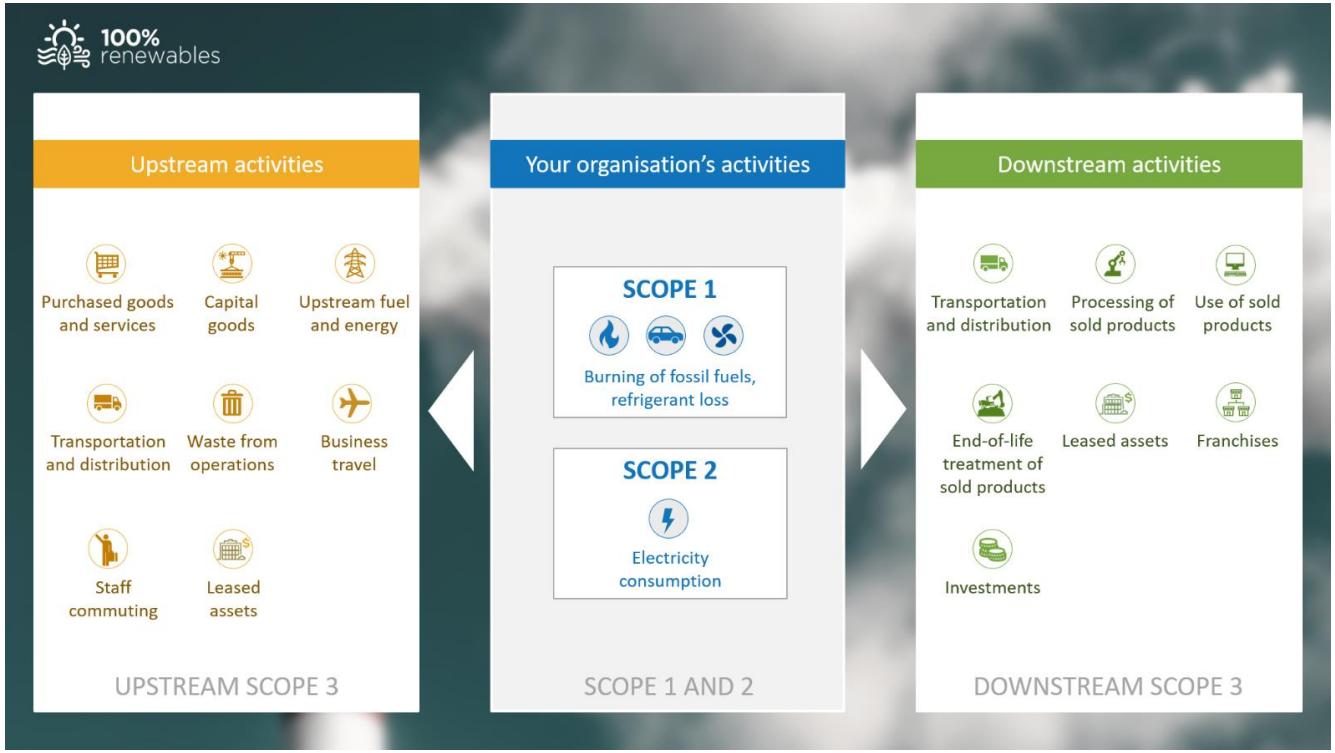
Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Promenade Reserve									
COB Child Care Association - Roberts Street Pre-School Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$4,499	$300	15.00	1,144	20.00%	0.80	100%RE
Football West - Gibbney Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
COB Child Care Association - Silverwood Child Care Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,093	$140	15.00	532	5.00%	0.37	100%RE
Interchange Inc - aka Olive Tree House	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,405	$160	15.00	612	10.00%	0.43	100%RE
COB Child Care Association - Richard Street	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,775	$252	15.00	960	20.00%	0.67	100%RE
Morley Sporting Club Incorporated - RA Cook Pavilion	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Department of Education - Inglewood	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,981	$532	15.00	2,030	20.00%	1.42	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
Kindergarten Centre									
1st Bayswater Sea Scouts Group - Hinds Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$3,204	$214	15.00	815	20.00%	0.57	100%RE
Bayswater Organisation Loan of Toys	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Bedford Bowling Club - Grand Prom Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$18,628	$1,242	15.00	4,737	15.00%	3.32	100%RE
COB Child Care Association - Noranda Child Care Centre	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$2,337	$156	15.00	594	20.00%	0.42	100%RE
ED Connect - Unit 4 The Rise	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
EdConnect Unit 3	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
ECHO Community Services, Brand Place	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$1,982	$132	15.00	504	20.00%	0.35	100%RE
Bayswater Lacrosse Club - Halliday Park	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$5,645	$376	15.00	1,436	10.00%	1.00	100%RE

Site	Description	Category	Capital cost	Cost savings	Payback (years)	Resource savings (kWh)	% energy saving	Emissions reduction (t CO_2-e)	Source
West Australian Ballet Inc - 134 Whatley Crescent, Maylands	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,028	$535	15.00	2,042	20.00%	1.43	100%RE
Minister of Education - Noranda Primary School - Deschamp Reserve Noranda	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$6,278	$419	15.00	1,597	15.00%	1.12	100%RE
Bayswater Childcare Assoc Inc - Derrick Ernst Neighbourhood Centre (Tara)	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$7,964	$531	15.00	2,025	15.00%	1.42	100%RE
Morley Windmills Club Inc - Wotton Reserve	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$11,207	$747	15.00	2,850	10.00%	2.00	100%RE
Morley Eagles Baseball Club - Crimea Park	Upgrade old HVAC system to new and efficient HVAC system with smart controls	HVAC	$8,371	$558	15.00	2,129	20.00%	1.49	100%RE
Sub-total			**$8,287,891**	**$1,035,743**	**8.0**	**4,231,493 kWh 306 GJ 50 kW**	**39%**	**2,979.1**	

Appendix B: Description of scope 3 emission categories

As per the GHG Protocol[39], there are 15 categories of upstream and downstream scope 3 emission sources (also called supply chain emissions), as shown in the graphic below, which are additional to scope and scope 2 emissions consumed by an organisation in their premises. Most commonly, organisations report energy-related scope 1, 2 and 3 emissions only. The categories shown below are further detailed in Table 20, which sets out the minimum and optional boundaries for accounting for the scope 1 and scope 2 emissions of up- and downstream activities in the City's scope 3 carbon footprint.



[39] GHG Protocol: Technical Guidance for Calculating Scope 3 Emissions

TABLE 20: CATEGORIES OF SUPPLY CHAIN EMISSIONS

#	Category name	Category description	Minimum boundary
1	**Purchased goods and services**	Extraction, production, and transportation of goods and services purchased or acquired by the reporting company in the reporting year, not otherwise included in Category 2	All upstream (cradle-to-gate) emissions of purchased goods and services
2	**Capital goods**	Extraction, production, and transportation of capital goods purchased or acquired by the reporting company in the reporting year	All upstream (cradle-to-gate) emissions of purchased capital goods
3	**Fuel- and energy-related activities (not included in scope 1 or scope 2)**	Extraction, production, and transportation of fuels and energy purchased or acquired by the reporting company in the reporting year, not already accounted for in scope 1 or scope 2, including: a. Upstream emissions of purchased fuels (extraction, production, and transportation of fuels consumed by the reporting company) b. Upstream emissions of purchased electricity (extraction, production, and transportation of fuels consumed in the generation of electricity, steam, heating, and cooling consumed by the reporting company) c. Transmission and distribution (T&D) losses (generation of electricity, steam, heating and cooling that is consumed (i.e., lost) in a T&D system) – reported by end user d. Generation of purchased electricity that is sold to end users (generation of electricity, steam, heating, and cooling that is purchased by the reporting company and sold to end	a) For upstream emissions of purchased fuels: All upstream (cradle-to-gate) emissions of purchased fuels (from raw material extraction up to the point of, but excluding combustion) b) For upstream emissions of purchased electricity: All upstream (cradle-to-gate) emissions of purchased fuels (from raw material extraction up to the point of, but excluding, combustion by a power generator) c) For T&D losses: All upstream (cradle-to-gate) emissions of energy consumed in a T&D system, including emissions from combustion d) For generation of purchased electricity that is sold to end users: Emissions from the generation of purchased energy

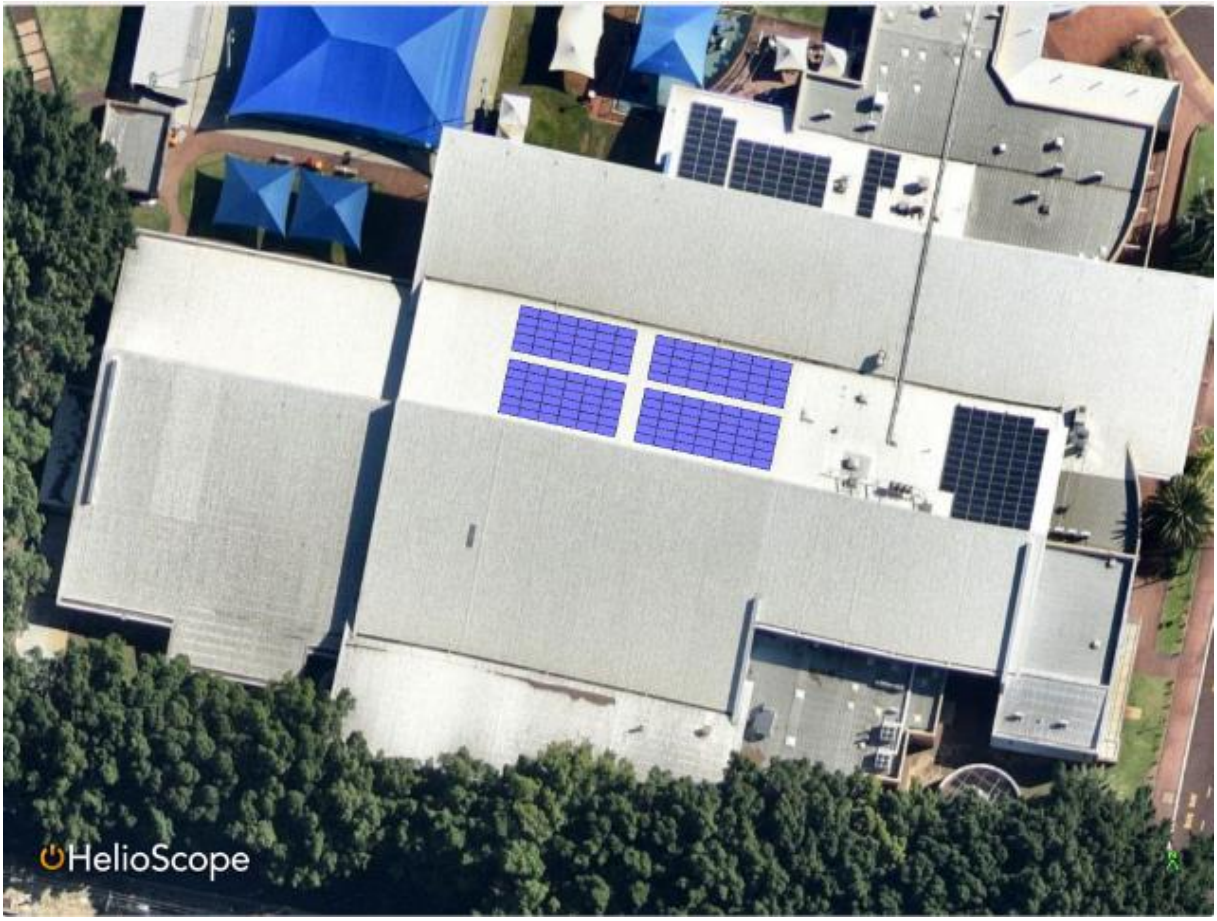
#	Category name	Category description	Minimum boundary
		users) – reported by utility company or energy retailer only	
4	**Upstream transportation and distribution**	Transportation and distribution of products purchased by the reporting company in the reporting year between a company's tier 1 suppliers and its own operations (in vehicles and facilities not owned or controlled by the reporting company) Transportation and distribution services purchased by the reporting company in the reporting year, including inbound logistics, outbound logistics (e.g., of sold products), and transportation and distribution between a company's own facilities (in vehicles and facilities not owned or controlled by the reporting company)	The scope 1 and scope 2 emissions of transportation and distribution providers that occur during use of vehicles and facilities (e.g., from energy use) *Optional:* The life cycle emissions associated with manufacturing vehicles, facilities, or infrastructure
5	**Waste generated in operations**	Disposal and treatment of waste generated in the reporting company's operations in the reporting year (in facilities not owned or controlled by the reporting company)	The scope 1 and scope 2 emissions of waste management suppliers that occur during disposal or treatment *Optional:* Emissions from transportation of waste
6	**Business travel**	Transportation of employees for business-related activities during the reporting year (in vehicles not owned or operated by the reporting company)	The scope 1 and scope 2 emissions of transportation carriers that occur during use of vehicles (e.g., from energy use) *Optional:* The life cycle emissions associated with manufacturing vehicles or infrastructure
7	**Employee commuting**	Transportation of employees between their homes and their worksites during the reporting year (in vehicles not owned or operated by the reporting company)	The scope 1 and scope 2 emissions of employees and transportation providers that occur during use of vehicles (e.g., from energy use) *Optional:* Emissions from employee teleworking

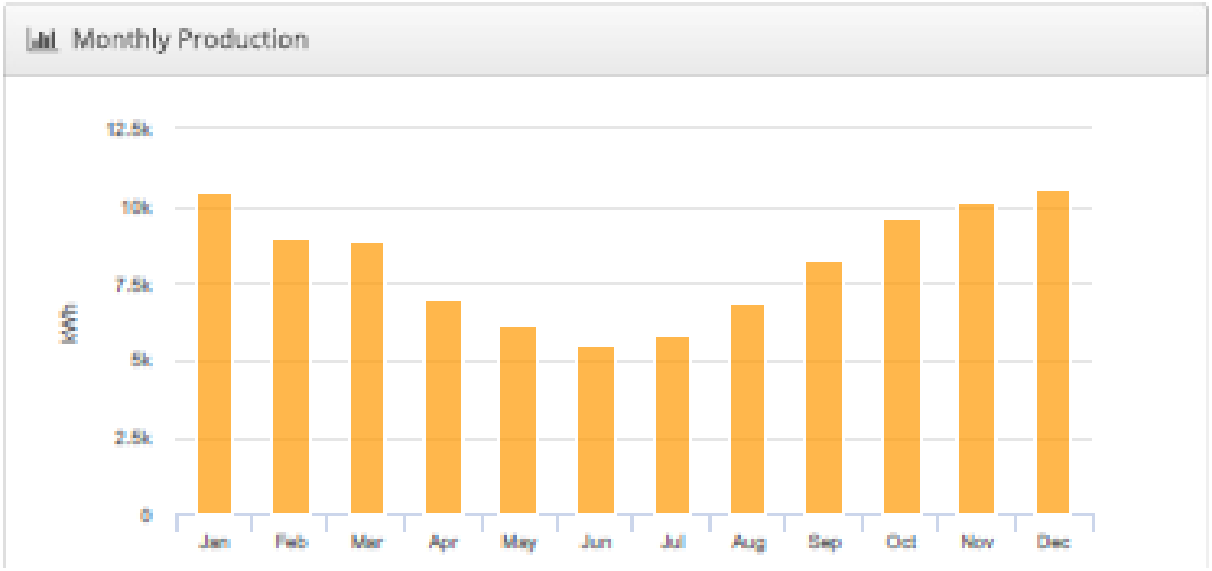
#	Category name	Category description	Minimum boundary
8	**Upstream leased assets**	Operation of assets leased by the reporting company (lessee) in the reporting year and not included in scope 1 and scope 2 – reported by lessee	The scope 1 and scope 2 emissions of lessors that occur during the reporting company's operation of leased assets (e.g., from energy use) *Optional:* The life cycle emissions associated with manufacturing or constructing leased assets
9	**Downstream transportation and distribution**	Transportation and distribution of products sold by the reporting company in the reporting year between the reporting company's operations and the end consumer (if not paid for by the reporting company), including retail and storage (in vehicles and facilities not owned or controlled by the reporting company)	The scope 1 and scope 2 emissions of transportation providers, distributors, and retailers that occur during use of vehicles and facilities (e.g., from energy use) *Optional:* The life cycle emissions associated with manufacturing vehicles, facilities, or infrastructure
10	**Processing of sold products**	Processing of intermediate products sold in the reporting year by downstream companies (e.g., manufacturers)	The scope 1 and scope 2 emissions of downstream companies that occur during processing (e.g., from energy use)
11	**Use of sold products**	End use of goods and services sold by the reporting company in the reporting year	The direct use-phase emissions of sold products over their expected lifetime (i.e., the scope 1 and scope 2 emissions of end users that occur from the use of: products that directly consume energy (fuels or electricity) during use; fuels and feedstocks; and GHGs and products that contain or form GHGs that are emitted during use) *Optional:* The indirect use-phase emissions of sold products over their expected lifetime (i.e., emissions from the use of products that indirectly consume energy (fuels or electricity) during use)

#	Category name	Category description	Minimum boundary
12	**End-of-life treatment of sold products**	Waste disposal and treatment of products sold by the reporting company (in the reporting year) at the end of their life	The scope 1 and scope 2 emissions of waste management companies that occur during disposal or treatment of sold products
13	**Downstream leased assets**	Operation of assets owned by the reporting company (lessor) and leased to other entities in the reporting year, not included in scope 1 and scope 2 – reported by lessor	The scope 1 and scope 2 emissions of lessees that occur during operation of leased assets (e.g., from energy use). *Optional:* The life cycle emissions associated with manufacturing or constructing leased assets
14	**Franchises**	Operation of franchises in the reporting year, not included in scope 1 and scope 2 – reported by franchisor	The scope 1 and scope 2 emissions of franchisees that occur during operation of franchises (e.g., from energy use) *Optional:* The life cycle emissions associated with manufacturing or constructing franchises
15	**Investments**	Operation of investments (including equity and debt investments and project finance) in the reporting year, not included in scope 1 or scope 2	Required: • Equity investments • Debt investments with known use of proceeds • Project finance Optional: • Managed investments and client services • Debt investments without known use of proceeds • Other investments or financial services

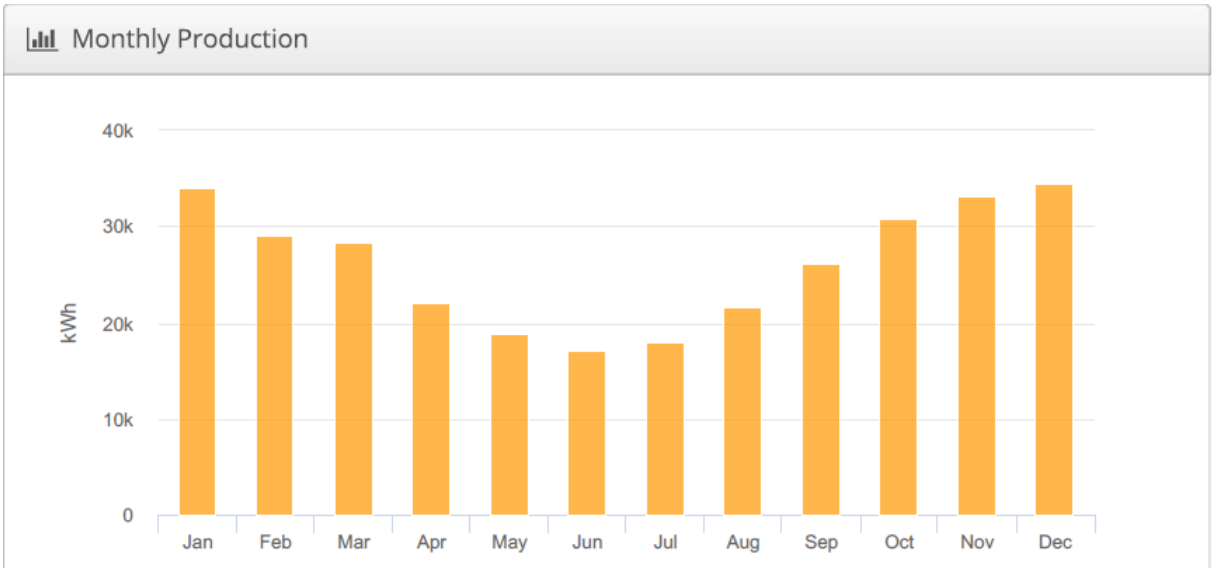
Appendix C: Solar PV Helioscope reports

Bayswater Waves – 60 kW

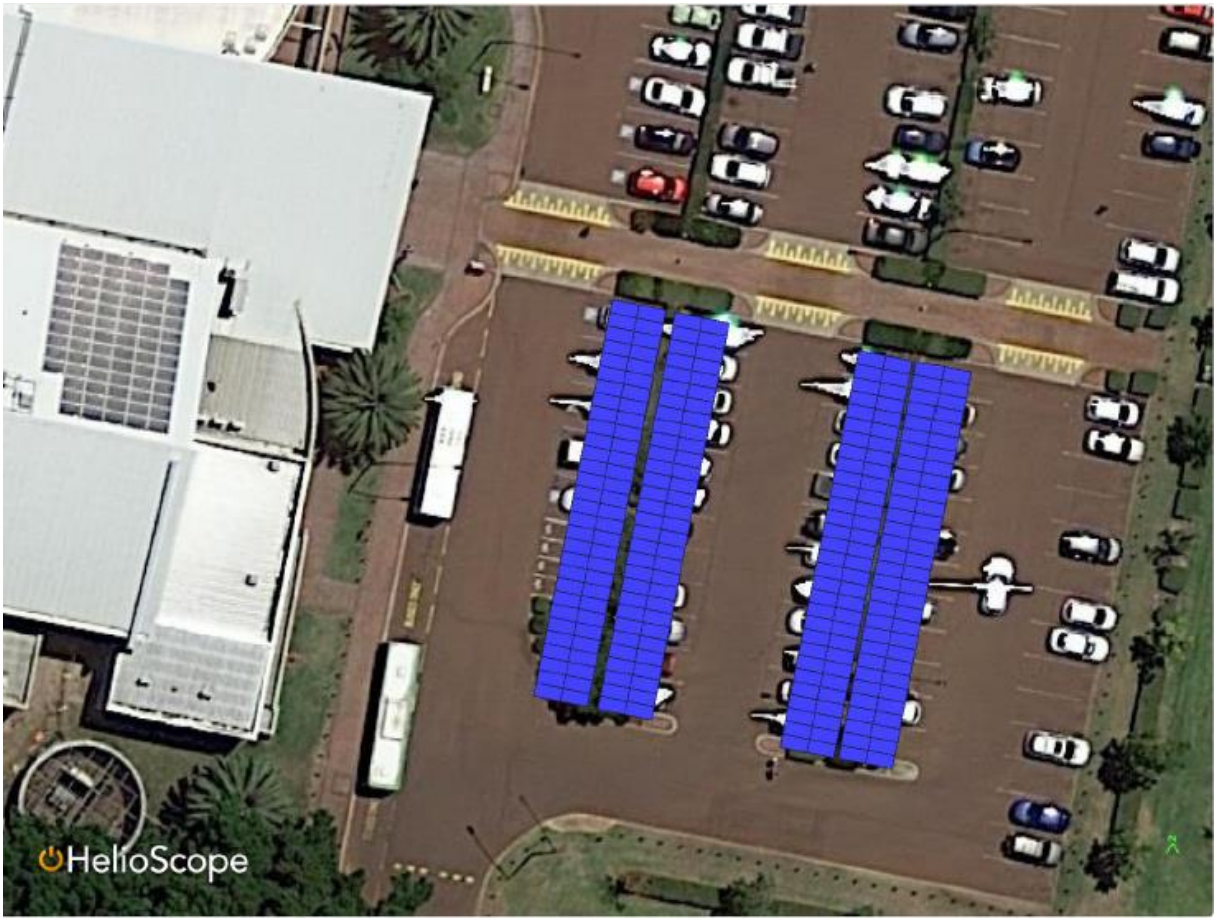


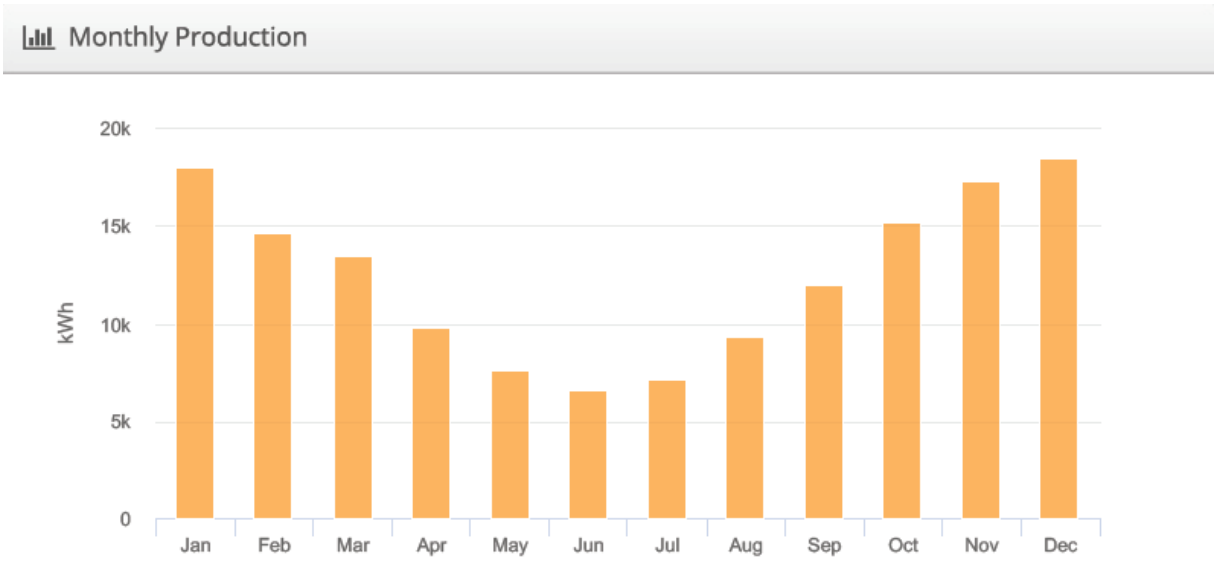


Bayswater Waves – maximum rooftop solar

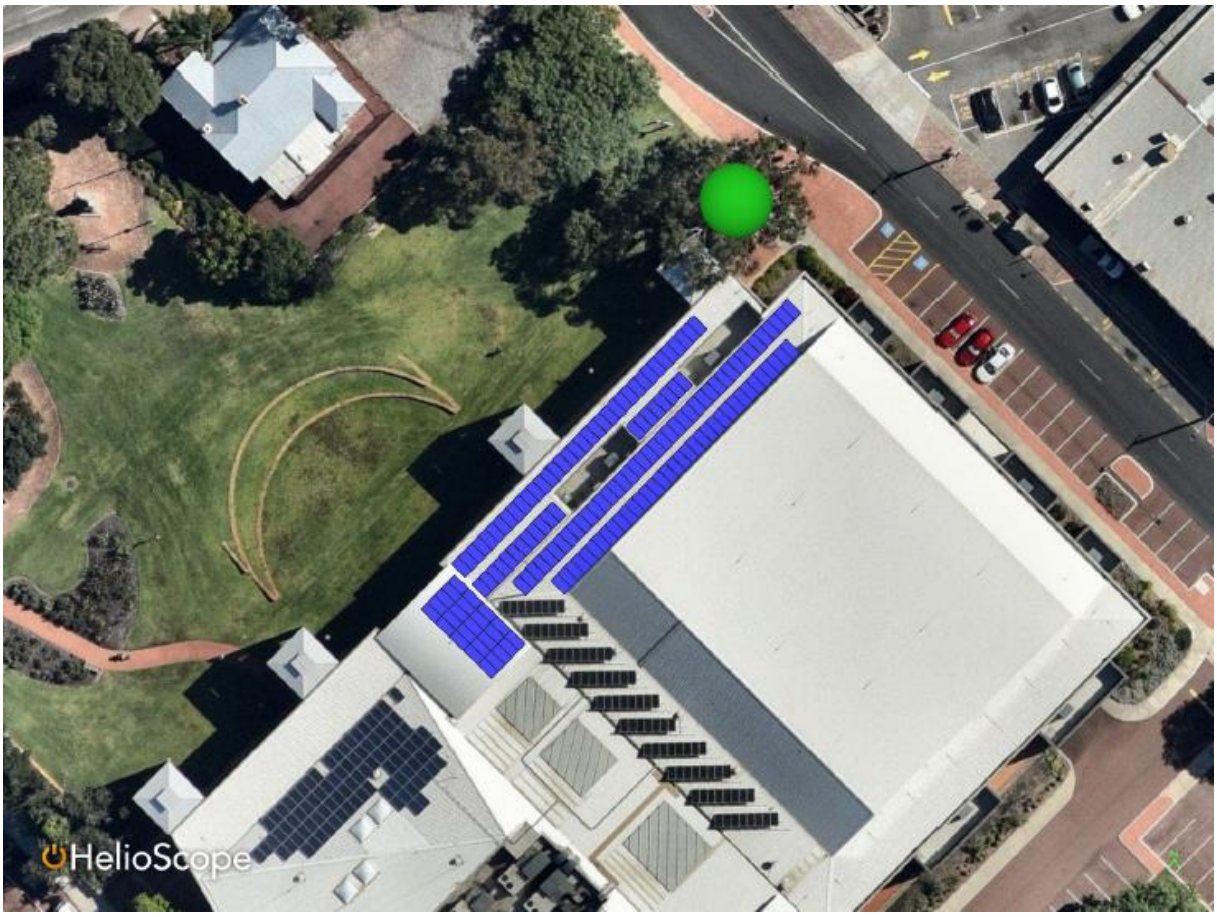


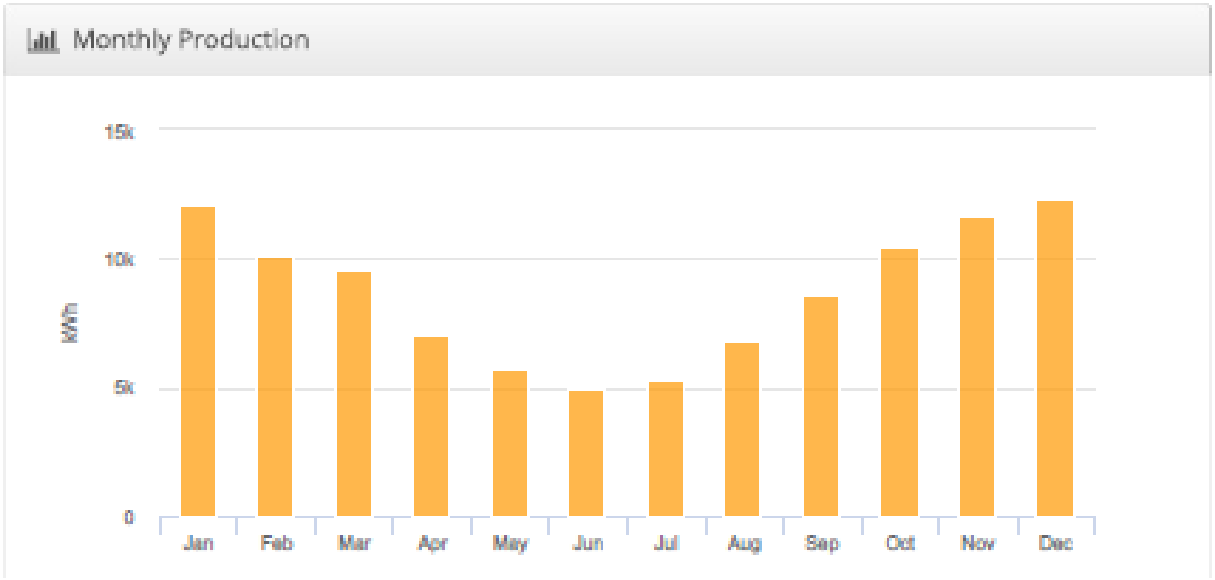
Bayswater Waves – 100 kW carport solar



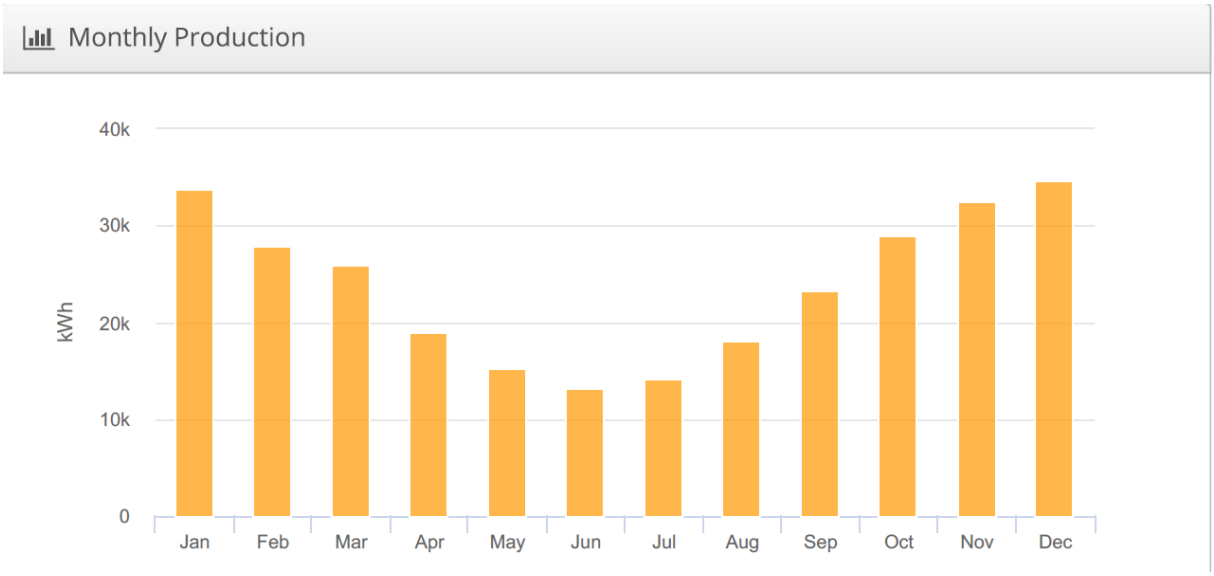


The RISE – 65 kW

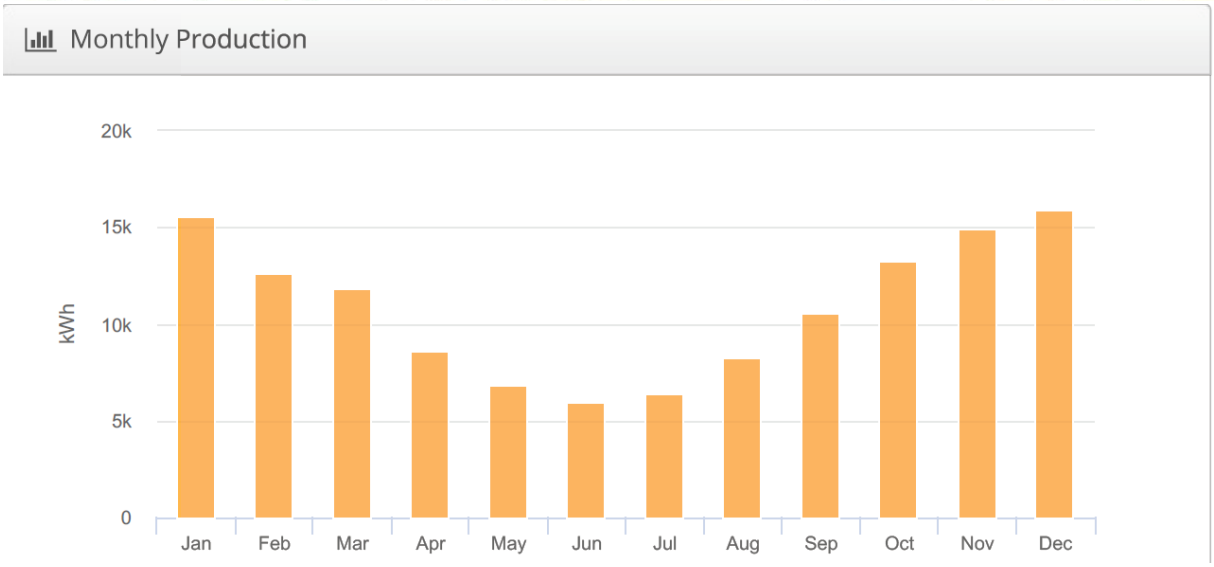




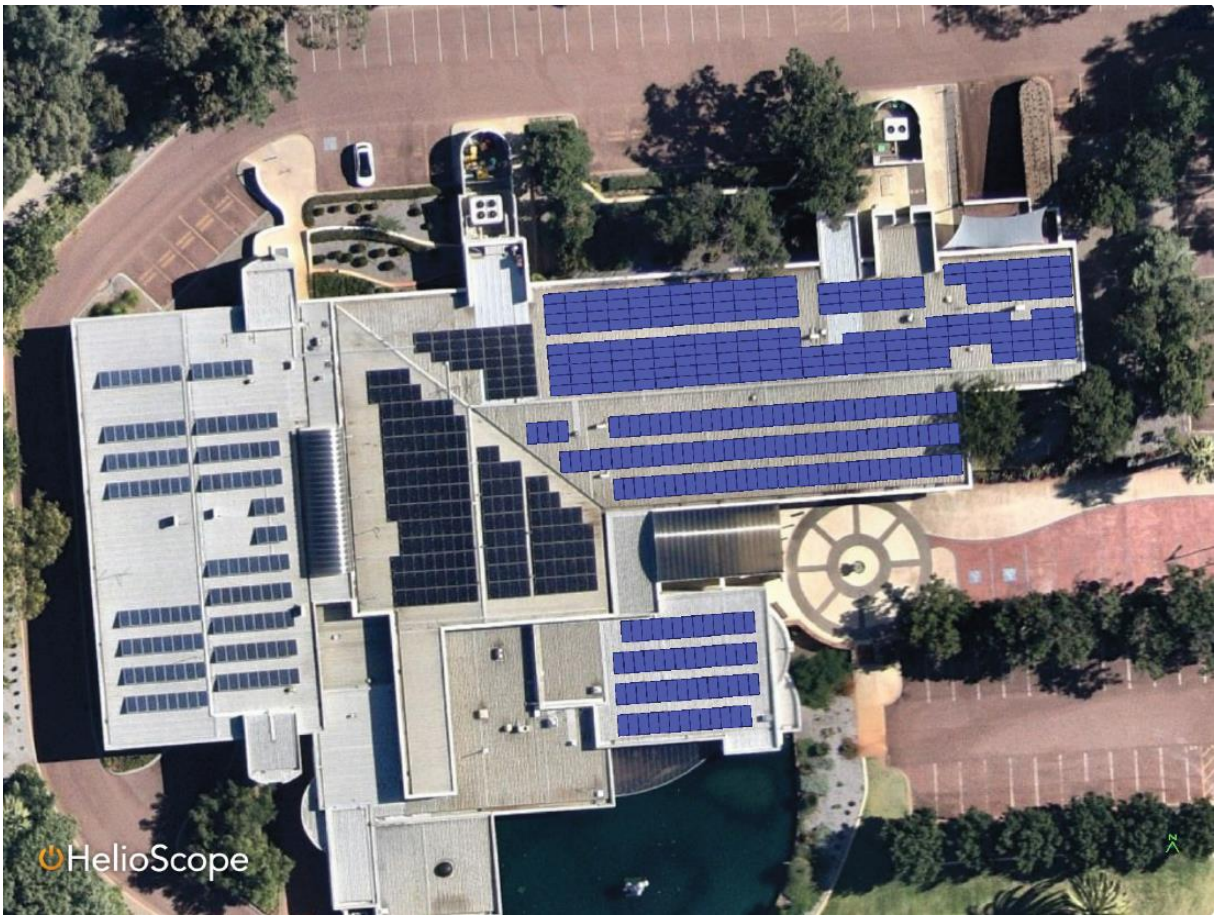
The RISE – maximum rooftop solar

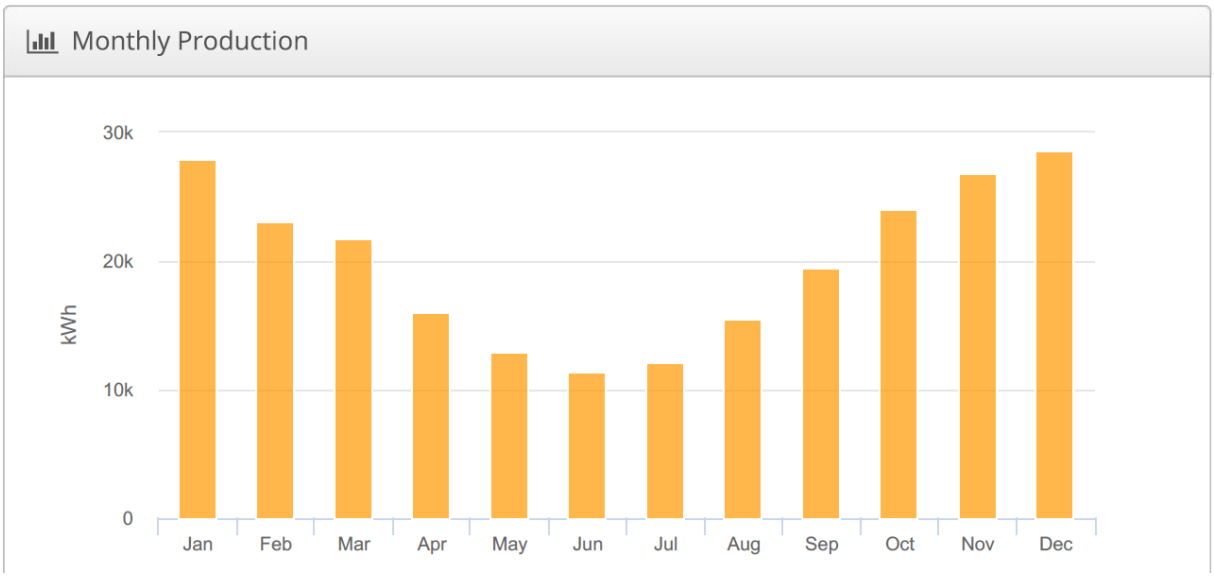


The RISE – 87 kW carport solar

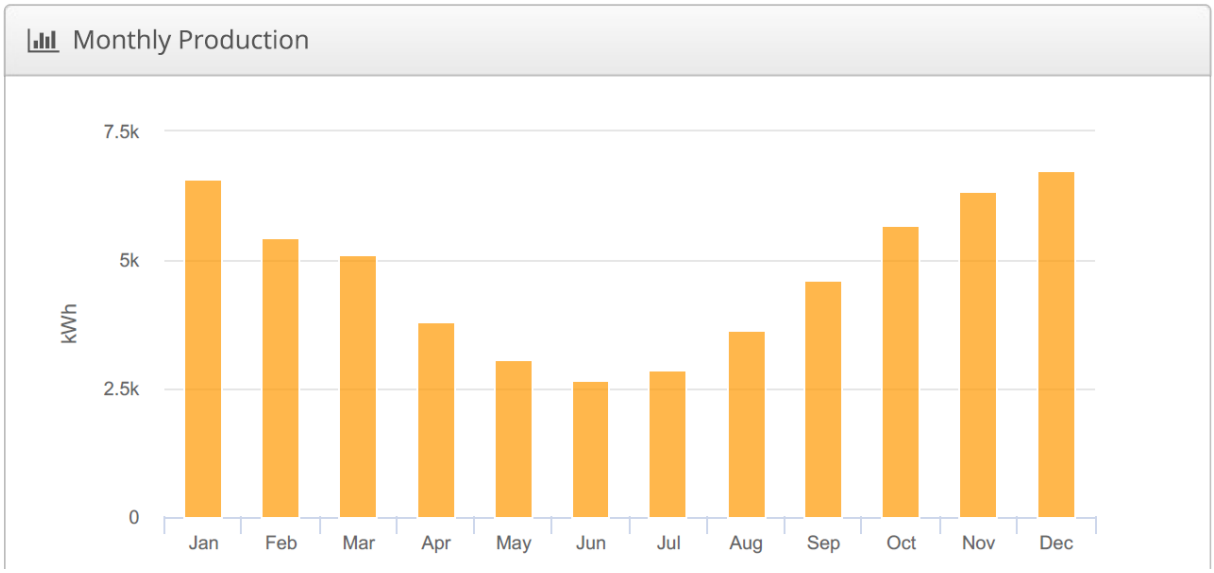


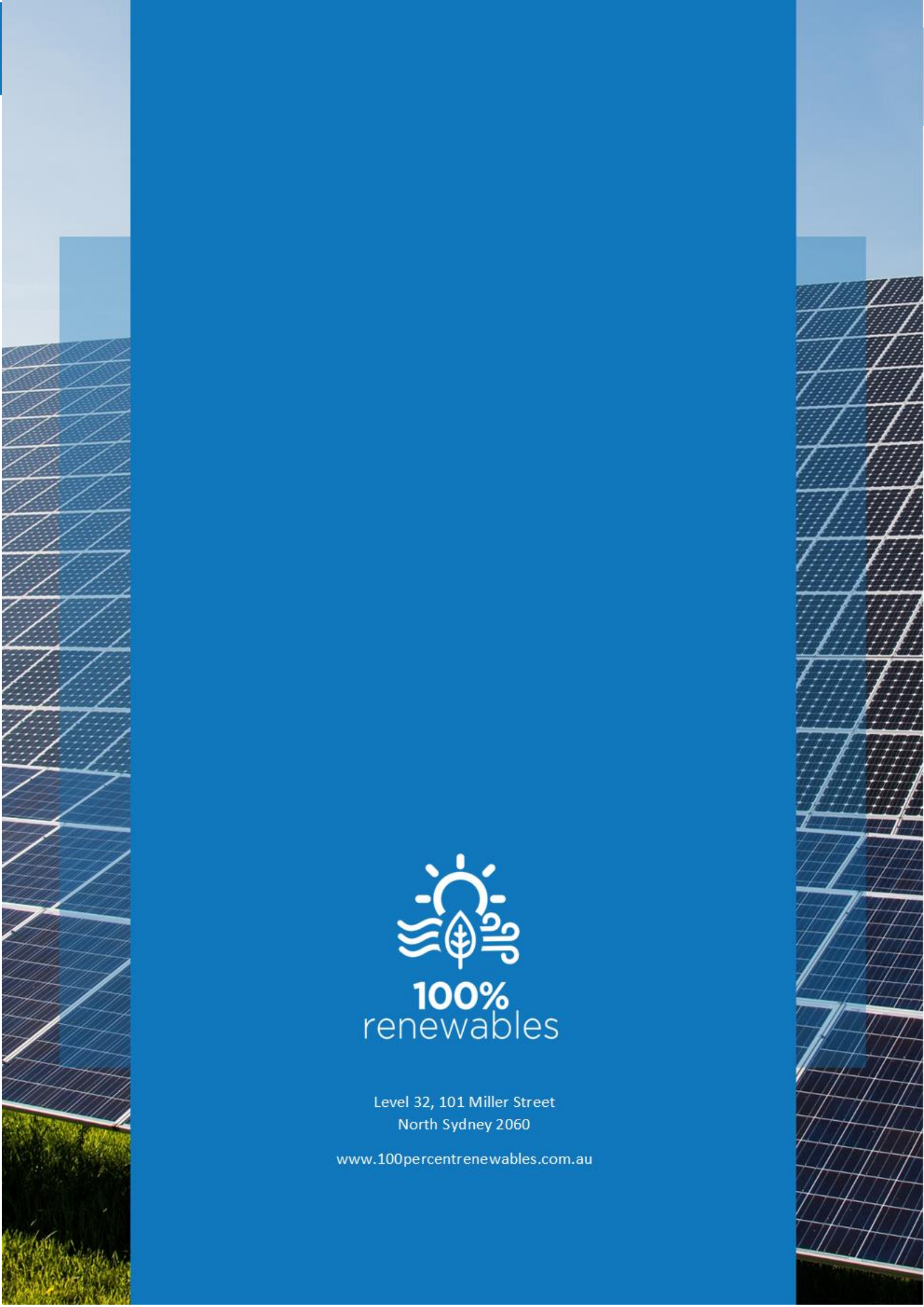
Civic Centre – maximum rooftop solar





Civic Centre – 36 kW carport solar





100% renewables

Level 32, 101 Miller Street
North Sydney 2060

www.100percentrenewables.com.au