

Mount Barker District Council

Corporate Energy & Emissions Reduction Plan

Pathway Towards Net Zero Emissions



MOUNT BARKER
DISTRICT COUNCIL

Document Control

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This Corporate Energy and Emissions Reduction Plan has been prepared by dsquared Consulting on behalf of Mount Barker District Council.

About dsquared

Our Vision is to think beyond the square.

Our Mission is to create spaces, places, and communities that are positive for both the environment and for people. We will do this by providing our clients with sustainable and bespoke solutions that are innovative, challenge perceived ideas, and push the boundaries of achievement and excellence.

We confirm that all work has been undertaken in accordance with our ISO 9001 accredited quality management system.

Acknowledgement of country

The dsquared team wish to acknowledge the Traditional Custodians of all country throughout Australia, and their cultural, spiritual, physical, and emotional connection with their land, waters, and community. We pay our respects to all Elders past, present, and emerging.



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Executive summary

This Corporate Energy & Emissions Reduction Plan (the Plan) provides Mount Barker District Council (Council) with a planned approach to reducing emissions, and incorporates an implementation plan that balances environmental, social, and financial outcomes. Information in this plan includes Council’s greenhouse gas (GHG) emissions for its corporate operations, emission reduction initiatives to work towards net zero emissions, and financial assessments of the proposed initiatives to inform future budgets and strategic planning.

Mount Barker District Council has been demonstrating leadership in sustainability and managing emissions for many years including developing an emissions inventory, implementing emissions reduction initiatives, and supporting the community in reducing environmental impacts. This Plan has been developed to continue this journey and set a plan to reduce greenhouse gas (GHG) emissions for Council’s corporate emissions and work towards net zero emissions in line with Australian and international commitments under the Paris Agreement.

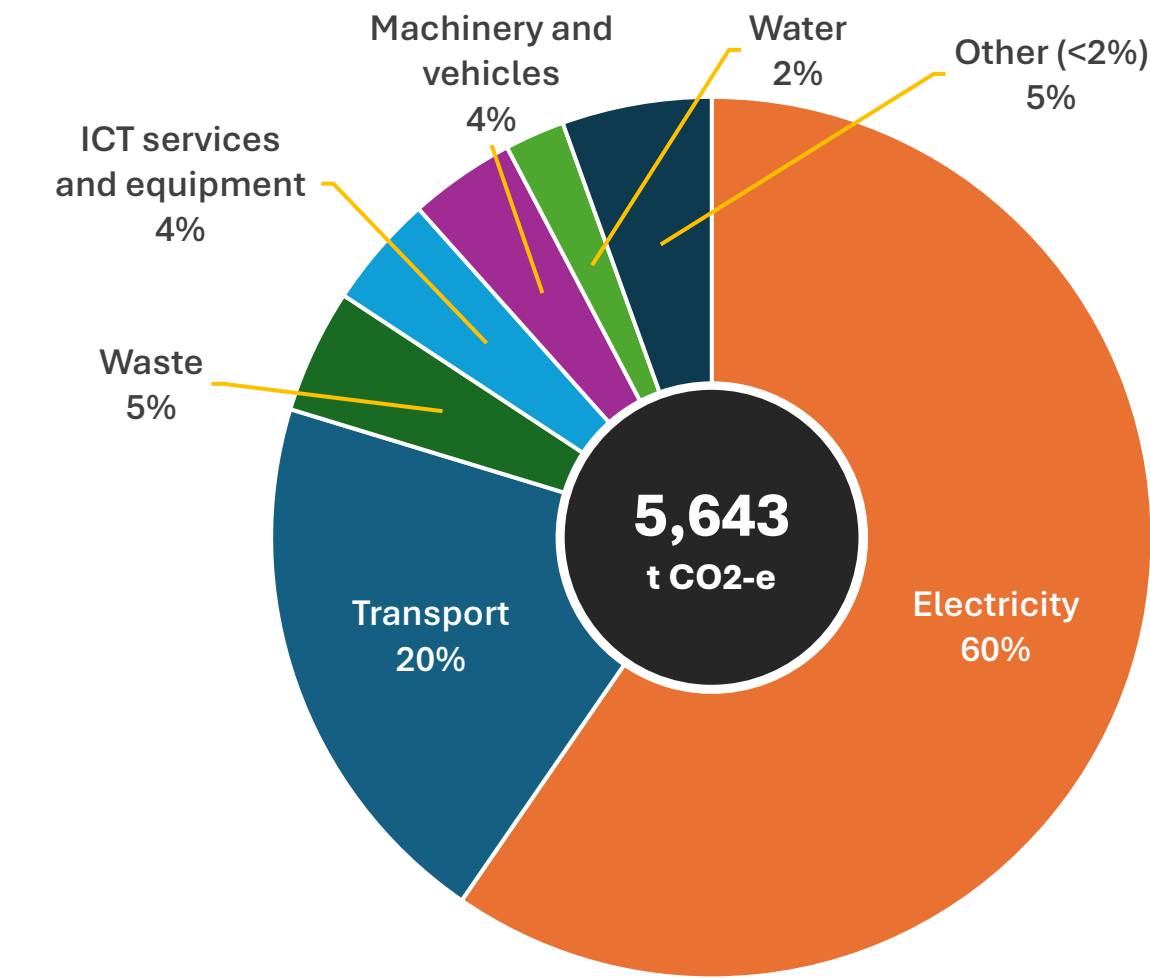
Scope

The scope of the plan is Mount Barker District Council’s corporate operations which are in direct control of the Council. However, where the Council can implement initiatives and programs that support the community to reduce emissions, these opportunities have also been identified to ensure the Council is considering a holistic approach to transitioning to net zero emissions.

Emissions inventory

Council’s previous emissions inventories included electricity use in buildings and facilities, streetlighting electricity consumption, and fleet fuel use. The FY23 emissions inventory has been updated and expanded to include additional emissions sources to align with current reporting standards including the GHG Protocol and Climate Active Carbon Neutral standards. This also aligns with the Local Government Net Zero Accelerate Program of which Council is a participant.

The emissions inventory includes Scope 1, 2, and 3 emissions categories in Council’s direct corporate control and totals 5,643 tCO₂-e (refer adjacent). Scope 1, 2, and 3 emissions are categorised as follows, with Scope 2 emissions currently the largest source of emissions.

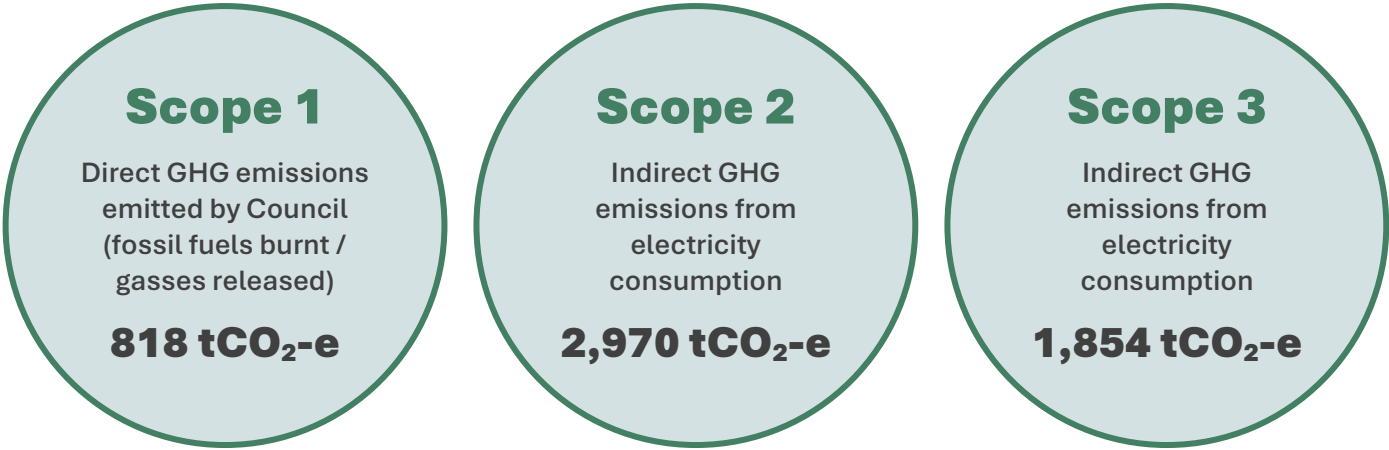


FY23 emissions inventory

Top 5 emissions

Council’s top 5 emissions sources are:

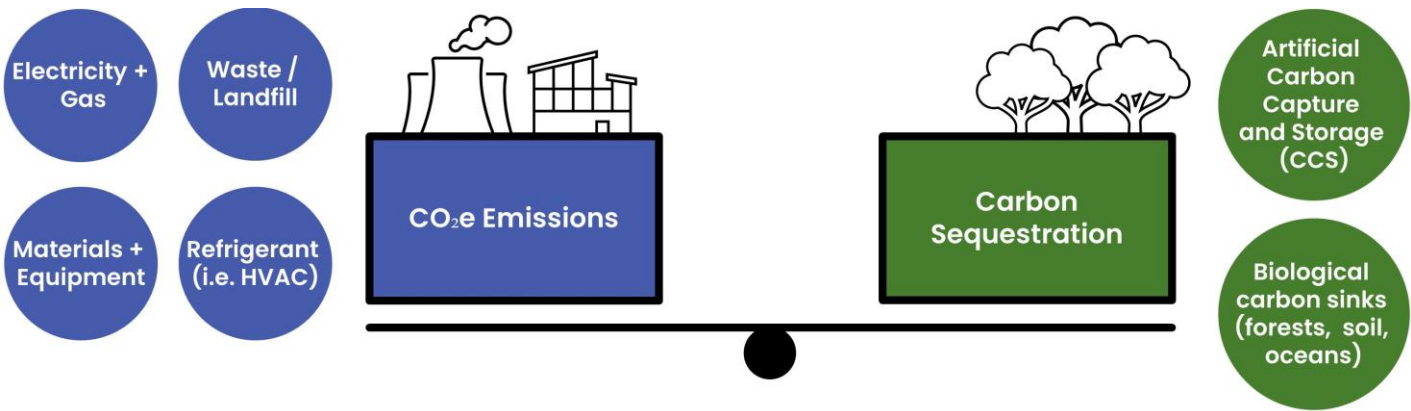
Energy	Transport	Waste	Water	Supply chain
Electricity and natural gas for buildings, facilities, and streetlights.	Fuel used in fleet vehicles, and emissions from purchasing vehicles and machinery.	Waste to landfill and associated methane emissions.	Water supply and associated emissions for water treatment and pumping.	Emissions associated with products, good, and services Council purchase.



What is net zero emissions

This Plan has been developed to set a pathway to net zero emissions in line with the following definition:

“net zero means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphereⁱ”



Due to Scope 3 emissions being included in Council’s emissions inventory, until Council’s supply chain reduces their own emissions there will be emissions sources that Council is unable to reduce to zero without the use of carbon sequestration and or carbon offsets. As a result, this Plan has identified initiatives that will reduce emissions as close to zero as possible and has set reduction priorities and targets to 2035 as an interim target.

As Australia and the broader economy decarbonises, it is recommended that Council reviews its progression against the targets identified in this Plan and considers opportunities to reduce emissions to zero prior to 2050 in alignment with the Paris Agreement.

Emissions priorities

Emissions projections to 2035 have been developed to understand future emissions under a business-as-usual pathway based on Australian Government projections. This includes increasing renewable energy generation, improvements in energy and transport related technologies, and reductions in waste to landfill.

The emissions projections were based on the following categories and priorities for emissions reduction initiatives, with transport, energy, and supply chain emissions the main FY23 opportunities. Remaining emission accounted for <1% of emissions and have not be included.

Emission category		Reduction priorities	Contribution (%)	
Energy		Electricity • Optimise / maximise onsite renewable energy (solar PV) + Power Purchase Agreement • Energy efficiency upgrades • 100% all-electric facilities	60%	61%
		Natural Gas • All-electric buildings and services	1%	
Transport		Transport - Fleet fuel & staff commute • Fleet optimisation / review • EV fleet transition	20%	24%
		Machinery and vehicles • Transition petrol powered equipment to electric	4%	
Waste		Waste to landfill • Waste management, diversion and tracking	5%	5%
Water		Water • Alternative water supplies • Water conservation / efficiency programs	2%	2%
Supply Chain	 	Reducing supply chain emissions including: • ICT services and equipment (4%) • Cleaning and chemicals (0.6%) • Food (0.2%) • Office equipment and supplies (0.1%) • Products (0.1%)	6%	6%

Energy reduction initiatives

With energy a major emissions source for Council, site visits have been undertaken to review opportunities to reduce energy consumption and increase on site renewable energy. The following is a summary of the key initiatives identified which will require a budget of approximately \$1.5m-1.8m to implement.

Project		Installation cost estimate	Cost reduction
	Caravan Park communal gas replacement Replace existing bottled gas services with all-electric, efficient heat pump technologies including hot water and gas-powered dryers.	\$50,000-\$70,000	\$7,605
	Caravan Park cabin gas to heat pump replacement Replace instant gas units and cooktops (at end of life) with all-electric, efficient heat pumps and induction cooktops.	At end of life	At end of life
	Caravan Park – 30kW Solar PV Install solar PV at the Caravan Park to support the all-electric transition and reduce costs.	\$30,000-\$45,000	\$7,308
	Sports field LED lighting replacement (adjacent caravan park) Upgrade the sports field lighting adjacent the Caravan Park to LED.	\$5,000-\$8,000	\$920
	ESC solar PV reconfiguration / rectification Reconfigure the solar PV at the Environmental Services Centre (ESC) to supply the whole site, increase self-consumption and reduce export.	\$8,000-\$11,000	\$10,000-\$12,000
	Amenity blocks (toilets) - LED lighting and automatic lighting controls Replace amenity lighting with LED lighting and automatic controls and consider integration with alarms / electronic locks.	\$5,000-\$8,000	\$2,391
	Larger solar PV car park array (700kW total) at new aquatic centre Increase the solar PV system at the new aquatic centre to include a large car park array to reduce consumption and costs.	\$1.4m - \$1.6m	\$180,000
Total		\$1.5-\$1.8m	\$200,000

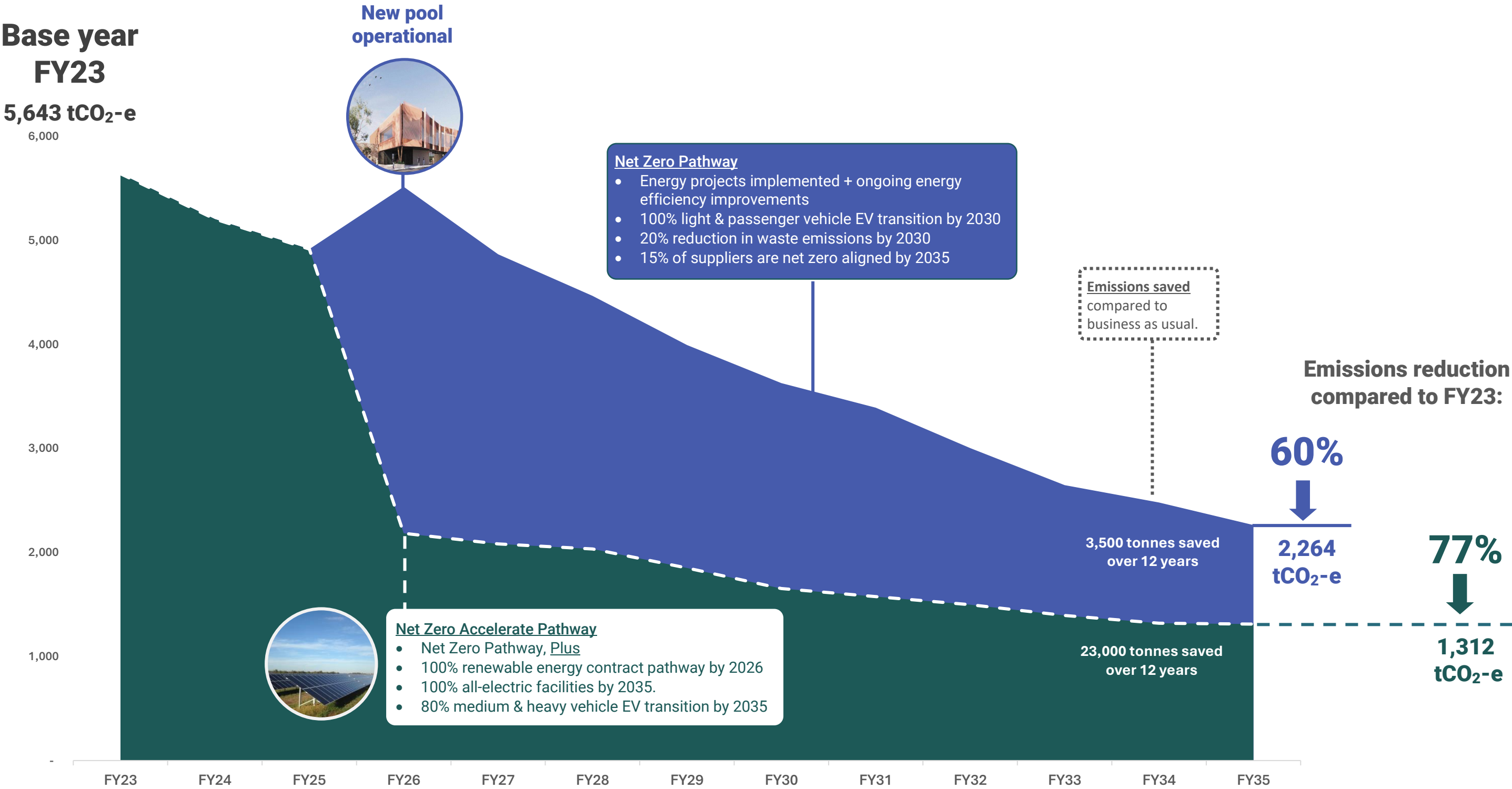
Emissions reduction initiatives

The following emissions reduction initiatives have been identified for Council to implement to work towards net zero emissions:

Optimise fleet vehicles & transition to electric vehicles (EVs) based on vehicle availability / operational requirements. 	Implementing sustainability KPIs / specifications as part of maintenance and capital works projects. 	Developing a Sustainable Procurement Procedure to transition to sustainable, ethical, and low emissions suppliers. 
 Implement energy performance projects to transition Council facilities to 100% renewable energy powered, efficient and all-electric.	Developing a medium and heavy vehicle low emission transition plan. Begin transition from 2027 as vehicles become more available. 	Mandating low Global Warming Potential (GWP) refrigerants as part of air-conditioning maintenance and replacement programs. 
Transitioning equipment to all-electric (mowers, blowers, etc.) to reduce noise, pollution and emissions. 	Targeting / preferencing carbon neutral certified suppliers to support businesses aligned with Council's net zero pathway. 	Continuing to improve water efficiency for buildings and irrigation systems to reduce consumption, costs, and emissions. 
Optimising / maximising solar PV to support the all-electric transition including EV charging and reduce consumption, costs, and emissions. 	 Develop Sustainable Design Guidelines for building projects, including Undertaking Life Cycle Assessments (LCAs) to improve data for embodied emissions.	Develop case studies and guidance material on emissions reduction initiatives to support community emissions reduction initiatives. 

Energy and emissions reduction pathway

Based on the above initiatives, the following net zero pathway has been developed to demonstrate the estimated emissions reduction achieved by FY35. Two scenarios have been developed with a standard net zero pathway and an accelerated pathway with 100% renewable energy procurement and the transition of medium and heavy vehicles to zero emission vehicles. The projections demonstrate that Council can reduce emissions by over 60% based on the net zero pathway compared to the FY23 baseline, and up to 77% if 100% renewables is procured and the medium and heavy fleet is targeted. They key consideration between the two options is the total emissions avoided with the accelerated pathway significantly reducing emissions compared to a business-as-usual approach.

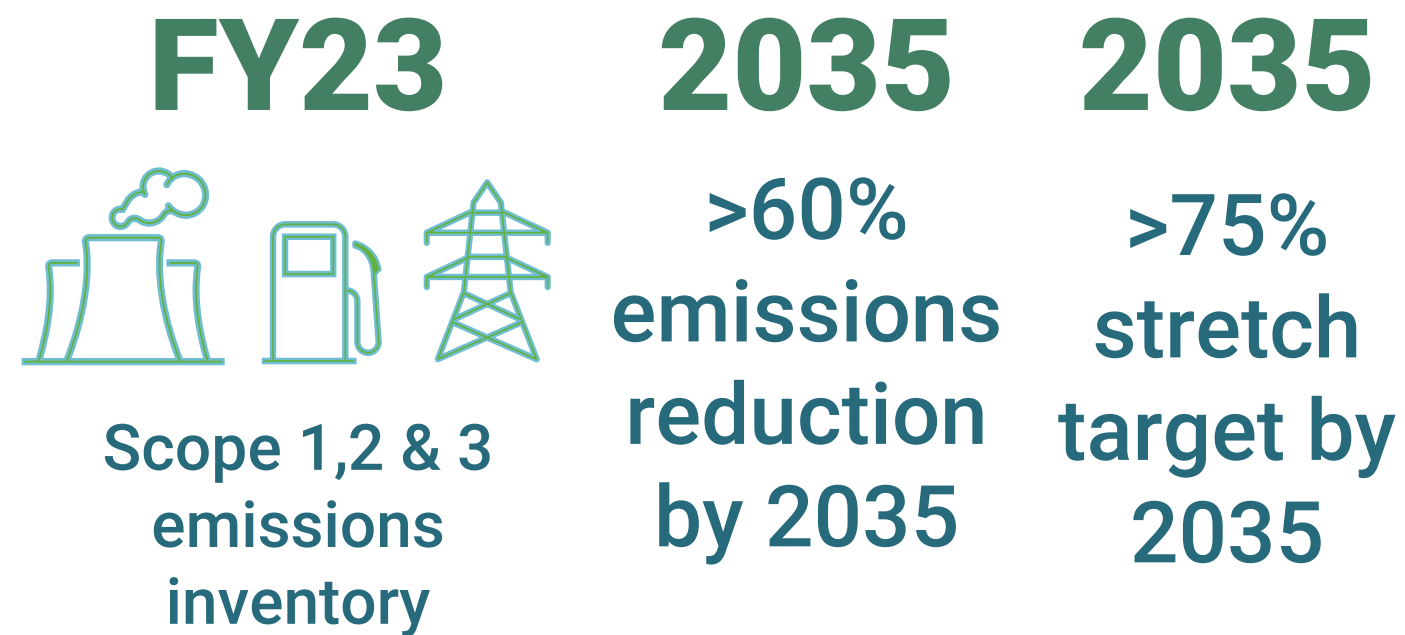


Emissions reduction target

This plan recommends implementing direct emission reduction initiatives that will reduce the Council's emissions as close to zero as possible, with a review to be undertaken in 3-5 years to confirm when and how net zero emissions could be achieved based on global and Australian progression on the net zero emissions transition.

Based on the emissions projections, it is recommended that the Council considers a 60% emissions reduction target for 2035, with a stretch target of 75% pending more detailed assessments for energy contracting and low emissions medium and heavy fleet transition planning.

The 60% emissions reduction target is estimated to be in alignment with and exceed South Australia's goal for a 50% emissions reduction by 2030 which is based on a 2005 baseline. This will demonstrate leadership while also being based in pragmatic actions that can be implemented over time.



To ensure the Council can achieve these targets, additional resources and budget will be required, however identified initiatives are likely to reduce operating costs and more detailed investigations and planning is required.

Key priorities - Pathway to net zero

In summary, the key emissions priorities and reduction initiatives recommended for implementation, that will have the largest opportunity to reduce emissions and work towards net zero emissions, include:



Energy is a large source of emissions, with 100% renewable energy powered, all-electric facilities and equipment a priority to reduce consumption, costs and emissions.



Transport related emissions are the second highest priority including optimising Council's fleet, transitioning to low emission vehicles, and support sustainable staff commute.



Supply chain emissions will continue to grow in share, with Council able to influence and transition to local low emission businesses and suppliers.

To support the above priorities, it is recommended Council undertake more detailed assessments including:

- **Power Purchase Agreement (PPA) Review:** Undertake a review of electricity procurement options including PPAs to transition a 100% renewable energy powered, all-electric Council.
- **Low Emissions Fleet Review and Plan:** A fleet optimisation review and low emissions fleet transition plan, to transition to low emission vehicles in a planned manner. This should include an EV charging infrastructure review and investigations into how Council can support the EV transition for staff e.g., home charging and/or subsidies.
- **Sustainable Procurement Procedure:** A supply chain review should be undertaken to identify priority businesses and suppliers that contribute to Council emissions, and set targets and KPIs to transition to a local, low emissions supply chain. This should also consider ways Council can support local businesses on reducing emissions and becoming more competitive.
- **Sustainable Design Guidelines:** Develop new guidelines for capital works projects and major refurbishments to embed sustainability and the net zero transition into future projects.

By focussing on the above priorities, Council will be able to make meaningful and tangible reductions in emissions while reducing costs, improving facilities and supporting the community.

Summary

This Plan has been developed to provide Council with a pathway to work towards net zero emissions and demonstrate leadership. The key recommendations include:

FY23 Baseline	Updating Council’s emissions baseline to the FY23 inventory developed for this Plan. This aligns with best practice approaches for emissions inventories and will enable Council to track its emissions and reduction measures moving forward.
Emissions reduction initiatives	Implementing immediate emissions reduction initiatives targeting the top 5 emissions sources. The largest opportunities include energy, transport, and supply chain emissions with opportunities to reduce consumption, costs and emissions.
60% emissions reduction target	Setting a 60% emissions reduction target by 2035 to work towards net zero emissions. The emissions inventory and target should be reviewed and updated every 3-5 years to track progression and revise the target if required, with the aim of reaching net zero emissions prior to 2050.
Detailed planning	Additional investigations and planning to fast-track emissions reduction action. This includes feasibility assessments for procuring 100% accredited renewable energy, a detail low emissions fleet transition plan to include medium and heavy vehicles, and implementing a new procedure for Sustainable Procurement and Design Guidelines for new buildings.
Data improvements	Implementing improve data management systems to track emissions, and consider an emissions data portal to track consumption, emissions and costs.
Publicly commit	Publicly committing to emissions reduction initiatives and targets to demonstrate leadership and enable Council to celebrate achievements. Learnings from the Council initiatives should also be shared to support community emissions reduction action.
Net zero journey	The net zero emissions transition is a journey which is continually evolving as new approaches, technologies and data becomes available. A flexible approach based on a continual improvement model should be adopted to improve over time and work towards net zero emissions.

By adopting the above recommendations, Council can begin the net zero emissions journey and continue to demonstrate leadership in taking action on climate change.

1. Introduction

1.1 Purpose

This Corporate Energy & Emissions Reduction Plan (the Plan) provides Mount Barker District Council (Council) with a planned approach to reducing emissions, and incorporates an implementation plan that balances environmental, social, and financial outcomes. Information in this plan includes Council's' greenhouse gas (GHG) emissions for its corporate operations, emission reduction initiatives to work towards net zero emissions, and financial assessments of the proposed initiatives to inform future budgets and strategic planning.

1.2 Scope

The scope of the plan is the Mount Barker District Council's corporate operations which are in direct control of the Council. However, where the Council can implement initiatives and programs that support the community to reduce emissions, these opportunities have also been identified to ensure the Council is considering a holistic approach to transitioning to net zero emissions.

For the purpose of this Plan, community emissions relating to Council's wastewater treatment plant (methane emissions) have been excluded, however are a large source of emissions and should be considered.

1.3 Objectives

The objectives of this plan are to:

- Establish an emissions inventory to account for Council's corporate operations and associated greenhouse gas (GHG) emissions. This includes Scope 1, 2 and Scope 3 emission sources to enable the Council to prioritise and influence their supply chain as part of the net zero transition. The emissions inventory has been based on the Local Government Association of South Australia's (LGA SA) Net Zero Accelerate Program.
- Identify and prioritise emissions reduction initiatives that will reduce consumption of resources, costs, and GHG emissions, while aligning with the Council's Community Plan 2020-2035 strategic priorities.
- Develop an implementation plan for emissions reduction initiatives that enables effective budgeting and staging.
- Develop emission reduction initiatives that will reduce the Council's emissions and operating costs to enable the efficient use of Council budgets.
- Increase Council and community knowledge and awareness of climate change mitigation and emission reduction initiatives being implemented by Council.
- Demonstrate leadership to the community by implementing pragmatic and effective emissions reduction initiatives that can also be adopted by the community and businesses.



1.4 National and State context

Since 2009, Australia has decarbonised its economy by an average of 12 MtCO₂-e per year. In 2022 the Australian Government increased its commitment under the COP21 Paris Agreement to reduce emissions by 43% below 2005 levels, as well as committing to the goal of achieving net zero emissions by 2050, enshrined in the Climate Change Act 2022. Australia has also signed the Global Methane Pledge to collectively reduce global methane emissions by 30% by 2030.

In South Australia (SA), the State Government has similarly set goals to reduce GHG emissions by more than 50% below 2005 levels by 2030 and achieve net zero emissions by 2050. An amendment to the *Climate Change and Greenhouse Emissions Reduction Act 2007* is currently out for consultation which will legislate the 50% emissions reduction target and require SA Government agencies to track GHG emissions and set targets for their own operations. Although the legislation is not proposing to require local government to report, it is expected that this may be required in the near future.

SA has been a national leader in the renewable energy transition, transforming its energy system to a share of 70% renewables in 2022 (Refer Figure 1). The Australian Energy Market Operator forecasts this could rise to approximately 93% by 2025/2026, on track to meet the State Government’s commitment to achieve 100% net renewables by the end of 2027 (Refer Figure 3 for 2030 generation share projections). In 2023, there were 289 days in which renewables met all of the state’s operational demand for part of the day, and rooftop solar alone has met all state demand on occasions.

Australia’s decarbonising of its energy sources within government, non-government and private industry, means electricity emissions will continue to reduce over time. Therefore, recommendations in this Report reflect a potential pathway for electricity emissions, to ensure initiatives and capital investment results in a balanced outcome for while supporting an all-electric approach.



Figure 2: Solar PV farm (Source: Stock image)

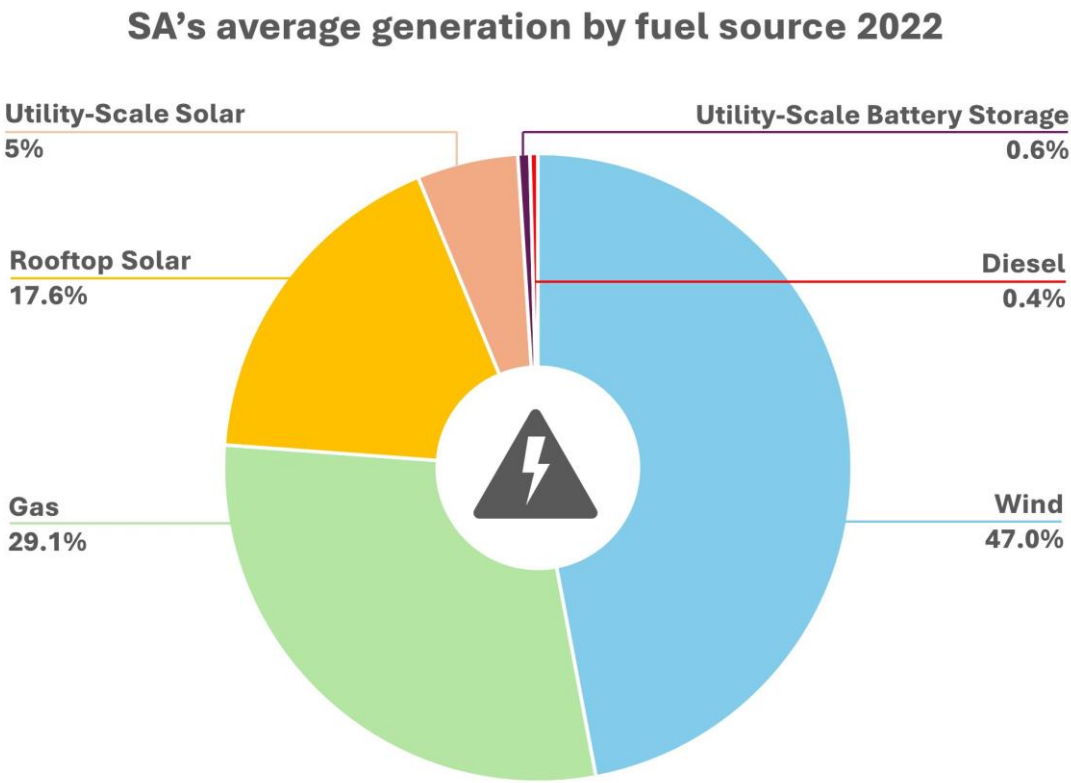


Figure 1: South Australia's Renewable Energy Share - Australian Energy Update 2023

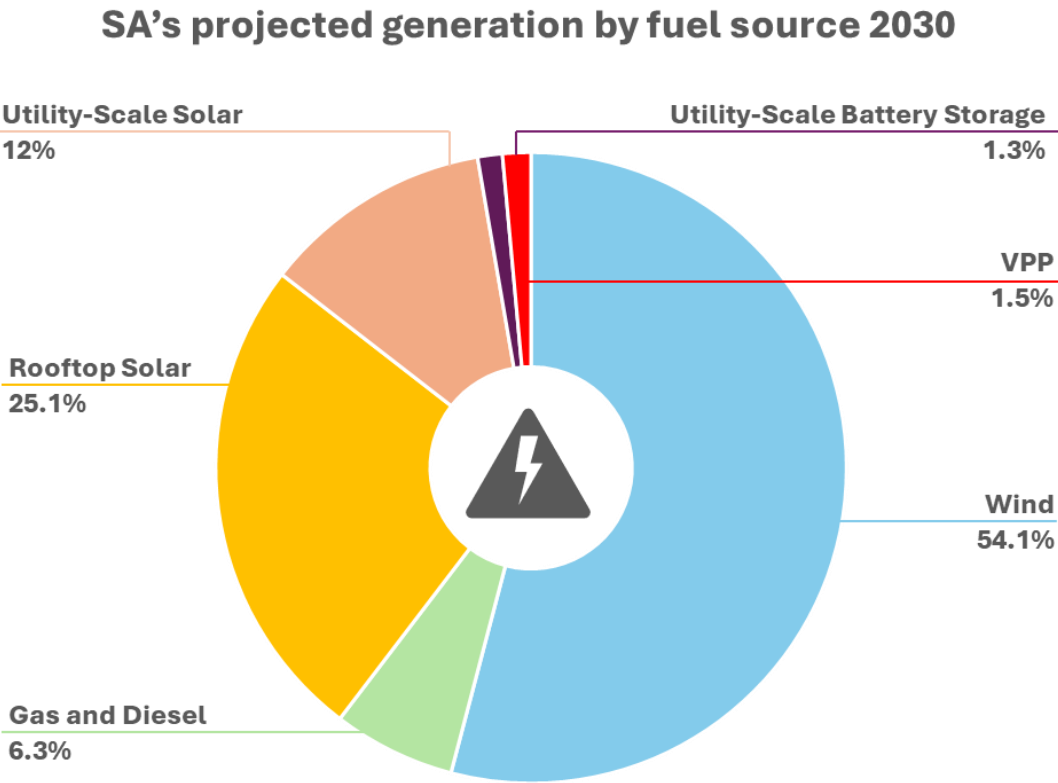


Figure 3: South Australian Generation Forecasts 2023 - Australian Energy Market Operator

1.5 Council context

Council has been demonstrating leadership in climate action for many years and is committed to protecting the environment, improving biodiversity, and responding to climate change as priorities in its Community Plan 2020-2035. This is captured under the Ecological Sustainability theme which is one of 3 guiding themes for Council:

Our guiding themes



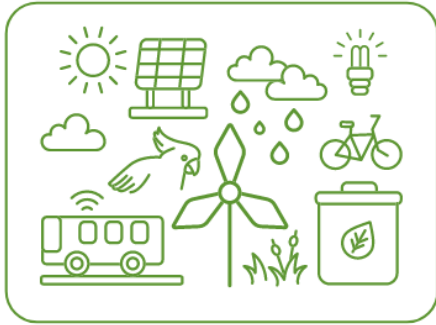
Community Wellbeing

- Activity and movement
- Health and social connection
- Heritage, cultural expression and celebration
- Safety and resilience
- Mobility and accessibility



Economic Prosperity

- Business and employment
- Identity and reputation
- Growth and opportunity
- Education, learning and innovation



Ecological Sustainability

- Emissions reduction
- Urban greening
- Nature and wildlife
- Low waste
- Clean and abundant water

This Plan relates to *ES Goal 1 Emissions reduction* which aims to address climate change mitigation by embarking on rapid transition to net zero emissions, including 100% renewable energy. The plan has been developed as the first stage to reduce emissions as far as possible as part of the net zero emissions transition, while acknowledging that currently net zero emissions will require carbon sequestration or offsets while the rest of the economy decarbonises.

The scope of the plan relates to the Council’s corporate GHG emissions as a direct result of its operations and excludes community emissions for which it provides services but is not directly responsible.

Council has already implemented important emissions reduction projects as demonstrated in the following section. This plan builds on these projects and Council’s leadership and proposes a staged plan to work towards net zero emissions.

Ecological Sustainability

The natural environment supports all life. With an intentional approach to management, community wellbeing and economic prosperity can be enhanced and sustained. We have the opportunity to strike a new deal where nature is defended against adverse human impacts and we evolve to lower our consumption and modify our lifestyles to live within sustainable limits. We acknowledge that humans are not separate from, but are in fact integrated with and dependent on the natural environment.



ES Goal 1
Emissions reduction

The district embarks on a rapid transition to net zero emissions, including 100% renewable energy

ES Objective 1.1 Advocate for, showcase and encourage investment and take up of net zero emissions development and technology- assisted emissions reduction management systems.

ES Objective 1.2 Significantly reduce carbon and other greenhouse gas emissions in capital projects and operational practices.

ES Objective 1.3 Work towards 100% renewable energy.

ES Objective 1.4 Apply a high standard of built and operational sustainability performance in infrastructure projects of Council

ES Goal 2
Low waste

Waste reduction is the priority objective followed by reuse, repurposing and recycling

ES Objective 2.1 Promote and encourage lifestyles and the consumption of goods and services that have positive impacts on people, other species and ecosystems.

ES Objective 2.2 Lead and support circular economy development, best practice waste minimisation, procurement of recycled and upcycled materials and engagement of systems and programs that significantly increase recycling rates.

ES Objective 2.3 Prioritise the management, diversion and reuse of green and food waste.

ES Goal 3
Urban greening

The district’s urban areas are known for the high levels of tree canopy coverage, biodiverse watercourses, linear trails and parklands. Natural and remnant vegetation is integrated with and enhances residential and commercial development.

ES Objective 3.1 Ensure that trees and other vegetation including vegetated roofs and vertical gardens are an integral part of the urban landscape.

ES Objective 3.2 Plan for and manage healthy and functional water- courses as the spines of the open space network and ecologically functional wildlife corridors.

ES Objective 3.3 Establish and maintain high-amenity urban landscapes that are suited to current and future environmental conditions and outcomes.

ES Objective 3.4 Apply a strategic, planned and consistent approach to the provision, development and maintenance of public open space.

ES Objective 3.5 Provide well vegetated and shaded transport corridors and green, biodiverse buffers between urban and rural environments.



Figure 4: Mount Barker District Council - Community Plan 2020-2035

1.6 Council achievements

Mount Barker District Council has been demonstrating leadership in climate change mitigation and adaptation by implementing programs to reduce consumption and emissions. The below summarises some of the key initiatives that have supported emission reduction outcomes and taking action on climate change.

Context

Land area: 595 km²
Population: 40,358
Distance from
Adelaide: 20km SE



Climate Resilience

Following preparation of a Climate Change Adaptation Plan through the Resilient Hills and Coasts partnership, an Action Plan targets 3% emission reduction per year.

Solar PV systems

Significant investment in rooftop solar systems, with combined 350kW capacity installed across key facilities.



Low emission community

A network of footpaths and linear trails encourage active transport and a collaboration with the State Government implemented the on-demand bus service, 'Keoride'.

Development of community education and resources, including the 'Living Sustainably' virtual interactive site and 'House of tomorrow' education campaign.



Circular Economy

Signatory to the Memorandum of Understanding, as part of the LGA's Circular Procurement Pilot Project, to prioritise buying products made from recycled materials. Council's seeks to use the collective buying power to significantly increase demand for recyclable materials in South Australia.



Community wastewater treatment scheme

Council operates the largest CWMS in South Australia through the establishment of the Laratinga Wetlands and WWTP. The wetlands create a habitat for many varied flora and fauna species and treated water is used for irrigation of parks and gardens. This provides a reliable source of non-potable water, independent of climate conditions, whilst increasing biodiversity.



Low emissions fleet

All commuter fleet vehicles transitioned to hybrid vehicle alternatives.



Cities Power Partnership

Partnership pledges include: supporting update to renewable energy, energy efficient lighting upgrades, setting targets and education programs.



Emissions tracking

Ongoing monitoring of greenhouse gas emissions since 2001, to track & improve performance against a science-based target.



2 Carbon management & net zero emissions

2.1 Introduction

The following section summarises what carbon management and net zero means, the different types of emissions, what emissions are typically included in council emissions inventories, and the standards and references used to develop this plan.

2.2 Standards

To ensure this plan follows credible info and processes this plan has been developed in line with the GHG Protocol Corporate Standard, Climate Active Carbon Neutral Organisation Standard, and Science Based Targets Manuals and reference documents. The GHG Protocol and Climate Active are the main standards used in this Plan and are summarised below.



The **GHG Protocol** is an internationally accepted set of standards and resources for GHG emissions accounting and reporting and is used by both public and private entities. The GHG Protocol is referenced by many GHG emissions tools and certifications including Climate Active and the Science Based Targets initiative (SBTi). Although the GHG Protocol includes setting emissions reduction targets, the SBTi standards provide further guidance on setting a target in line with the Paris Agreement.



Climate Active Carbon Neutral Organisation Standards and Technical Guidance Manuals have been used throughout the development of this plan and associated emission calculations, including setting an emissions boundary and baseline year, to ensure that in the event Council pursues Carbon Neutral certification, the emissions inventory and initiatives will meet the minimum requirements.

2.3 Carbon management hierarchy

To ensure the Council is following an established pathway, this plan has been developed based on a carbon management hierarchy as show in the adjacent diagram, with the aim to reduce emissions by measuring, avoiding, reducing, and switching sources. However, it is also acknowledged that there will be remaining emissions associated with Council’s operations that will not be able to reduce to net zero emissions without using carbon offsets.

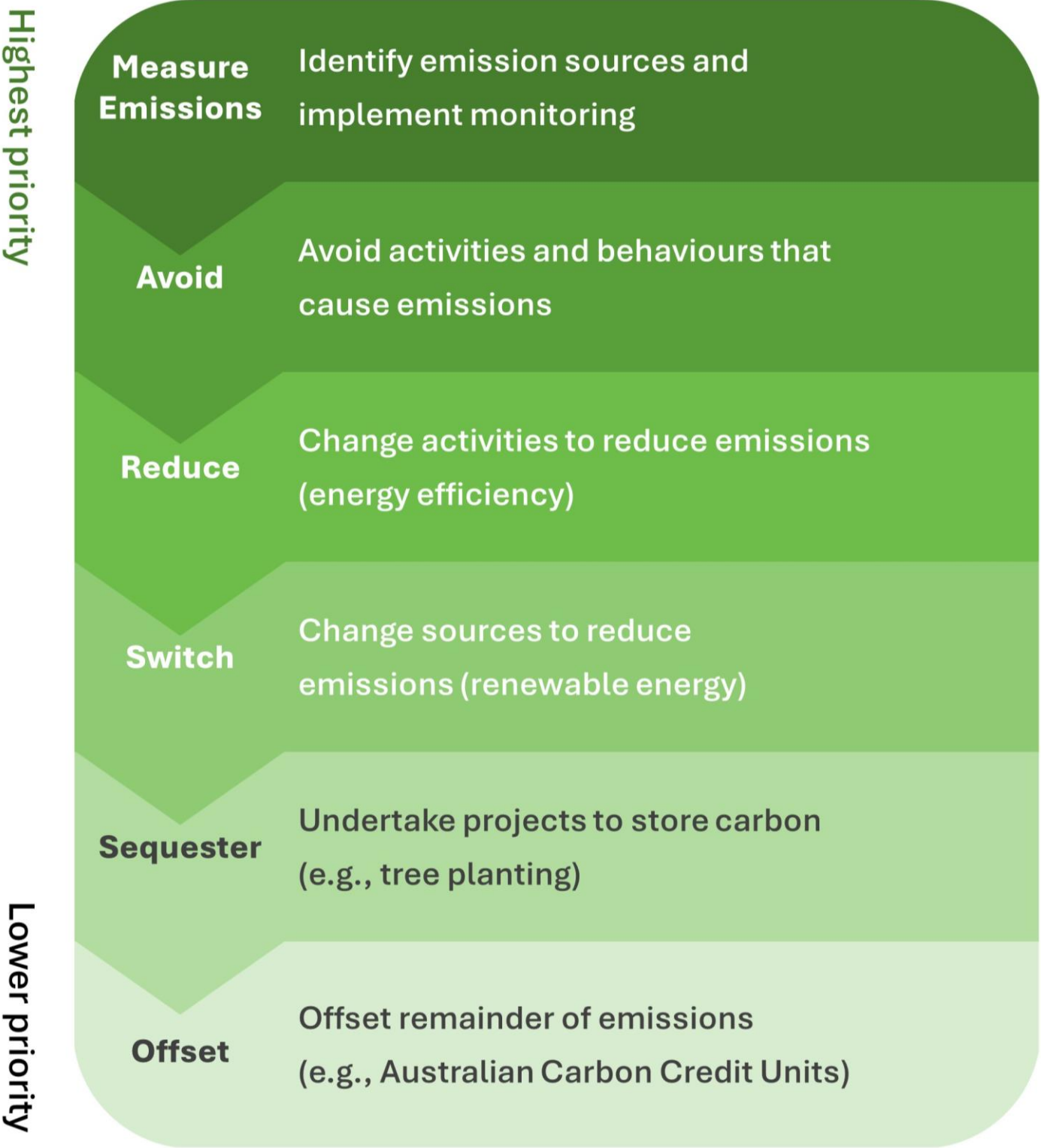


Figure 5: Carbon management hierarchy (Source: dsquared diagram adapted from IEMA diagramⁱⁱ)

2.4 Net zero emissions

The net zero emissions definition is:

“net zero means cutting greenhouse gas emissions to as close to zero as possible, with any remaining emissions re-absorbed from the atmosphereⁱⁱⁱ”

The process of re-absorbing emissions is known as carbon sequestration and can occur through biological carbon sinks such as forests, soil and oceans, or through artificial Carbon Capture and Storage (CCS) initiatives, which involves technological interventions. Carbon sequestration projects are independently verified to produce accredited carbon offsets, which Council can purchase to neutralise the remaining emissions to achieve net zero status.

This plan recommends implementing direct emission reduction initiatives that will reduce the Council’s emissions as close to zero as possible, with a review to be undertaken in 3-5 years to confirm when and how net zero emissions could be achieved based on global and Australian progression on the net zero emissions transition.

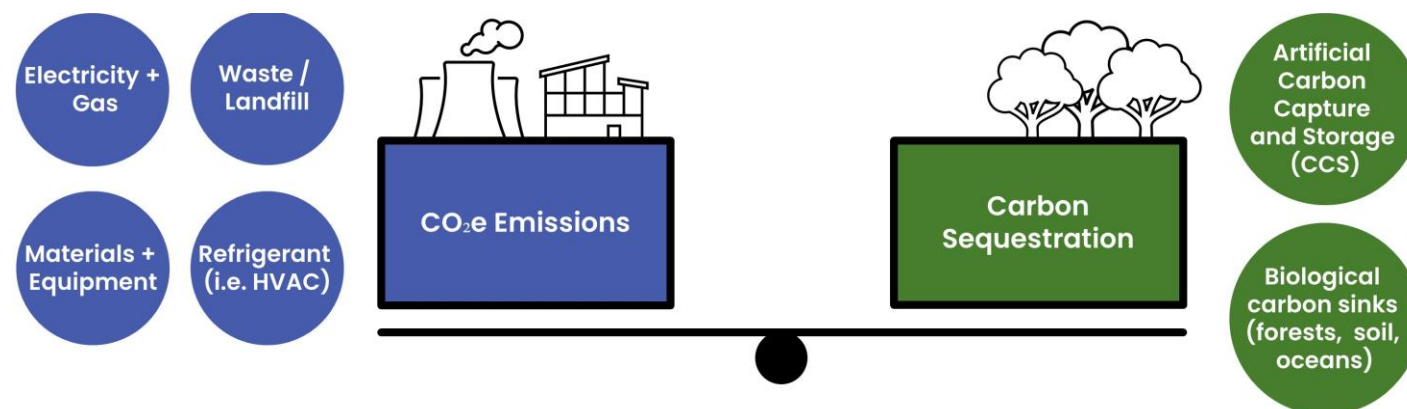


Figure 6: Net zero diagram (Source: dsquared)

2.5 Carbon neutrality

The key difference between net zero emissions and carbon neutrality is the use of carbon offsets. Carbon neutrality is achieved by calculating GHG emissions, implementing an emissions reduction strategy, and purchasing carbon offsets from outside of the organisation boundary. Refer to Section 5.11 for further guidance on carbon offsets.

The Climate Active Carbon Neutral standards should be used if pursuing carbon neutrality as this is an industry recognised certification administered by the Australian Government. Refer to Appendix A Standards & assumptions for further information on the Climate Active standards.

2.6 Emissions sources

The emissions inventory developed for the Council is categorised based on Scope 1, 2 & 3 emissions profiles of Council’s corporate operations (refer figure 4).

Emissions scopes and sources are categorised as follows:

- **Scope 1:** Direct GHG emissions occur from sources that are owned or controlled by the reporting organisation.
- **Scope 2:** Indirect GHG emissions associated with the purchase of energy (electricity, steam, heat, or cooling).
- **Scope 3:** Scope 3 emissions are the result of activities from assets not owned or controlled by the reporting organisation, but that the organisation indirectly impacts in its value chain, including embodied carbon.

Scope 3 emissions are becoming as increasingly important to report on as Scope 1 and 2 emissions reduce and as data availability improves. Based on typical organisations that develop emissions inventories, approximately 90% of emissions are from Scope 3 indirect emissions which highlights that supplier and embodied emissions are a key priority for identifying emission reduction opportunities, as well as working with suppliers to reduce emissions and environmental impacts over time.

Scope 3 emissions have been incorporated to enable the Council to demonstrate leadership by including indirect emissions from its operations and enable the Council to influence emissions across their supply chain.

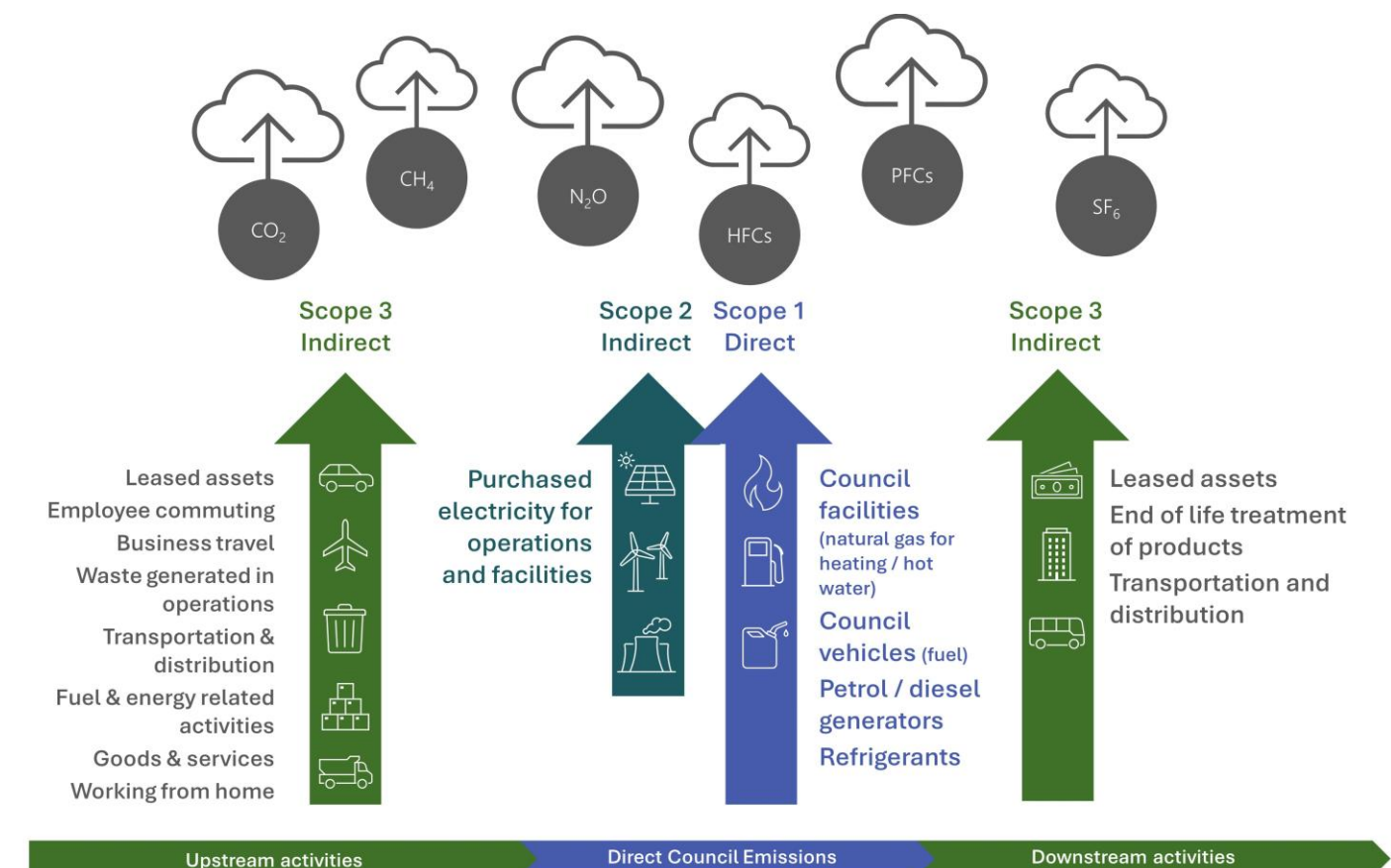


Figure 7: Emissions scopes (Source: dsquared image adapted from the GHG Protocol)

2.7 Council emissions

The following is a summary of the emissions included in this Plan:

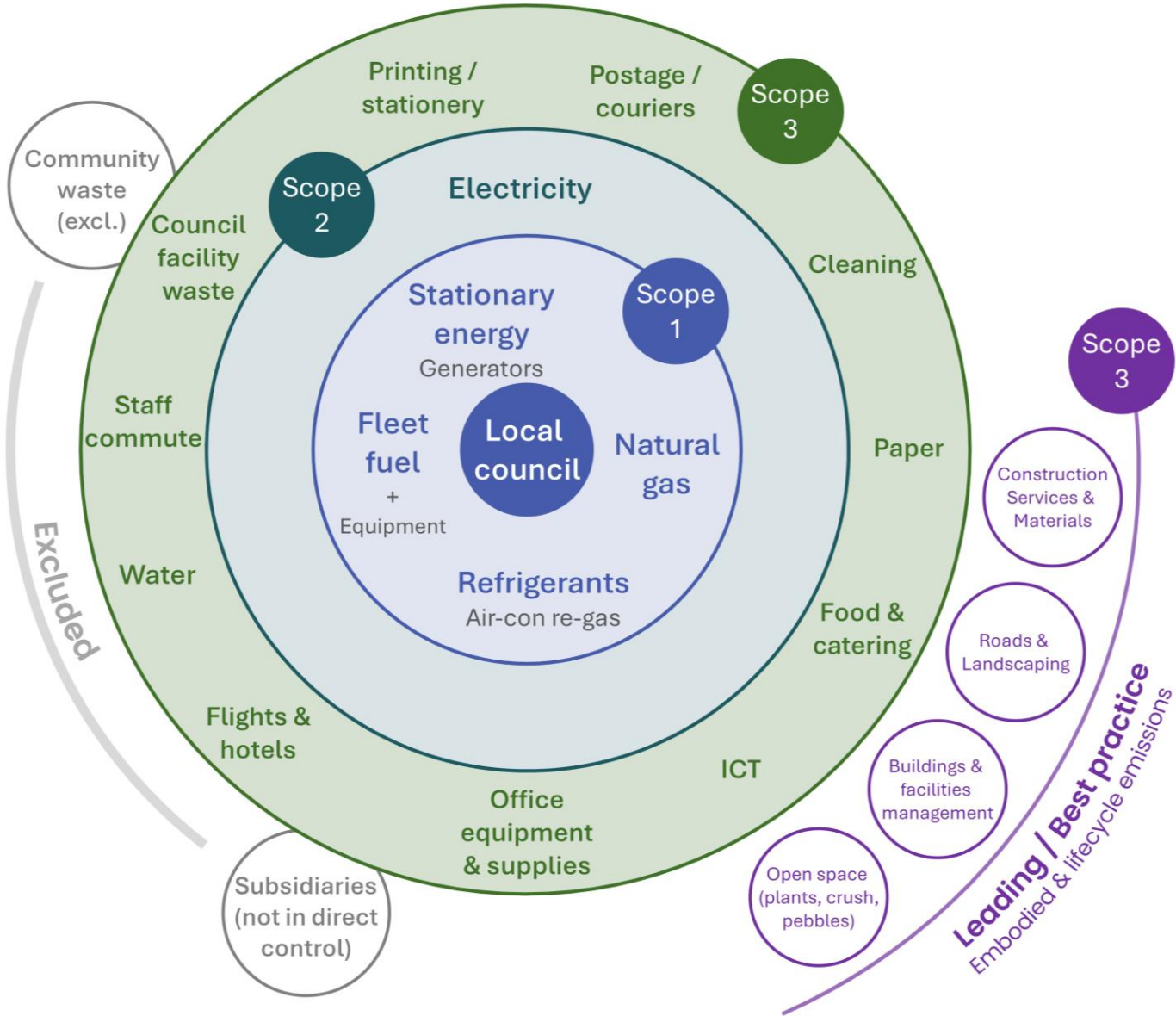


Figure 8: Emissions inclusions summary

2.8 Calculating emissions

Once the Scope 1, 2 and 3 activity data has been collated for the identified emissions sources, emissions factors are then used to convert activity data to a CO2 equivalent. Emissions factors are based on an average emissions intensity from different activities and are sourced from a range of references including:

- **National Greenhouse Accounts Factors:** Australian Government emissions factors published annually and used as part of National Greenhouse and Energy Reporting (NGERS).
- **Australia’s Emissions Projections:** Emissions projections which are updated annually and include future emissions factors for categories such as electricity.
- **Climate Active Carbon Neutral:** For councils that choose to pursue Carbon Neutral certification, Climate Active provides a set of resources which include emissions calculators. The resources and spreadsheets are protected under a License Agreement and can only be used for the purpose of calculating emissions for the participating organisation.
- **Subscriptions / licenses:** Emissions factors typically associated with Scope 3 emissions and embodied emissions are commercially available via subscriptions and licenses, and some open sources.

See below example for calculating emissions:

Emissions calculation example

The below is an example calculation to convert emissions data to t CO₂-e for typical emissions sources for local councils.

Category	Activity Data	Unit	Emissions Factor	Emissions (kg CO ₂ -e)	Emissions (t CO ₂ -e)
Electricity	100,000	kWh	0.77 kg CO ₂ -e / kWh	77,000	77
Natural Gas	300	GJ	62.13 kg CO ₂ -e / GJ	18,648	18.6
Water	50,000	kL	1.4932518 kg CO ₂ -e / kL	74,663	75
Waste	50	t	1,600 kg CO ₂ -e / t	80,000	80
Total					250.6

Figure 9: Emissions calculation example

2.9 Electricity emissions

There are two options for calculating electricity emissions called the Location-based and Market-based approaches.

- **Location-based:** The emissions factor is based on the local electricity grid emissions intensity e.g. the South Australian emissions factor published in the National Greenhouse Accounts Factors. It is expected that Council has previously used the Location-based approach for previous emissions inventories.
- **Market-based:** Represents the emissions intensity from the contractual arrangements of the organisation which takes into account the procurement of renewable energy via Renewable Energy Certificates (RECs typically in the form of Large-scale Generation Certificates (LGCs)) or Green Power. In the event the Council purchases 100% Green Power or LGCs are voluntarily surrendered on their behalf, a market-based approach must be used.

Based on the 2022/23 emissions calculations, the Market-based approach results in electricity emissions being 2-3x higher than using the South Australian emissions factor. However, as renewable energy generation increases across Australia, Market-based electricity emissions will reduce.

For this Plan and the Net Zero Accelerate Program, a Market-based approach has been adopted for the following reasons:

- A Market-based approach enables a consistent calculation of electricity emissions across Australia, allowing local government to compare emissions across jurisdictions.
- Some councils elect to purchase Green Power as part of their electricity contract, or some councils have entered into a Power Purchase Agreement (PPA) which includes 100% accredited renewable energy via the voluntary surrender of LGCs.
- During consultation at the end of 2023, Climate Active proposed to mandate a Market-based approach as part of their Carbon Neutral certification standards. Climate Active reforms have not yet been finalised.
- Calculating electricity emissions based on the Australian market supports a greater focus on increasing renewables across Australia. In 2022 and 2023, renewable energy investment and installations have slowed due to a number of reasons including the need for new transmission infrastructure (poles and wires), market conditions (financial), and regulatory challenges.

3 Emissions inventory

3.1 Introduction

The following section summarises Council's emissions inventories and identifies priority emissions to target for reduction initiatives. For reference, Council data from 2001 to 2017 has also been included for comparison.

GHG emissions have been calculated based on activity data (e.g., kWh, MJ, kL, t) multiplied by an emissions factor. An emissions factor is representative value of emissions emitted from an activity.

3.2 Previous emissions inventories

Council has been collating GHG emissions for many years with data collated in 2001, 2005, 2007 and 2017. The below summarises emissions over this period.

Table 1: Previous Council emissions inventories

Category	Emission Inventory Year			
	2001	2005	2007	2017
Stationary Energy (Buildings)	497	820	760	1859
Vehicle Fleet	465	435	491	719
Streetlighting	601	663	671	786
Total	1563	1918	1922	3364

The adjacent graph shows emissions over time which identifies an increase in emissions from 2001 to 2017. It is expected that this is due to Council's operations and number of community facilities increasing as the Mount Barker area has grown, however may also be due to improved data and records.

Electricity emissions (buildings and streetlighting) are by far the largest source of emissions which is associated with South Australia's electricity generation predominantly coming from coal and gas power stations when the inventories were developed. The Port Augusta coal power station closed in mid-2016 and South Australia has since transformed its energy system to a share of >70% renewable energy generation in 2022. This has reduced the Scope 2 and 3 electricity emissions combined factor significantly from 0.64 kgCO₂-e per kWh of electricity consumed in FY16, to 0.33 kgCO₂-e in FY23. However, emissions have not reduced as Council has increased in size for both the number of buildings services and number of streetlights.

The below graph demonstrates that in 2001, electricity (stationary energy and streetlighting) was the largest sources of emissions for Council and therefore was a priority for emissions reduction initiatives.

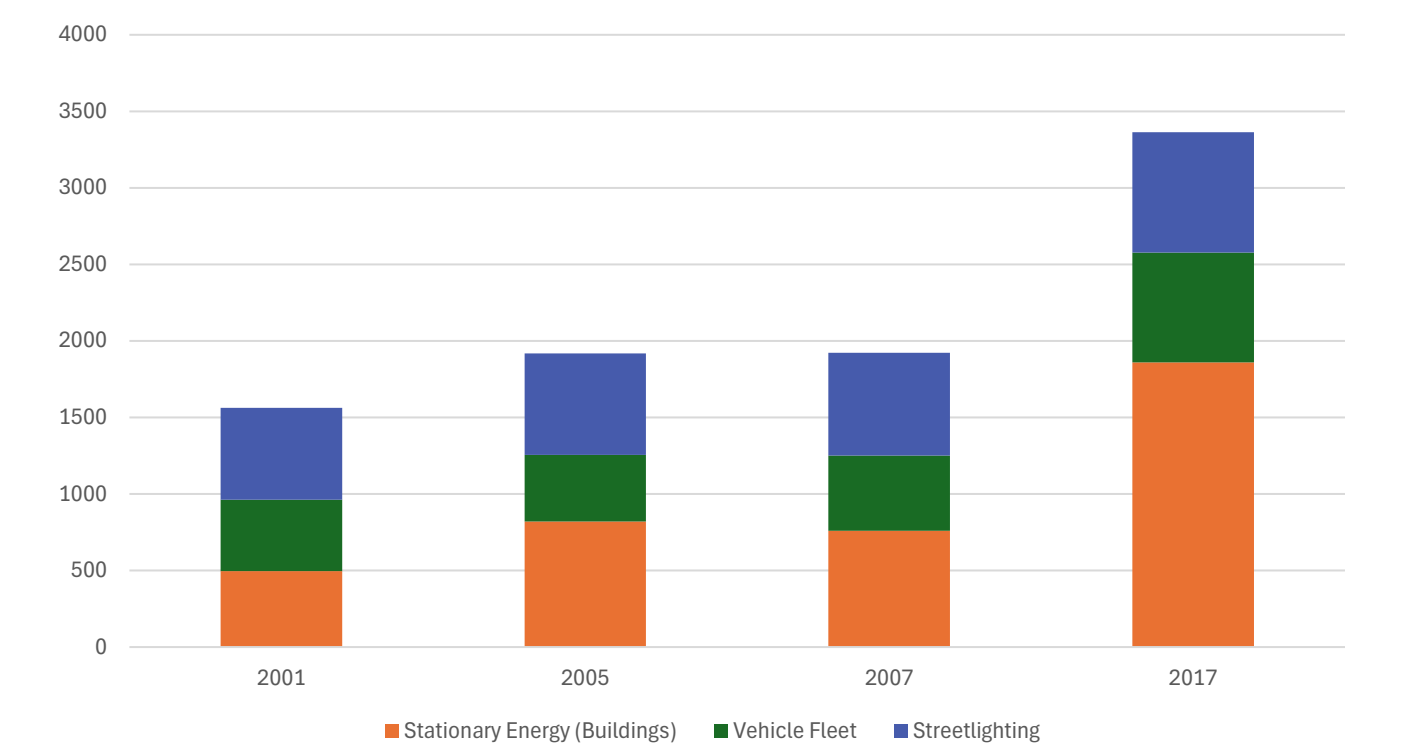


Figure 10: Emissions Inventories graph

The graph demonstrates that as Council continues to grow and provide improved services to the community, reducing emissions will be a challenge that requires ongoing initiatives. Refer to the Emissions reduction target section for further information.

3.3 Emissions inventory FY23

FY23 is being used as updated base year for comparison as it was the latest available set of data at the start of project and aligns with the LGA Net Zero Accelerate Program. The FY23 emissions inventory is as follows with highlighted figures representing over 90% of the Council's total emissions. The emissions profile is significantly higher than previous calculations due to including Scope 1, 2, and 3 emissions across multiple categories not previously collated.

Table 2: FY23 Emissions inventory totals

Emissions category	FY23 Total emissions (t CO2-e)	Percentage of total
Electricity	3,363	60%
Transport	1,134	20%
Waste	257	5%
ICT services and equipment	234	4%
Machinery and vehicles	220	4%
Water	124	2%
On site gas use	68	1%
Wastewater	44	1%
Refrigerants	41	1%
Recycled water	40	1%
Cleaning and chemicals	36	1%
Streetlighting	23	0.4%
Postage, courier and freight	18	0.3%
Working from home	15	0.3%
Food	13	0.2%
Office equipment and supplies	6	0.1%
Products	6	0.1%
Total	5,643	

The below graph demonstrates that in FY23, electricity and transport related emissions are the main sources of emissions for Council. This includes electricity use for buildings, facilities and streetlights, fleet fuel, and staff commute.

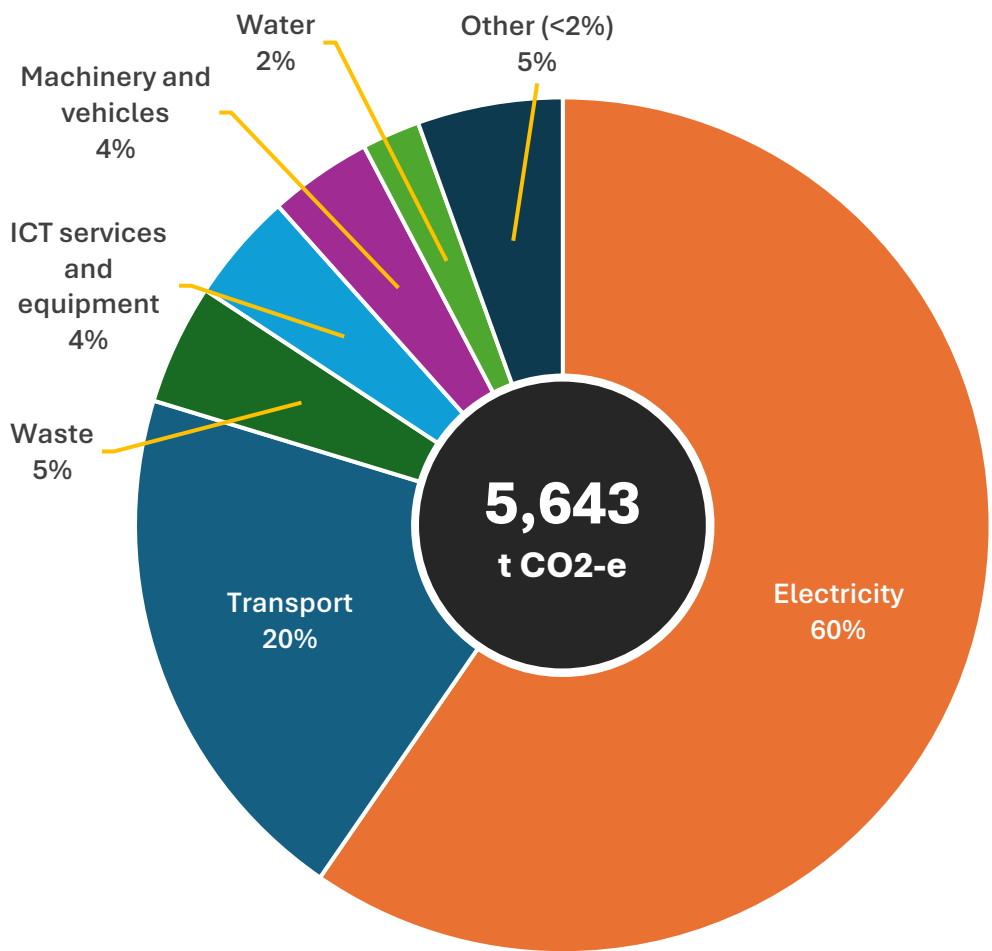


Figure 11: FY22 Emissions Inventory Breakdown

Scope 2 electricity emissions are currently the largest, with Scope 3 supply chain and Scope 1 fuel use large contributors to the Council's emissions profile.

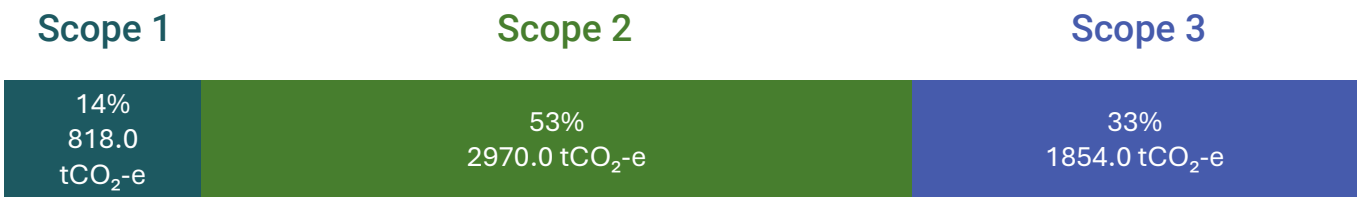


Figure 12: FY23 Emissions Inventory – Scope 1, 2, and 3 Breakdown

An emissions inventory using the Location-based approach for electricity emissions is included in Appendix B.

3.4 Data improvements

The FY23 emissions inventory is based on the latest data that available at the time. Based on the data received from Council, the following recommendations are provided to improve ongoing data tracking and capture, as well as emissions accuracy and scope.

Data improvement recommendations:

- Maintain a record of hotel accommodation nights and costs.
- Maintain separate accessible financial records for purchases in the following categories:
 - Electronic office equipment
 - Office furniture
 - Paper products
 - Newspapers, journals and periodicals
 - Courier services
- Record HVAC and equipment assets (make/model) and refrigerant re-gassing in maintenance records, including confirmation of the refrigerant used and quantity provided by the contractor.
- Maintain vehicle fuel reports separately from onsite use of fuels (i.e. fuel use in generators and buildings).
- Maintain a record of flight itineraries, rideshare and taxi trips.
- Obtain waste contractor reports for council facilities and commercial/ industrial waste, that includes waste to landfill and recycling volumes.
- Undertake staff survey to collate a list of daily commuting distance, travel/vehicle type (i.e. car, bus, motorcycle), FTE and average days that the staff member would typically work from home.
- Review streetlighting electricity data and confirm that all data sets have been included.

3.5 Emissions data portal

To assist in collating data and tracking emissions, it is recommended that Council consider an emissions data portal. The portal should be able to automatically source data from invoices and suppliers for Scope 1 and 2 data and include options for tracking Scope 3 emissions.

There are a number of platforms that can provide emissions tracking and it is recommended that Council review:

- The emissions data captured in this Plan, with a focus on which data is easy to source and incorporate.
- Which emissions are mandatory to track from a reporting perspective from an environmental and financial perspective e.g., if Council are already reporting electricity and water consumption and tracking utility costs. This includes understanding existing resources that are required to monitor and report which could be reduced with a centralised platform.
- What the aim of the data portal and tracking is e.g., reducing environmental impacts, financial management and bill verification, tracking projects, emissions reporting, etc. However, the more complicated the emissions portal is the more costly it will be to implement and manage.
- The frequency of reporting e.g., quarterly, annual, 3-yearly.

4 Energy opportunities

4.1 Introduction

With energy (electricity and natural gas) the largest emissions source for Council, energy site visits were undertaken to review energy efficiency and reduction initiatives. The following section summarises the key recommendations from the energy site visits and further detail is provided in Appendix C. An analysis of increasing renewable energy in the South Australian and Australia electricity grid has also been incorporated to inform the all-electric transition.

4.2 Energy analysis

The table below summarises the top 5 facilities by consumption which was used to identify locations for the site visits.

Table 3: Top 5 energy consuming sites

Asset	Annual Electricity Consumption (kWh)	Annual Gas Consumption (MJ)	Total Energy Consumption (kWh)	Percentage Share (%)
Wastewater Treatment Plant	1,745,146	-	1,745,146	69.3%
Mount Barker Caravan and Tourist Park	280,655	499,063	419,284	16.6%
Sports Hub	93,455	192,119	146,821	5.8%
Mount Barker Civic Centre	116,850	-	116,850	4.6%
Environmental Service Centre(ESC) & Council Depot	90,896	-	90,896	3.6%
Total	2,327,002	691,182	2,518,997	

It should be noted that the 2022/23 data did not include the existing swimming pool with the new Regional Indoor Aquatic & Leisure Centre in construction. The existing pool was a relatively large user of gas and therefore the new pool, which is all-electric and includes rooftop solar PV, will increase electricity consumption for Council.

Following a review of the sites, it was noted that most of the facilities were either relatively new, due to be replaced in the near future, or were undergoing upgrades which will impact the energy profile as per the following:

Asset	Notes
Wastewater Treatment Plant	Major capital works project underway to replace the wastewater treatment plant with the construction tender recently awarded. The new facility is expected to be operational in 2027 and the old facility will be decommissioned.
Mount Barker Caravan and Tourist Park	6 new cabins in delivery to replace older transportable cabins. Staged replacement over the coming years will gradually replace all older cabins.
Sports Hub	New facility opened in 2021. Based on the facility design and services it is expected the building certification was approved under NCC 2016 Section J requirements.
Mount Barker Civic Centre	The Homemaker Centre is not owned by Council which limits opportunities. A 5-year lease extension was being entered into to continue operations until the new Mount Barker City Centre Project is complete with a new Council office facility.
ESC & Council Depot	The ESC has been developed in stages with Stage 2 including a new field services centre and community use facilities. It is expected the building certification was approved under NCC 2016 Section J requirements.

Due to the age of most of the facilities, the energy reduction initiatives are limited to ongoing improvements in energy efficiency with the exception of the Caravan Park which has a number of opportunities due to the age of the facilities.

The largest emissions reduction opportunities which require capital investment include:

- **Caravan Park communal gas replacement (hot water and gas clothes dryers)**
- **Caravan Park cabin gas to heat pump replacement**
- **Caravan Park – 30kW Solar PV**
- **Sports field LED lighting replacement (adjacent caravan park)**
- **Amenity blocks (toilets) - LED lighting and automatic lighting controls**
- **Reconfiguring the solar PV at the ESC to supply the whole site and reduce export to the grid.**

Refer to the Energy efficiency projects section below for further information and Appendix C which includes the full summary of energy improvements identified during site visits.

4.3 Energy efficiency projects

It is recommended that the following projects are implemented as part of the Council's energy efficiency programs:

Project	Cost (\$)	Consumption Reduction (kWh)	Emissions reduction estimate (t CO2-e)	Annual cost reduction (\$)	Simple payback (yrs.)	Recommended to proceed?	Comments
Caravan Park communal gas replacement (hot water and gas clothes dryers) 	\$50,000-\$80,000	53,152*	9.8	\$7,605	6-10 years	Yes	Install cost will be dependent on approach and quality of equipment. Calculations have allowed for commercial heat pumps and dryers and lower cost options may be available.
Caravan Park cabin gas to heat pump replacement 	\$24,000-\$54,000 (\$1,500-\$3,000 per cabin)	32,891	6.3	\$1,180	>20 years	No	Gas consumption for cabins not sufficient to justify immediate replacement program. Transition to all-electric with heat pumps at replacement e.g., when units fail and for all new cabins.
Caravan Park – 30kW Solar PV 	\$30,000-\$45,000	25,200	8.3	\$7,308	4-6 years	Yes	Solar PV recommended to support all-electric transition (heat pumps hot water and dryers). A 30kW system has been allowed for in the calculations however a shading analysis will be required to confirm suitable rooftops.
Sports field LED lighting replacement (adjacent caravan park) 	\$5,000-\$6,000	2,555	0.84	\$920	5-6 years	Yes	Improved public lighting for sports field, and reduced consumption, emissions and costs
ESC solar PV reconfiguration / rectification 	\$8,000-\$11,000	55,000-65,000	18-22	\$10,000-\$12,000	1 year	Yes	Quotes received from electrical contractors, and it is recommended Council proceed as soon as possible.
Amenity blocks (toilets) - LED lighting and automatic lighting controls	\$5,000-\$8,000	6,643	2.19	\$2,391	2-4 years	Yes	Calculations have assumed lighting upgrades from fluorescent lights with automatic switch off when facility locked. Price for integration with alarm / security systems not incorporated.
Total	\$100,000 - \$150,000	120,000 kWh	47t CO2-e	\$30,000	5-7years		

Project	Cost (\$)	Consumption Reduction (kWh)	Emissions reduction estimate (t CO2-e)	Annual cost reduction (\$)	Simple payback (yrs.)	Recommended to proceed?	Comments
Additional energy opportunities The following has been identified from reviewing existing Council documentation for the new Regional Aquatic & Leisure Centre. The consumption estimates are based on benchmarking undertaken by the project team and are a							
Larger solar PV car park array (700kW total) at new aquatic centre 	\$1.3-\$1.6m	996,699	329	\$179,000	8-9 years	Yes	Due to the significant load from the aquatic centre, and the additional opportunities to incorporate energy storage and EV charging into the aquatic centre in the future, a larger solar PV array is recommended for further investigation.
Larger solar PV car park array and battery storage at new aquatic centre 	\$2.3-\$2.8m	10,068	3.3	\$2,000-\$5,000**	12-15 years (incl. solar PV)	Maybe	Battery storage should only be investigated further if incorporated into a PPA / VPP arrangement where Council are not required to operate and maintain the battery. Additional revenue opportunities available from Frequency Control Ancillary Services (FCAS) and Demand Response markets which will increase financial viability.

*kWh equivalent compared to gas consumption (MJ)

**Cost reduction on top of solar PV without VPP in integration.

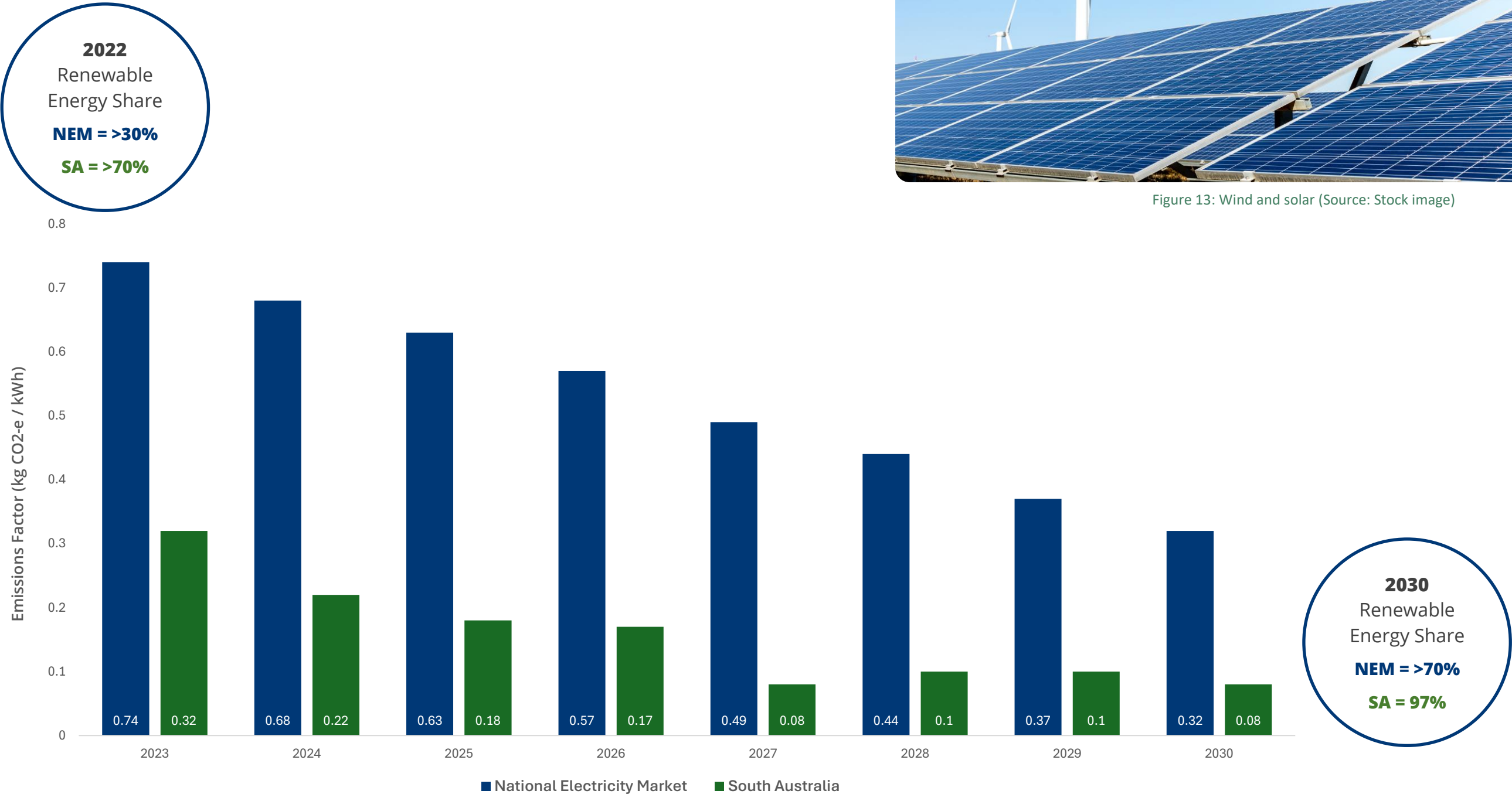
4.4 Renewable energy opportunities

Although electricity emissions are currently the highest, emissions projections should also be considered to inform priorities. A key projection to consider is the increasing renewable energy across Australia, which is projected to reach >70% renewable energy generation by 2030 and has already been achieved in South Australia (refer adjacent and below). This will reduce electricity emissions significantly while supporting all-electric buildings and vehicles.

However, there is no guarantee that the projections, and in particular the renewable energy and electricity transmission investment required to achieve the projections, will be achieved without continued focus on supporting both onsite and offsite renewable energy investment. As a result, this Plan recommends that increased onsite and offsite solar PV continue to be invested in as part of emissions reduction initiatives. This is explored further in the Emissions reduction initiatives section.



Figure 13: Wind and solar (Source: Stock image)



5 Emissions projections & priorities

5.1 Introduction

The following section provides a summary of the emissions projections developed to understand future emissions profiles and ensure emission reduction initiatives are focussed on priority emissions sources. The projections include a business-as-usual pathway and pathways for the Council to accelerate the net zero emissions transition.

Based on the emissions projections, emissions reduction initiatives have been developed to work towards net zero emissions.

5.2 Business-as-usual pathway

The following business-as-usual (BAU) projection has been developed to estimate the Council's emissions inventory in 2035. The projections are based on the Council maintaining existing policies and approaches and does not target the net zero emissions transition as a key strategic priority.

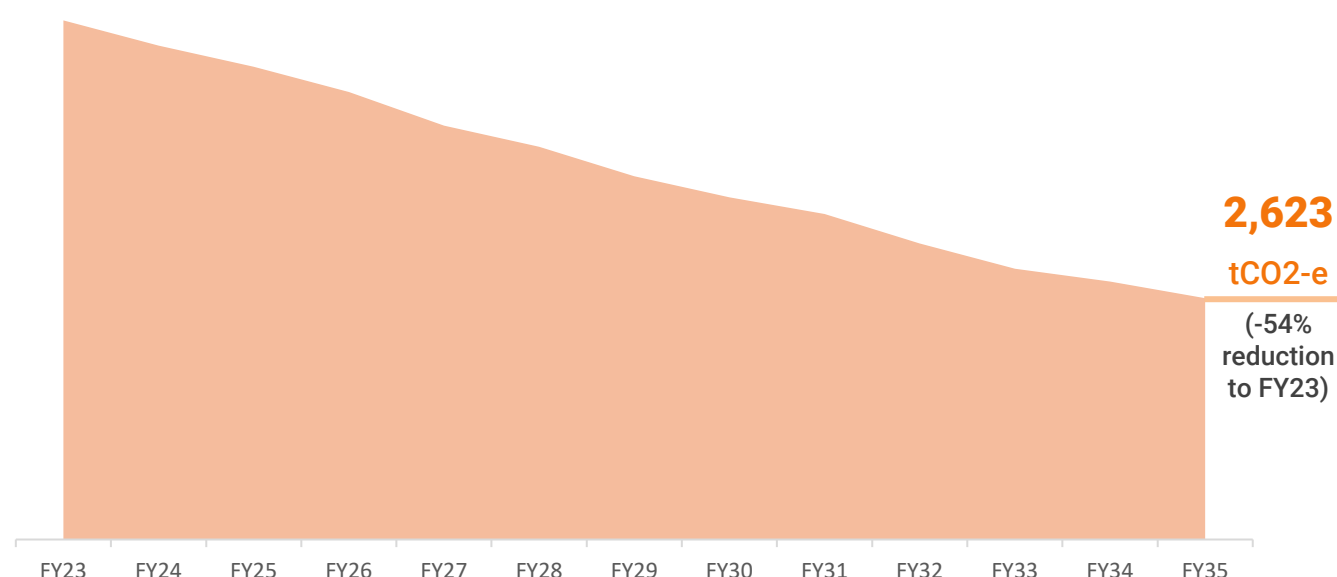


Figure 14: BAU emissions projection

The projections identify that emissions will reduce by an estimated 54% by FY35, largely due to increasing renewable energy in Australia. In addition, minor reductions from other emissions sources will contribute to this reduction such as fuel and vehicle efficiency improvements and reduced waste to landfill.

The projections are based on the Australian Emissions Projections 2023 report which is published by the Department of Climate Change, Energy, the Environment and Water^{iv}. Australia is currently falling behind these projections due to a slowdown in renewable energy investment and approvals. As a result, it is important that Council does not rely on these projections to reduce emissions and instead supports increased investment in the highly efficient facilities that are powered by onsite and offsite renewable energy.

Key things to consider when using emissions projections:

- The projections are based on collective action by federal, state, and local governments, as well as commercial and community action to reduce emissions. Local government, as a critical connection to businesses and communities, will be a key actor in achieving the projected emissions reductions.
- There is no guarantee that the projections, and in particular the renewable energy and electricity transmission investment required to achieve the projections, will be achieved without continued focus on supporting both onsite and offsite renewable energy investment.
- Relying on the rest of Australia to decarbonise and reduce emissions for Council does not demonstrate leadership in supporting the net zero emissions transition and responding to community concerns on climate change.
- Global GHG emissions are not on track to achieve the Paris Agreement based on current policy and action. Although Australia is a small part in global emissions, Australia has one of the highest GHG emissions per capita at approximately 20tCO2-e / capita^v. The emissions intensity from electricity generation is also amongst the highest in the developed world^{vi}.
- Australia has one of the highest energy use intensities in the world i.e., Australia is inefficient in the way it uses energy due to issues such as lower performing buildings and lower efficiency standards for buildings, vehicles, and appliances. Improving energy efficiency and productivity is a critical pathway to reducing emissions, while also reducing the amount of electrical infrastructure and renewables required for the net zero transition.

5.3 Emission reduction priorities

The following emissions categories represent the largest emissions priorities which should be targeted to work towards net zero emissions while improving council and community facilities, reducing costs, and demonstrating leadership. The table below has been separated into the largest single sources of emissions to enable emissions reduction initiatives to be prioritised e.g. Fleet fuel, staff commute, and fleet vehicles have been combined as they are interrelated with emissions reduction priorities identified which are summarised in further detail in the following section.

Table 4: Summary of largest emissions sources and priorities

Emission category		Reduction priorities	Contribution (%)	
Energy		Electricity • Optimise / maximise onsite renewable energy (solar PV) + Power Purchase Agreement • Energy efficiency upgrades • 100% all-electric facilities	60%	61%
		Natural Gas • All-electric buildings and services	1%	
Transport		Transport - Fleet fuel & staff commute • Fleet optimisation / review • EV fleet transition	20%	24%
		Machinery and vehicles • Transition petrol powered equipment to electric	4%	
Waste		Waste to landfill • Waste management, diversion and tracking	5%	5%
Water		Water • Alternative water supplies • Water conservation / efficiency programs	2%	2%
Supply Chain		Reducing supply chain emissions including: • ICT services and equipment (4%) • Cleaning and chemicals (0.6%) • Food (0.2%) • Office equipment and supplies (0.1%) • Products (0.1%)	6%	6%

To address the emission priorities, the following provides a summary of the main emissions reduction initiatives that are recommended for Council to implement.

5.4 Energy

Electricity and natural gas are a major source of emissions. However, as renewable energy generation has increased, electricity has become a lower emission, higher efficiency, and more cost-effective form of energy. This includes being directly powered by either onsite and offsite renewable energy, ongoing improvements in electric systems efficiencies, technological advancements, and the ability to implement improved monitoring and controls. Utilising one form of energy also reduces duplication and removes the need for gas meters and infrastructure costs to the building.

Whereas natural gas, which is a direct Scope 1 emissions source, is becoming increasingly uncompetitive as it cannot be powered by onsite renewables (rooftop solar PV), does not take advantage of SA's increasing renewable energy generation, and will not increase in efficiency due to the limitations of combustion.

It is therefore recommended that Council transition its facilities to 100% renewable energy powered, all-electric buildings and systems to reduce operating costs and emissions. This includes consideration of the outcome of the Power Purchase Agreement (PPA) investigations currently underway by local councils and investigating Council's own PPA if the outcomes from these investigations are creating financial and environmental benefits.

The following ongoing emissions reduction opportunities for Council are recommended.

5.4.1 Increased onsite solar PV

Maximise and optimise rooftop solar PV to support the all-electric transition and provide renewable energy to electric vehicles including:



Figure 15: Civic Centre Solar PV System

Environmental Services Centre
Reconfigure the ESC solar PV system to supply the main field services offices and community facilities to increase self-consumption and reduce costs and solar PV exports.

Rooftop solar PV Systems
Mandate solar PV installations as part of new capital works projects including the new City Centre Project.

- Typical commercial payback of 4-7 years. Approximately \$1,300-\$1,500 per kW installed.
- Enables all-electric transition for buildings and transport e.g. heat pumps and electric vehicle charging.
- Supports renewable energy transition for the electricity grid while reducing costs.
- Can be coupled with energy storage for back-up power.

The new swimming pool already has a large solar PV system and is all-electric supporting this approach.

5.4.2 All-electric transition

Although gas use is relatively small with the new pool development transitioning to all-electric systems with rooftop solar PV, there are some sites with bottled gas supplying cooktops and hot water (Caravan Park) and hot water for sports facilities (Sports Hub). It is recommended Council plan for the replacement of gas-powered systems at end of life to transition to 100% all-electric facilities over time.

The below provides a summary of the key efficiency improvements of going to all-electric systems, which can also be powered by onsite renewable energy.

Induction cooking

Induction: 90-95% of the energy that goes in is used for cooking

Gas: 40-65% is used for cooking with the rest lost to heating your kitchen



Heat pump hot water

Heat pump: Every kWh of energy that goes in = 4-5x heating hot water (400-500% efficiency)

Gas storage: 85% efficiency, the rest is lost in heat transfer and to the atmosphere.



Figure 16: All-electric options (Source: dsquared)

It is recommended that Council incorporate all-electric replacements as part of their ongoing asset management plans including, LED lighting and HVAC upgrades, replacing inefficient appliances, transitioning from natural gas, and optimising solar PV.



Figure 17: Regional Aquatic & Leisure Centre

5.4.3 100% renewable energy contract

To support the transition to 100% renewable energy, it is important that the Council consider mechanisms to facilitate the continued rollout of renewables across South Australia and Australia. One way to support this is to consider procuring 100% renewable energy as part of Council's electricity contract.

Opportunities include:

- Investigating a Power Purchase Agreement (PPA) to procure 100% renewable energy directly from renewable energy project. Examples include the City of Adelaide's PPA with Flow Power and a recent procurement process run by a group of local SA councils. Advice has been sought to inform
- Procuring 100% accredited Green Power as part of Council's electricity contract. This will attract a price premium however supports ongoing investment in renewable energy projects.

It is recommended that Council consider a PPA which supports renewable energy in South Australia to power Council's facilities. There are several things to consider when negotiating a PPA and/or developing a PPA tender including:

- **Volume and term:** PPA's are typically more competitive when they have a larger volume over a longer period as this provides certainty both to the PPA operator and Council. This can also support the development of new renewable energy projects.
- **Existing and planned consumption and generation:** Understand your energy consumption patterns, future demand (new facilities) and existing and planned renewable energy (onsite solar PV).
- **Pricing:** Understand how the pricing will be structured. There are a number of PPA and pricing structures and independent advice from an energy contracting consultant is recommended.
- **Development risk:** Assess the risks associated with project development if supporting a new renewable energy project. Delays, permitting issues, and construction challenges can impact the project's timeline and financial viability.
- **Price volatility:** Wholesale prices in Australia and South Australia have fluctuated significantly over the last 2 years due to global circumstances, the ageing fleet of coal powered stations in Australia has led to an increase in outages, and the rise of variable renewable energy and rooftop solar PV as an energy generation sources. Potential price fluctuations should be evaluated over the contract term and requires input from an energy contracting consultant.
- **Innovation:** PPAs should be structured to include innovative approaches to energy management including energy performance upgrades, demand management / response, accessing alternative markets such as Frequency Control Ancillary Services (FCAS) for sites that have or are planned to have energy storage, and incorporating a Virtual Power Plant (VPP).

Pursuing a PPA will require internal resourcing as well as expert advice to ensure the PPA is suitable for Council. In addition, learnings from other councils should be sought to ensure that Council are not duplicating work undertaken previously.

5.5 Transport

Transport emissions relating to fleet fuel consumption, the purchase of new vehicles, and staff commute are a significant source of emissions. Due to fuel consumption being a Scope 1 direct emissions source (fossil fuel combustion and direct emissions to the atmosphere), it is a priority that the Council implement emissions reduction initiatives to support a low and zero emissions fleet transition.

The following provides a summary of the emissions reduction outcomes of transitioning to low and zero emission forms of transport per kilometre travelled. For public transport the figure is based on per person per kilometre travelled based on average trip data and fuel use for Adelaide Metro. In line with Council’s transport strategies, it is recommended that Council continue to support public transport infrastructure to support both staff and the community in reducing emission.

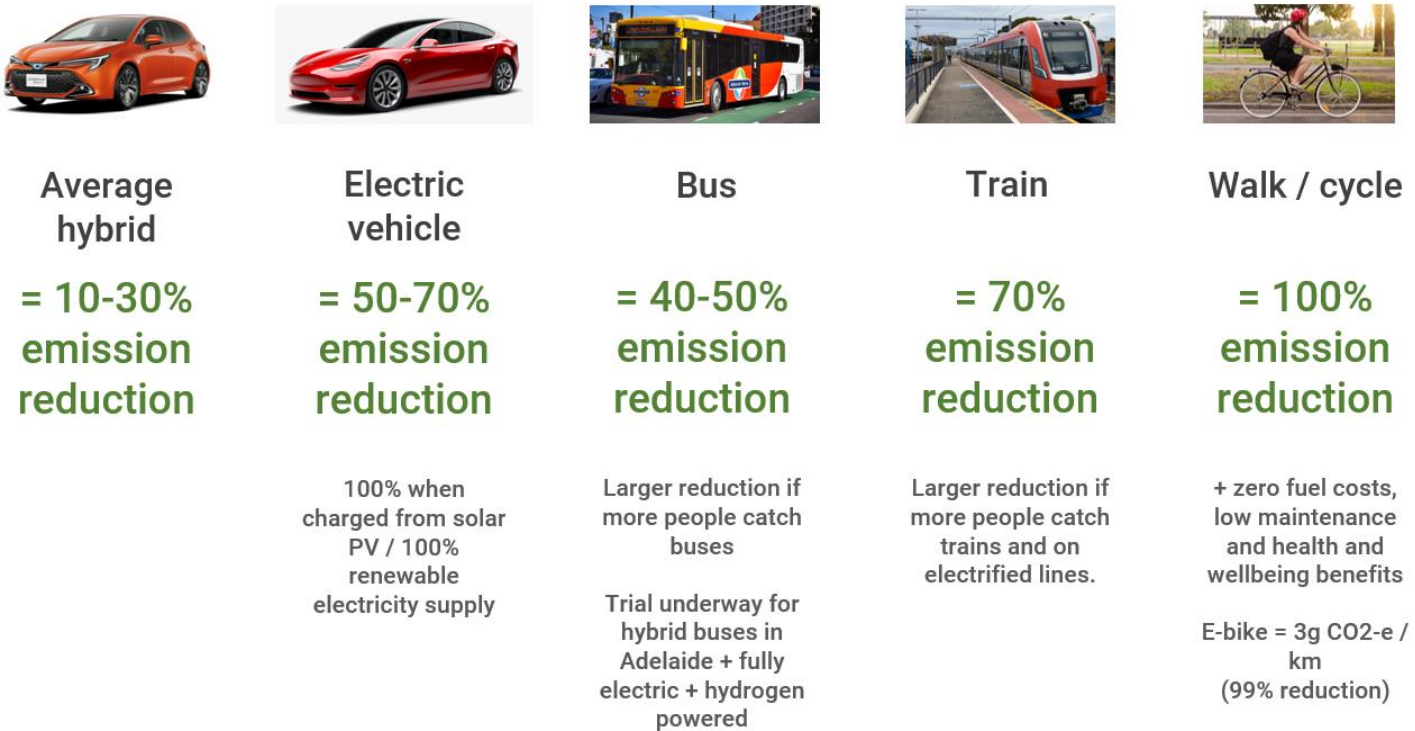


Figure 18: Average emission reduction outcomes from low emission transport (Source: dsquared)

Council’s current light and passenger fleet has transitioned to hybrid vehicles which is expected to have reduced emissions by 10-20% compared to comparable internal combustion vehicle. The next stage will be to develop a fleet transition plan to progressively procure low and zero emission vehicles such as electric vehicles (EVs) and hybrid and electric or hydrogen cell medium and heavy vehicles.

It is recommended Council consider:

- Optimising fleet utilisation and reducing the number of fleet vehicles if possible. This will reduce emissions at purchase while reducing costs.
- Transitioning existing hybrid light and passenger vehicles to EVs by 2030 based on the current replacement cycle. It is expected this may occur earlier with EVs already identified by Council, however the emissions and cost savings are likely to occur in the year following.
- Increasing budgets to account for the higher upfront cost (30-40%) as well as considering increased repair and insurance costs (average increase of \$660 per annum for EVs due to higher upfront cost as well as increased repair costs if damaged^{vii}).

- Reviewing EV charging infrastructure requirements, including electrical capacity of Council facilities and identifying EV charging locations for fleet vehicles.
- Developing a procedure / approach for EV charging at home for staff that use fleet vehicles for daily commute, as well as implementing processes for public charging.
- Developing a fleet replacement policy which requires the lowest emissions, operationally suitable vehicle to be purchased at replacement e.g., vehicle emissions should be assessed as part of fleet replacement planning and procurement practices.
- Reviewing risks and opportunities associated with transitioning to EVs including:
 - **Work Health and Safety (WHS)** issues such as trips for charging cables. Charging sites should include cable management systems and signage.
 - **Charging infrastructure:** Including electrical capacity and distances to charging locations.
 - **EV fires** are topical, however it should be noted that based on worldwide statistics, EVs have a 0.0012 per cent chance of catching fire, compared to 0.1 per cent for internal combustion vehicles^{viii}. This does not however address the fact that EV fires can be significantly more difficult to contain due to thermal runaway. Charging locations should preference locations in open car parks (not in building under-crofts) and include automatic shutdown isolation buttons in safe locations away from the charging stations to isolate the electrical supply.
 - **Back-up power provisions** and charging during a power outage.
 - **Training** and development requirements for employees required to use EVs.
 - **Innovations:** Future innovations should be considered including Vehicle-to-Grid (V2G) and Vehicle-to-Home/Building (V2H) which enables EV batteries to be used as energy storage for buildings and grid stability. Options are currently limited to residential scale with the Nissan Leaf and Mitsubishi EVs capable of V2H, and trials for V2G e.g., the Flinders University V2G trial below with grant funding from SA Government^{ix}.



Figure 19: Flinders University Vehicle-to-Grid Trial

5.6 Sustainable procurement

With Scope 3 emissions becoming one of the largest emissions sources for Council, sustainable procurement policies and procedures are a priority. It is recommended that the Council implement improved procurement procedures and criteria to target the largest emissions sources.

This includes investigating criteria and KPIs for the following topics and aligning with *ISO 20400:2017 – Sustainable Procurement*. Priorities include Professional Services, ICT services and equipment, Cleaning and chemicals, and Office equipment and supplies which account for 15% of Council's emissions.



Avoid / reduce and only buy what is required.



Recycled content and reused materials / products.



Buying from local businesses and local manufacturing.



Preferencing low emissions / carbon neutral products and organisations.



Supporting circular economy and closed loop outcomes.



Preferencing products and materials with reduced waste to landfill e.g. can be readily recycled.



Preferencing suppliers with reduced packaging and take-back schemes at end of life.

Examples of other council's investigating and developing sustainable procurement procedures includes Adelaide Hills Council who have recently completed an analysis against ISO20400 for their own procurement processes and the City of Port Adelaide Enfield's Sustainable Buildings Policy.

Key stages are outlined below (refer Figure 20):



Figure 20: Sustainable procurement stages (ISO 20400 summary)

5.7 Refrigerants

As a Scope 1 emissions source, refrigerant gases used in air-conditioning and refrigeration systems should be a priority for Council. Refrigerants typically have a high Global Warming Potential (GWP) and refrigerant gases can be up to 2,000 to 4,000x more potent than CO₂. Refrigerants are emitted to the atmosphere when air-conditioning and refrigerant systems have a leak e.g. a seal is broken in a reverse cycle air conditioner and needs to be re-gassed.

Based on audits and average recharge data, air-conditioning systems such as split systems and packaged units leak 2.7% of their refrigerants per year. As a result, it is recommended that Council:



Collate improved refrigerant data from HVAC contractors and collate a list of air-conditioning make, model and refrigerant type.



Replace older air-conditioning systems with high GWP refrigerants as part of maintenance programs with more efficient and lower GWP systems.



Mandate low and ultra-low GWP refrigerants as part of maintenance and capital works programs.

5.8 Waste

Although relatively small compared to other emission sources, waste to landfill totals can be easily reduced via effective waste separation and connecting waste materials with circular economy outcomes. With approximately 40% of landfill waste consisting of organic food waste and garden organics, increasing organic waste diversion should be a key priority both as part of Council's operations and in the community.

Council is already supporting waste separation and diversion through a number of programs including providing kitchen caddies and food and organics waste servicing, and therefore increased awareness and support for residents and businesses should be a focus.

It is recommended that Council:



Continue to work with Council's waste contractor to improve waste data collection and tracking for Council facilities to demonstrate diversion rates.



Implement improved waste separation and reduce waste to landfill.

5.9 Embodied emissions

Although excluded from the Council's corporate emissions profile, it is recommended that the Council continue to implement and investigate opportunities to reduce Scope 3 emissions for capital works projects and embodied emissions. Based on previous assessments of council projects and inventories, the largest emissions sources are expected to be:

- Asphalt associated with road replacement programs.
- Concrete for curbs and pedestrian pathways and pavements.
- Concrete and steel in capital works and maintenance projects.

It is recommended that the Council consider:

- Mandating a minimum embodied emissions reduction as part of major capital works projects in line with Green Star requirements. This will require a Life Cycle Assessment (LCA) to be undertaken which will increase consultancy costs but will enable the Council to identify and quantify embodied emission reductions achieved in projects and inform future emission profiles which may include emissions associated with capital works projects.
- Incorporating an embodied emissions / recycled content assessment for all infrastructure projects (e.g. road, pathways, outdoor recreation areas) to continue to focus on embodied emissions. This could be requested as a value add or preference as part of tender documentation where the respondents are responsible for identifying embodied emission reduction opportunities from local suppliers.
- Expanding the use of recycled and low emission materials as part of infrastructure works and tracking progression over time to reduce embodied emissions and demonstrate leadership to the community.
- Developing Sustainable Design Guidelines which incorporate embodied emissions as well as other emissions reduction actions identified in this Plan for all new capital works and major refurbishments.

5.9.1 Embodied emissions opportunities

The following embodied emissions opportunities should be considered.

Table 5: Embodied emissions opportunities

Option	Summary
 Low emission / carbon neutral concrete	Low emission concrete: 30% emissions reduction through improved process efficiencies + recycled content Carbon neutral concrete: Low emissions + carbon neutral certified.
 Cross-laminated timber (CLT)	Replacing or reducing the use of steel with Cross-laminated timber (CLT) which has a lower embodied emissions and can be sourced from a renewable material supply.
 Green / recycled steel	Investigating steel supplies with a higher percentage of recycled content or green steel which uses lower emission production processes such as green hydrogen.
 Reconophalt - Recycled asphalt content	Continue to use recycled content for the asphalt such as Reconophalt which reduces embodied emissions by 20-30%.
 Recycled Crushed Rock	Consider options for recycled crush and rock for use as part of infrastructure works.
 Environmental certifications	Preferencing products and materials that have Environmental Product Declarations (EPDs) and environmental certifications (GECA, Green Tag, etc.) to prioritise lower impact materials and improve data capture.

5.10 Green hydrogen

Green hydrogen is increasingly being proposed as a zero emissions source of energy and an alternative to natural gas. Green hydrogen is created via electrolysis, where renewable energy such as large-scale wind and solar is used to power an electrolyser which splits water molecules to oxygen and hydrogen. Due to being powered by renewables and not emitting CO₂-e pollutants, green hydrogen provides an opportunity to transition away from fossil fuel powered processes and technologies.

Green hydrogen can be used for many different uses including:

- Replacing existing uses of hydrogen including in the chemical industry, refineries, steel production and heat and power generation.
- As fuel in the transport sector including for shipping, aviation, rail, trucks, buses and vehicles.
- Either as a blend in natural gas networks or as a 100% hydrogen replacement for heating e.g., boilers, hot water units, and cooking.
- Power generation, including in gas turbines and power plants.

The vast majority of hydrogen (96%) is currently derived from fossil fuel sources including natural gas (47%), 27% from coal, and 22% from oil as a byproduct^x. Only 4% of global production is currently produced as green hydrogen. Although there is significant investment underway into green hydrogen, there are a number of challenges for the uptake of green hydrogen including:

- High production, storage, and transportation costs.
- The efficiency of hydrogen when factoring in the whole cycle of generating hydrogen down to powering end uses. The below image demonstrates the number of stages required to refuel and power a hydrogen vehicle (which uses an electric engine) versus a battery electric vehicle. The same concept can be applied to commercial and household uses of green hydrogen such as heating and hot water in buildings.

- For each kilogram of hydrogen produced, approximately 50kWh of electricity and 9L of water is required^{xii}. Producing green hydrogen will require significant amounts of new renewable energy generation which is required to decarbonise existing electricity use and will also consume large volumes of water.
- The amount of land required for new renewable energy projects as well as access to fresh water supplies which are already under stress from climate change.
 - Research from the University of Adelaide has demonstrated that seawater can be used as part of the electrolysis process however this technology is still in development and not yet commercialised^{xiii}.
- A lack of international and national standards, legislation, and regulations around the production, storage, transportation, and financial markets for hydrogen.

Although green hydrogen is required to supply industry and processes that are hard to decarbonise or cannot be replaced with other technologies, it is not expected to be readily available for Council use in buildings or transport in the near future. It is recommended that Council focus on current, proven, and readily available technologies which can drive immediate emissions reduction outcomes.

Hydrogen and electric drive

Efficiency rates in comparison using eco-friendly energy

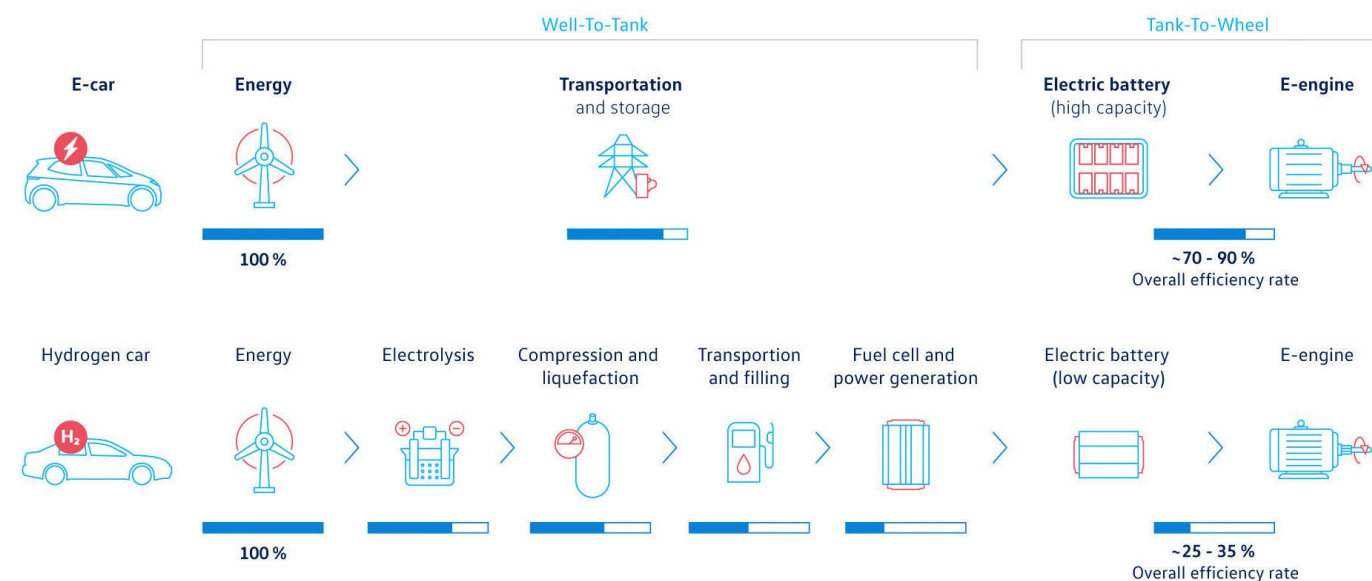


Figure 21: EV vs. Hydrogen Cell Vehicle Comparison (Source - Volkswagen^{xii})

5.11 Carbon sequestration & offsets

While the rest of Australia and the global economy decarbonises, there is also an opportunity for Council to support carbon sequestration to re-adsorb GHG emissions from the atmosphere. A review of carbon sequestration from Council programs as well as options for carbon offsets has been undertaken to determine if carbon sequestration and offsets are appropriate (Refer Appendix D). Based on the review, it is recommended that the Council continue to support street trees and plantings as part of its programs and Tree Strategy which will support carbon sequestration while also increasing climate resilience and reduce the impact of urban heat island effect. However, it is expected that the Council would not be able to sequester a sufficient amount of carbon to make an impact on the Council's emissions profile as part of these programs. It is therefore recommended that the Council investigate opportunities to partner with organisations that specialise in tree planting and revegetation programs with a focus on opportunities within the Council's boundary.

5.11.1 Carbon offset recommendations

If Council were to pursue carbon offsets, a considered approach is required to ensure credible and transparent offsets are purchased that align with Council's priorities. The following highlights the key recommendations when considering carbon offsets, with the initiatives identified in the Plan the highest priority.

1. **Avoid and reduce emissions first**
2. **Carbon removal should be the focus**
3. **Partner with credible and transparent organisations**
4. **Select offsets with social and environmental co-benefits**

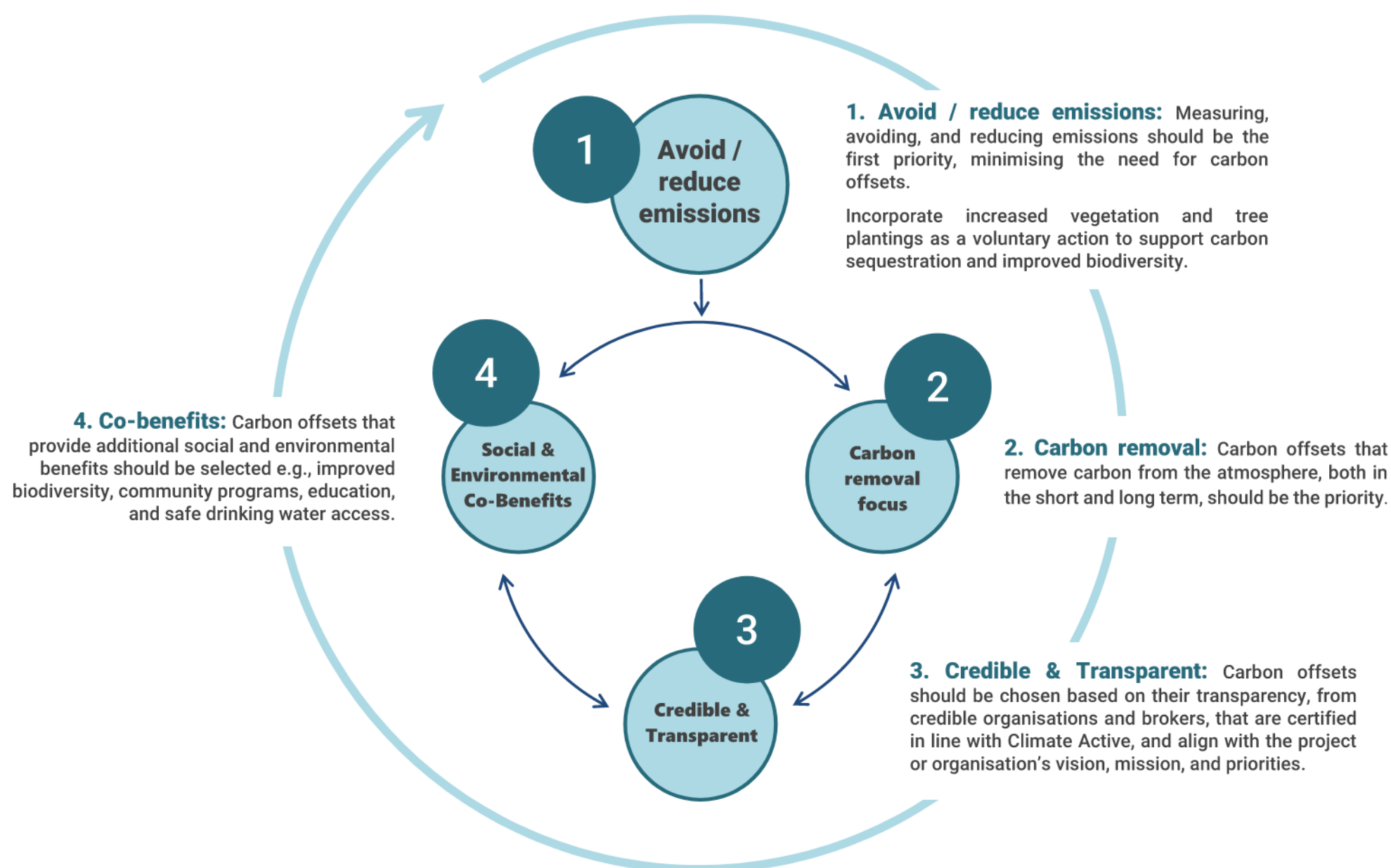


Figure 22: Carbon offset approach (Source: dsquared)

6 Pathway to net zero

6.1 Introduction

The following section summarises the recommended emissions reduction initiatives, targets, program plan, and emissions projections based on the proposed net zero emissions pathway.

6.2 Emissions reduction implementation plan

Based on the emissions projections and priorities identified in Section 4, the below emissions reduction initiatives and implementation plan is recommended for adoption.

Emission category	Emissions Contribution	Short term (1-3 years)	Medium term (3-5 years)	Long term (5-10 years)	Proposed Target from FY23	Reduction
Energy: 61%						
Key action/s: Support renewable energy and net zero transition with onsite solar PV and all-electric Council facilities.						
 Electricity	60%	- Implement energy efficiency improvements. - Ongoing energy efficiency improvement program.	- All Council facilities have solar PV (where viable / payback < 7 years). 100% renewable energy supply contract (pending Power Purchase Agreement (PPA) cost / benefit review).	100% renewable energy via PPA / electricity contract.	100% renewable energy supply	3,486 tCO₂-e 60% reduction in total emissions
 Natural gas	1%	- Transition to all-electric as part of facilities maintenance and replacement programs. - Mandate all-electric for all minor and major capital works.	Ongoing all-electric replacement program.	100% all-electric by 2030.	100% all-electric Council facilities	68 tCO₂-e 1% reduction in total emissions
Transport: 24%						
Key action/s: Optimise fleet utilisation and transition to hybrid and fully electric fleet vehicles, and support low emissions and sustainable staff commute.						
 Fleet fuel	15%	- Fleet optimisation and replacement frequency review. - Low emission fleet transition plan developed.	Transition light passenger vehicles to EVs by 2030.		100% light EV fleet by 2030	170tCO₂-e 3% reduction in total emissions
		Review low emission medium and heavy vehicle opportunities.	- Transition commercial vehicles (utility vehicles) to hybrid / low emissions. - Consider KPIs / thresholds / targets to assess new vehicle purchases.	- Transition commercial vehicles (utility vehicles) to EVs as the hybrid vehicles fall due for replacement. - Medium and heavy vehicles (trucks) low emission / EV transition.	80% of medium / heavy vehicles zero emissions by 2035	>500 tCO₂-e 10% reduction in total emissions
 Staff Commute	5%	- Staff travel survey to improve data. - End of trip facilities review and improvements. - Provision of electric bikes for staff use e.g., travelling between Civic Centre and ESC.	Low emission support / incentives program for staff commute / private vehicles.		10% reduction in staff commute emissions by 2035	25-30tCO₂-e 1% reduction in total emissions
 Machinery & vehicles	4%	- Implement fleet procurement procedures to optimise vehicle selection and prioritise smaller, low emission vehicles. - Electrification of machinery and vehicles.			Pending fleet and equipment review	

Emission category	Emissions Contribution	Short term (1-3 years)	Medium term (3-5 years)	Long term (5-10 years)	Proposed Target from FY23	Reduction
Supply chain: 6%						
Key action/s: Develop / update procurement procedures to preference sustainable and low emission suppliers and products and increase criteria and Key Performance Indicators (KPIs) over time.						
 General suppliers	6%	• Supplier review and hotspot analysis based on highest emissions sources. • Sustainable Procurement Procedure to preference emissions reduction / carbon neutral.	• Update Sustainable Procurement Procedure with increased sustainability / emissions criteria / KPIs.	• Mandate sustainability and emissions reduction criteria / KPIs.	15% reduction in supply chain emissions	45 tCO ₂ -e 1% reduction in total emissions
 ICT services and equipment		• Investigate IT suppliers with sustainability / net zero commitments / carbon neutrality. • Sustainable Procurement Procedure to preference emissions reduction / carbon neutral. • Investigate carbon neutral telecommunications providers.	• Update Sustainable Procurement Procedure with increased sustainability / emissions criteria / KPIs.	• Mandate sustainability and emissions reduction criteria / KPIs.		
 Cleaning and chemicals		• Optimise cleaning frequency, reduce the use of chemicals and preference carbon neutral organisations as part of future cleaning contracts.	• Mandate reduced chemicals and implement waste reduction targets as part of cleaning contracts.			
 Office equipment and supplies		• Preference reused office furniture and equipment. • Review opportunities to reduce paper use and increase recycled paper procurement.				
Other: 8%						
 Waste	4%	• Implement improved waste tracking and diversion initiatives with Council waste service provider.			20% reduction in waste to landfill	50 tCO ₂ -e 1% reduction in total emissions
 Water	3%	• Ongoing building and irrigation consumption monitoring and performance tracking.			Emissions expected to reduce as the grid de-carbonises	TBC – To be reviewed each year to track performance
 Refrigerants	1%	• Implement low Global Warming Potential (GWP) Refrigerant specifications as part of maintenance and replacement programs. • Mandate low / ultra-low GWP refrigerants as part of capital works programs.			TBC – Pending improved data collection	10 tCO ₂ -e <1% reduction in total emissions

6.3 Net zero pathway projections

Based on the above initiatives, the following net zero pathway has been developed to demonstrate the estimated emissions reduction achieved by FY35. Two scenarios have been developed with a 100% renewable energy contract option included for comparison, as well as an accelerated zero emission vehicle transition for medium and heavy vehicles. The projections demonstrate that Council can reduce emissions by over 60% based on the net zero pathway compared to the FY23 baseline, and up to 77% if the medium and heavy fleet is targeted.

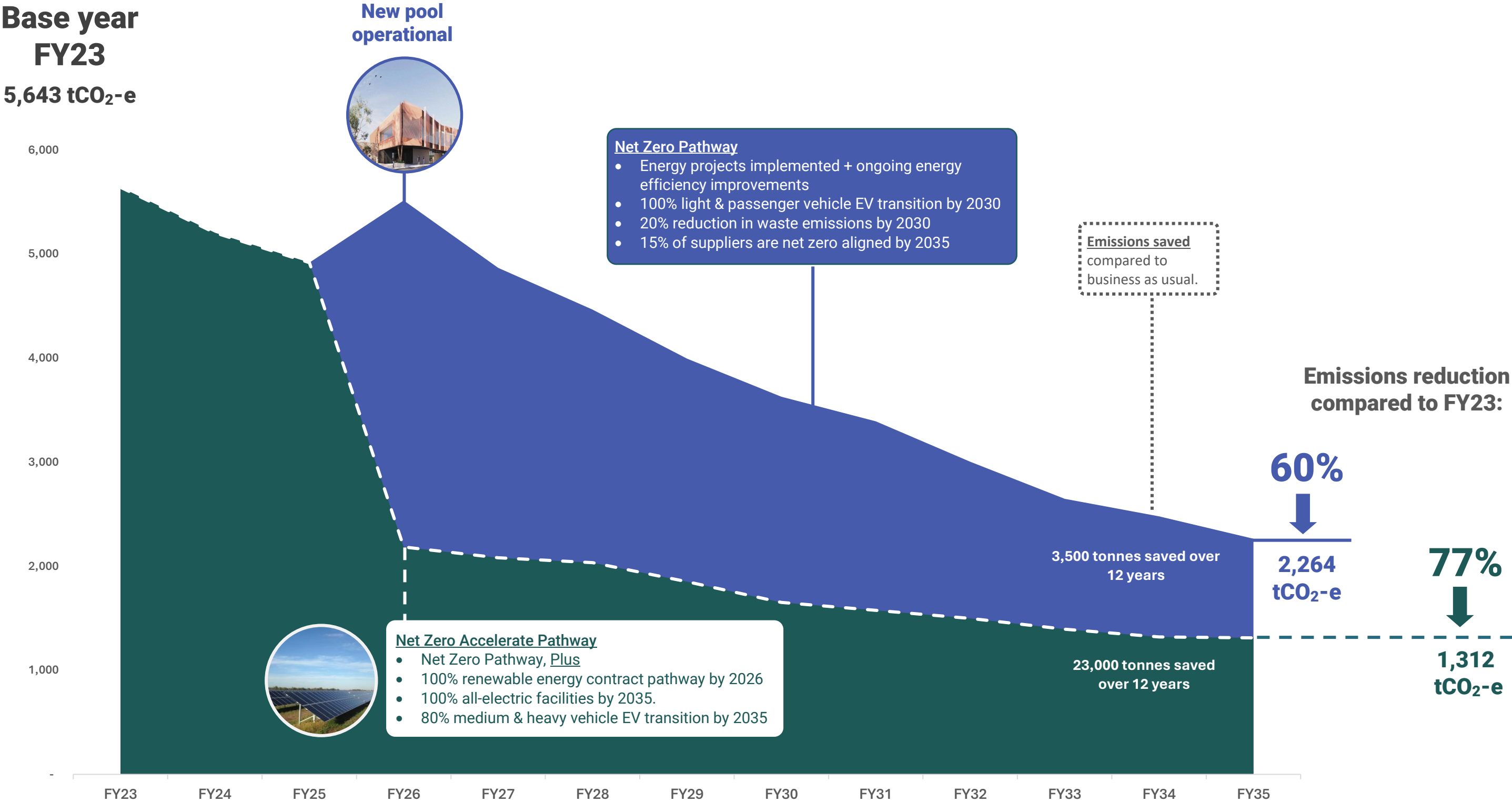
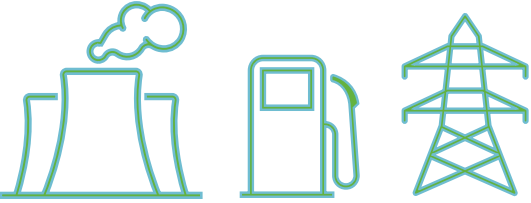


Figure 23: Pathway to net zero graphic

6.4 Emissions reduction target

Based on the emissions projections, it is recommended that the Council considers a 60% emissions reduction target for 2035, with a commitment to review the emissions inventory and target in 3 years' time to confirm progression. The 60% emissions reduction target is estimated to be in alignment with and exceed South Australia's goal for a 50% emissions reduction by 2030 which is based on a 2005 baseline (refer Figure 24). This will demonstrate leadership while also being based in pragmatic actions that can be implemented over time.

FY23



Scope 1,2 & 3 emissions inventory

2035

>60% emissions reduction by 2035

2035

>75% stretch target by 2035

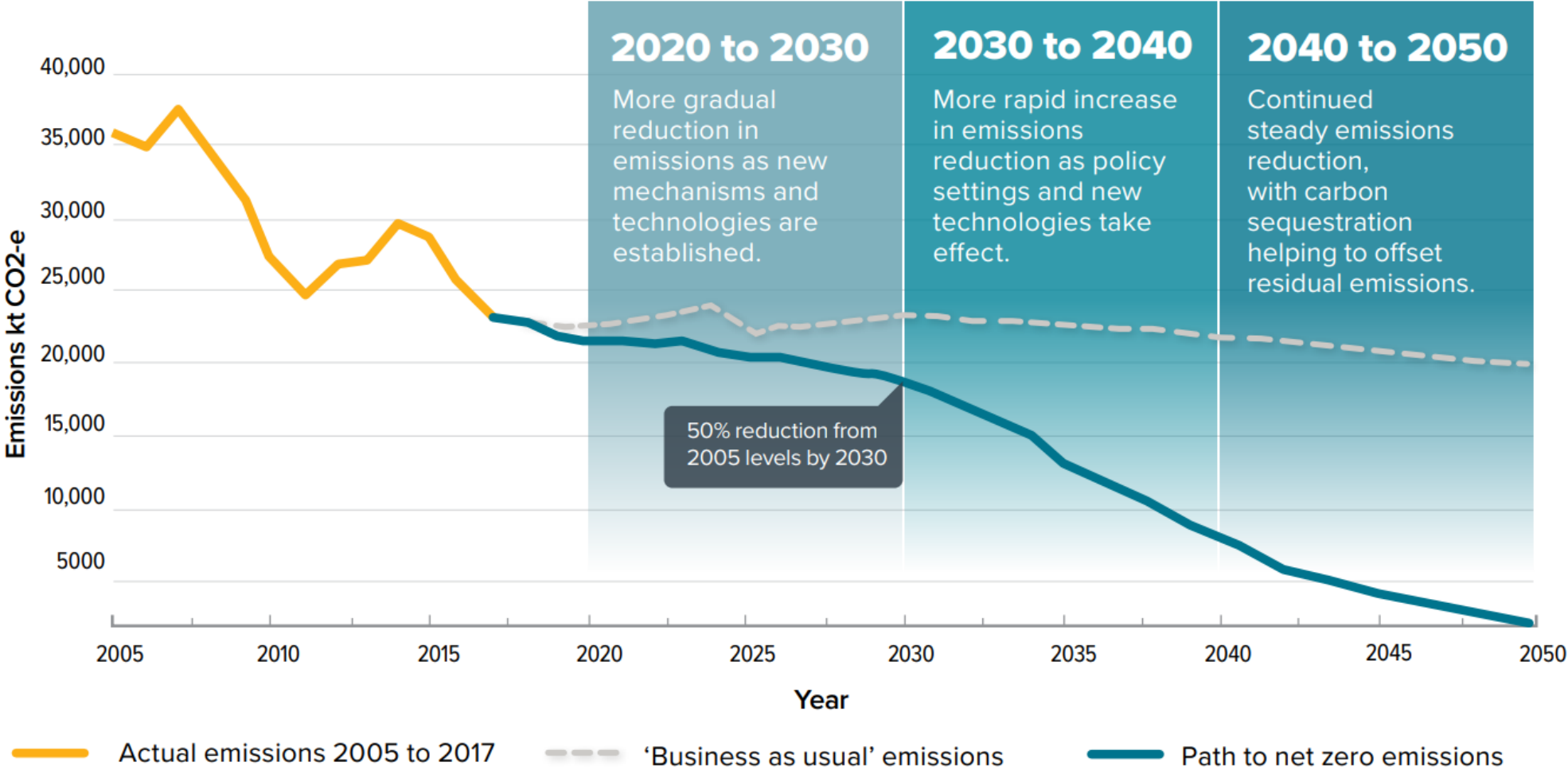


Figure 24: SA Government pathway to net zero emissions

6.5 Financial summary

The following cost estimates have been developed to inform Council budgets for projects that are expected to have a capital or operational budget requirement. It is recommended that the Council considers the below budgets and staging as part of developing forward plans and strategies.

Table 6: Implementation stages and financial summary

Legend:

Additional plan / investigation

Capital investment

Emission category	24/25	25/26	26/27	27/28	28/29	29/30	30/31
 Electricity +  Natural gas	\$160,000 – Energy efficiency improvements	\$1.6m for solar PV car park array at new aquatics centre					
	Implement energy efficiency program and all-electric transition. Update Council ESD guidelines / specifications to improve energy efficiency and transition remaining facilities from natural gas. Solar PV Program: All Council facilities have solar PV (where viable / payback < 7 years - solar PV average cost \$1,300-\$1,500 per kW).						
	Investigate Power Purchase Agreement Cost: \$30,000	100% renewable energy supply contract (pending Power Purchase Agreement (PPA) cost / benefit review). PPA may provide a lower cost option for electricity including 100% renewable energy compared to the LGA contract. Cost: TBC based on PPA investigations underway.					
 Transport - Fleet fuel	Low emission passenger fleet transition plan developed. Cost: \$12,000-\$15,000	Transition light passenger vehicles to EVs including EV charging review. Cost: Pending detailed fleet plan. Approx. 30-40% price increase compared to internal combustion equivalent. Prices will reduce and are expected to reach price parity in 2033. Allow \$200,000 per year for EV transition pending detailed review.					
			Low emission medium / heavy fleet transition plan developed. Cost: \$12-\$15,000	Transition commercial vehicles (utility vehicles) to hybrid. Cost: TBC – Pending vehicle release / availability.			
					Begin medium / heavy vehicle low emission transition. Cost: TBC – Pending vehicle release / availability		
 Machinery and vehicles	Review fleet procurement procedures. Resources: In-house						
 Transport - Staff Commute	Staff travel survey to improve data. End of trip facilities review and improvements. Resources: In-house	Low emission support / incentives program for staff commute.					

Emission category	24/25	25/26	26/27	27/28	28/29	29/30	30/31
 Sustainable Procurement	Supplier review and hotspot analysis based on highest emissions sources. Resources: In-house	Develop Sustainable Procurement Procedure with increased sustainability / emissions criteria / KPIs. Cost: \$15-\$20,000		Mandate sustainability and emissions reduction criteria / KPIs.			
 Refrigerants	Implement low Global Warming Potential (GWP) Refrigerant specifications as part of maintenance and replacement programs. Mandate low / ultra-low GWP refrigerants as part of capital works programs.						
 Embodied emissions	Investigate opportunities to implement increased recycled content as part of landscaping programs.	Undertake Life Cycle Assessment (LCA) of priority capital works projects. Cost: \$12-\$15,000					
		Develop Sustainable Design Guidelines for capital works and major refurbishments including emissions reduction actions identified in this Plan. Cost: \$15,000	Mandate minimum recycled content / low emission materials as part of maintenance and capital works programs. Include in Sustainable Procurement Procedure.				
 Detailed plans / audits	\$42,000-45,000	\$40,000-\$50,000	\$12,000-\$15,000				Planning budget: \$94,000-\$110,000
 CAPEX Budget	\$160,000	\$1.8m	\$200,000	\$200,000	\$200,000	\$200,000	CAPEX: \$2.8M

7 Community emissions

The Council's emissions inventory is based on corporate emissions and operations and excludes community emissions which are a major source of GHG emissions and provided below for information. This community emissions data is based on the Snapshot Climate online tool. In FY22, community emissions totalled approximately 291,000 tCO₂-e with Council emissions equating to almost 2% of community emissions. This highlights that by demonstrating leadership to the community and implementing projects that can inform and educate the community, Council can play a key role in supporting the community in reducing emissions.

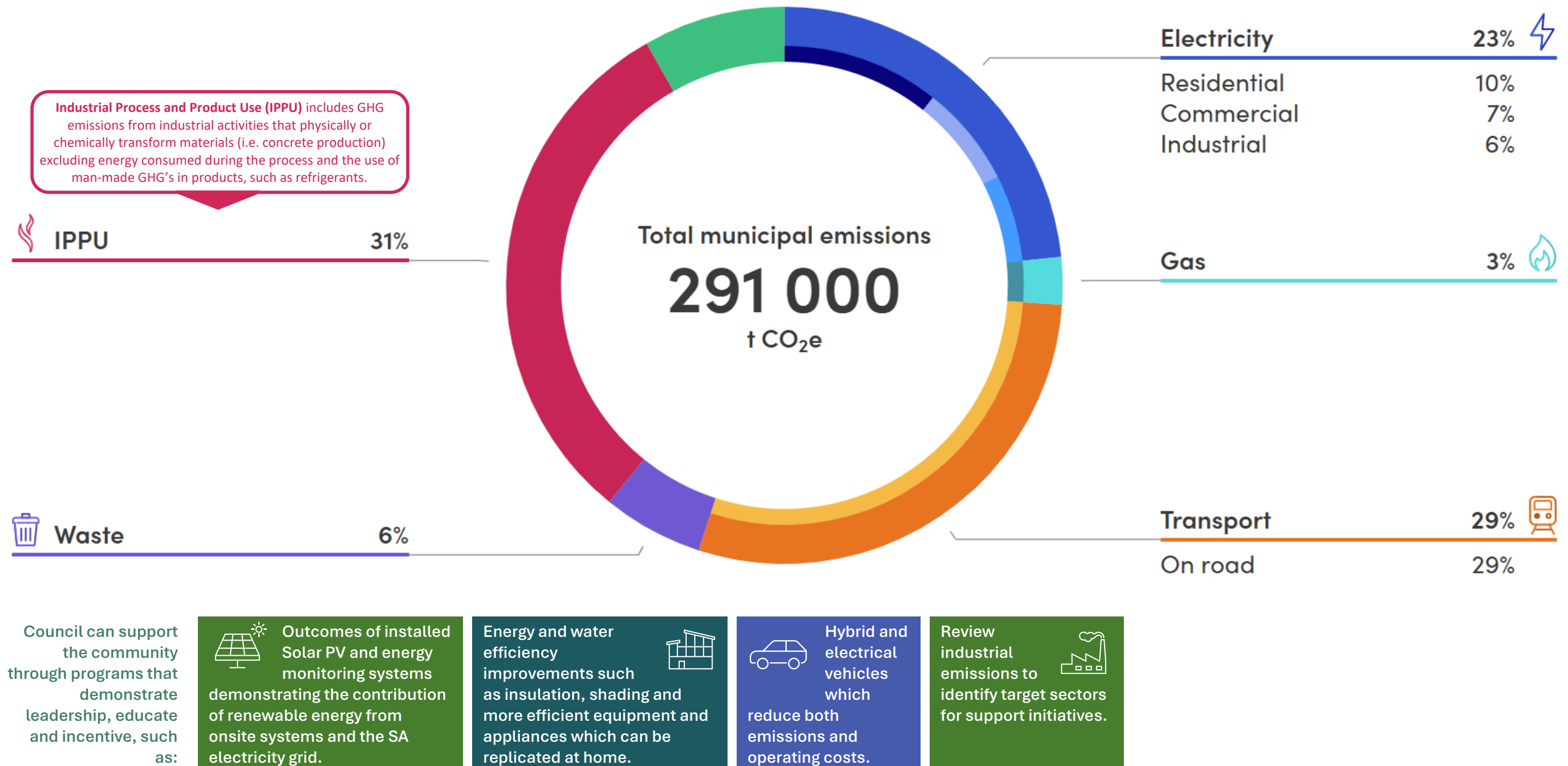


Figure 25: Snapshot Climate - Community Emissions Profile^{xiv}

Appendix A Standards & assumptions

This plan has been developed in line with the following standards and certifications to ensure Council is reporting in a transparent and industry recognised manner. This includes international standards, as well as aligning with the Australian Government Climate Active Carbon Neutral Standard. In addition, assumptions have been made based on a number of references and studies to quantify GHG emissions into the future and enable implementation planning to consider future scenarios.

Greenhouse Gas (GHG) Protocol



The Greenhouse Gas (GHG) Protocol Corporate Standard has been aligned with including setting an emissions boundary based on organisational control and including Scope 1, 2 and 3 emissions in the emissions inventory to capture both direct and indirect emissions.

Additional GHG Protocol guidance has also been used including Scope 2 Guidance and Scope 3 Calculation Guidance documents available on the [GHG Protocol](#) website.

Climate Active Carbon Neutral Standard

The Climate Active Carbon Neutral Organisation Standard, Technical Guidance Manual and templates have been used throughout the development of this plan and associated emission calculations to ensure that in the event Council pursues certification, the emissions inventory and initiatives will meet the minimum requirements.

The key stages in developing an emissions inventory and reduction strategy in line with the Climate Active standards include:

- **Emissions boundary** – Setting a boundary around what is being certified (e.g. Organisation, Building, Precinct, Service or Product). For this plan, the Council's corporate operations would be captured under the Organisation standard.
- **Baseline year** – A baseline year needs to be set (CY/FY) to begin tracking emissions and develop the initial emissions inventory.
- **Register with Climate Active** – Registering with Climate Active provides the applicant with templates and calculators to assist with collating the emissions inventory. The Organisation size will determine the applicable fees and requirements.
- **Emissions sources** – An assessment of the organisations emissions sources and data is undertaken to develop an initial emissions profile. This is used to test emission contributions and start collating data that will need to be included in the inventory.
- **Relevance test** – Check which emission sources are relevant to the certification and should be included in the inventory.
- **Emissions data** – Collate detailed emissions data to quantify the emissions and input into the Climate Active Inventory spreadsheet and associated calculators.

- **Non-quantified emissions** – Confirm which emissions you don't have data for and whether they should be incorporated into the inventory. Where an emissions source has been identified in the relevance test as being required, but data is not available, a data improvement plan is required to include the data in future inventories and an uplift must be applied representing the expected emissions size. For example, if the organisation does not have access to all of its supplier expenditure data, an estimate should be made and percentage (%) added to the emissions total to account for this.
- **Emission reduction strategy** – Once the organisation has an emissions inventory collated, a 5 year emissions reduction strategy is required to demonstrate how the organisation will reduce its relevant emissions as far as practicable. Realistic, quantified and time bound strategies and actions must be identified that can be reported on annually.
- **Carbon offsets** – Approved carbon offsets will need to be purchased for the total emissions inventory each year. Options include:
 - Australian Carbon Credit Units (ACCUs)
 - Certified Emissions Reductions (CERs)
 - Removal Units (RMUs)
 - Verified Emissions Reductions (VERs)
 - Verified Carbon Units (VCUs)
- **Documentation** – The Climate Active documentation is completed throughout the process including the Public Disclosure Statement (PDS), emissions inventory, calculators and associated records for certification. For the audit, it is recommended that a Basis of Preparation document is collated outlining emission data sources and how calculations have been done when not using the Climate Active Calculators. This will support the Registered Consultant or technical assessor in reviewing the data.

Science-Based Target initiative (SBTi)

Science Based Targets follow a similar approach to Climate Active with the exception that Scope 1 and 2 are mandatory however Scope 3 can be excluded unless Scope 3 emissions account for over 40% of the emissions profile. It should be noted that Scope 3 emissions are typically over 80% of a corporate organisation's emissions profile, unless it owns large manufacturing plants or power plants which generate large amounts of Scope 1 emissions.

In addition, Science Based Targets do not provide a certified carbon neutral or net zero outcome via the purchase of offsets but rely on targets and actions to reduce emissions in line with the commitments made under the Paris Agreement.

As a minimum, an emission inventory must be developed, and targets set to reduce GHG emissions in line with either a 1.5°C or well-below 2°C temperature increase pathway. For this to be achieved, a carbon budget must be set to reach net zero emissions by 2050 or earlier.

Assumptions & projections

The following assumptions and projections have been used in developing emissions projections to ensure the Council is prioritising emission reduction initiatives based on the expected context in the future. Electricity and transport are the main focus of the projections as they account for over 60% of Council's GHG emissions, and therefore understanding future scenarios is critical to prioritise emission reduction initiatives.

Electricity emissions

The following electricity emissions projection have been incorporated to consider how increasing renewable energy will impact the Council's emissions profile.

- **Australia's Emissions Projections (October 2023)**, published by the Department of Industry, Science, Energy and Resources. Renewable energy in South Australia was projected to reach 97% by 2025*.
- **Australia's Long-Term Emission Reduction Plan (October 2021) and reference data***. This set of projections includes South Australia reaching 97% renewables in 2025 which may not be likely and was published under the previous government. The plan is currently under review.
- **Australian Energy Update 2023 (September 2021)** which states that renewable energy generation in South Australia reached 71% in 2022.
- **National Greenhouse Accounts Factors (2023)** which is the latest available emissions factors for GHG reporting. The latest estimate for electricity Scope 2 and 3 emissions in South Australia is 0.33 kgCO₂-e per kWh.
- **OpenNEM (National Energy Market) Data (2021/22)** which demonstrated over 68% of generation in South Australia in 2021/22 was from renewable energy.
- **Clean Energy Australia Report 2022 (April 2022)** which states that renewable energy generation in South Australia reached 66.5% in 2020/21.
- **AEMO Integrated System Plan (June 2022)**: Insights into future energy infrastructure have been used to inform potential renewable energy integration.
- The South Australian Government's aspiration to reach net 100% renewable energy generation by 2030, including 100% of energy demand met by renewable energy.

Australia is rapidly decarbonising its energy sources with government, non-government and private industry all playing a part in the transition, and electricity emissions will continue to reduce over time. It is therefore a priority that this Plan reflects a potential pathway for electricity emissions, to ensure emission reduction initiatives and capital is not over invested in electricity emissions related initiatives.

The adjacent image provides a summary of South Australia's key energy statistics for 2021/22 from the Australian Energy Update 2023 which confirmed that SA reached over 70% renewable energy share.

SOUTH AUSTRALIA In 2021–22

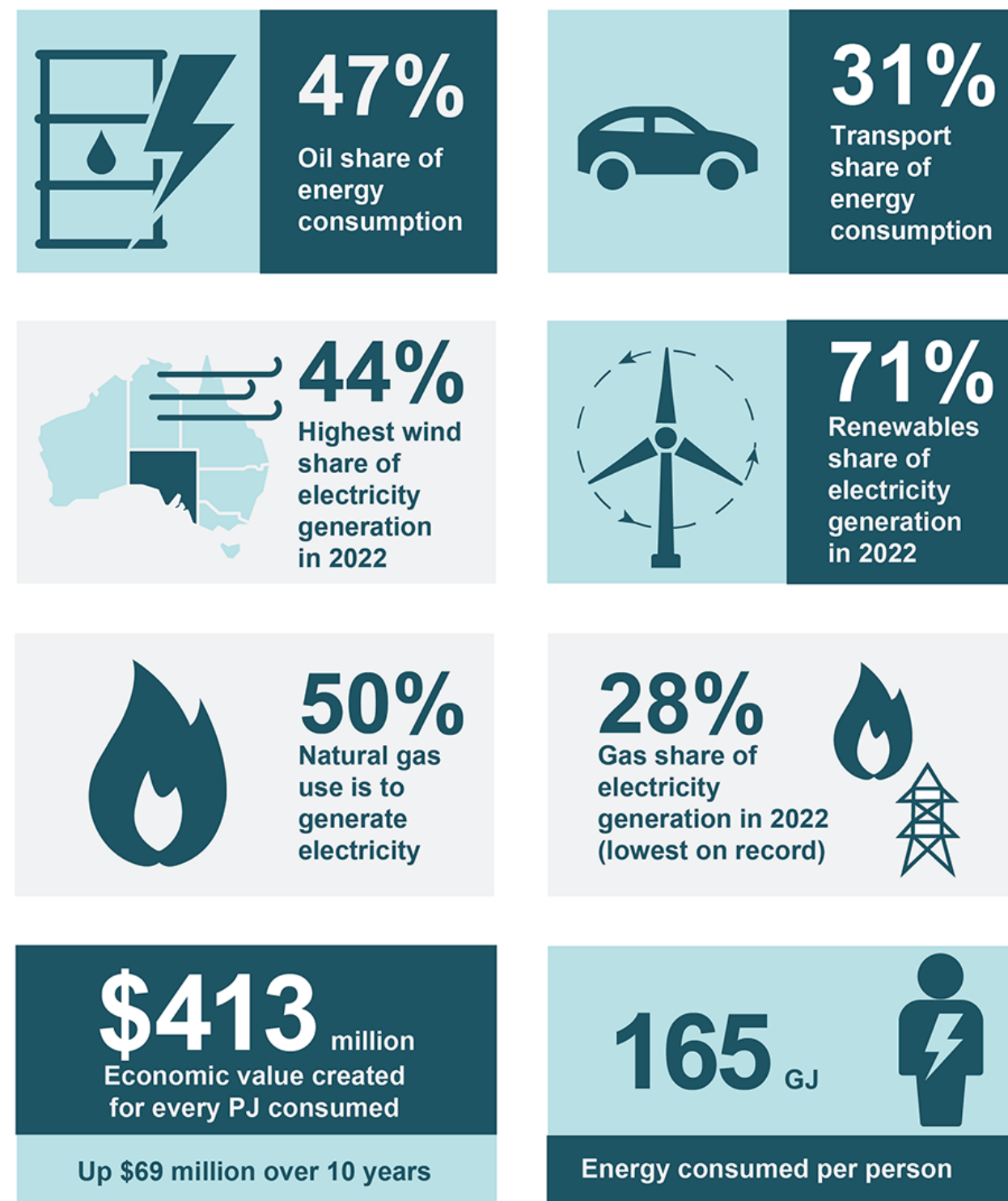


Figure 26: South Australia energy statistics^{xv}

Transport emissions

The following reports and references have been used to inform electric vehicle uptake projections and emission reduction outcomes:

- **AEMO / CISRO Electric vehicle projections 2022 (November 2022):** AEMO publishes reports to assist in modelling the impact of the EV transition on energy demand with approximately 17-18% of new vehicles sales to be an electric vehicle by 2030. This has been used to guide the business-as-usual projection for EV uptake however may be conservative as EV uptake increases.
- **Electric Vehicle Council - State of Electric Vehicles (July 2023)** which demonstrated that in 2023 approximately 8.4% of new car sales were EVs, up from 3.8% in 2022. The report also highlighted the increasing number of EVs soon to be available in the Australian market which is expected to increase uptake, however highlighted that demand is currently out stripping supply, resulting in long wait times for EVs.

Appendix B Additional emissions inventories

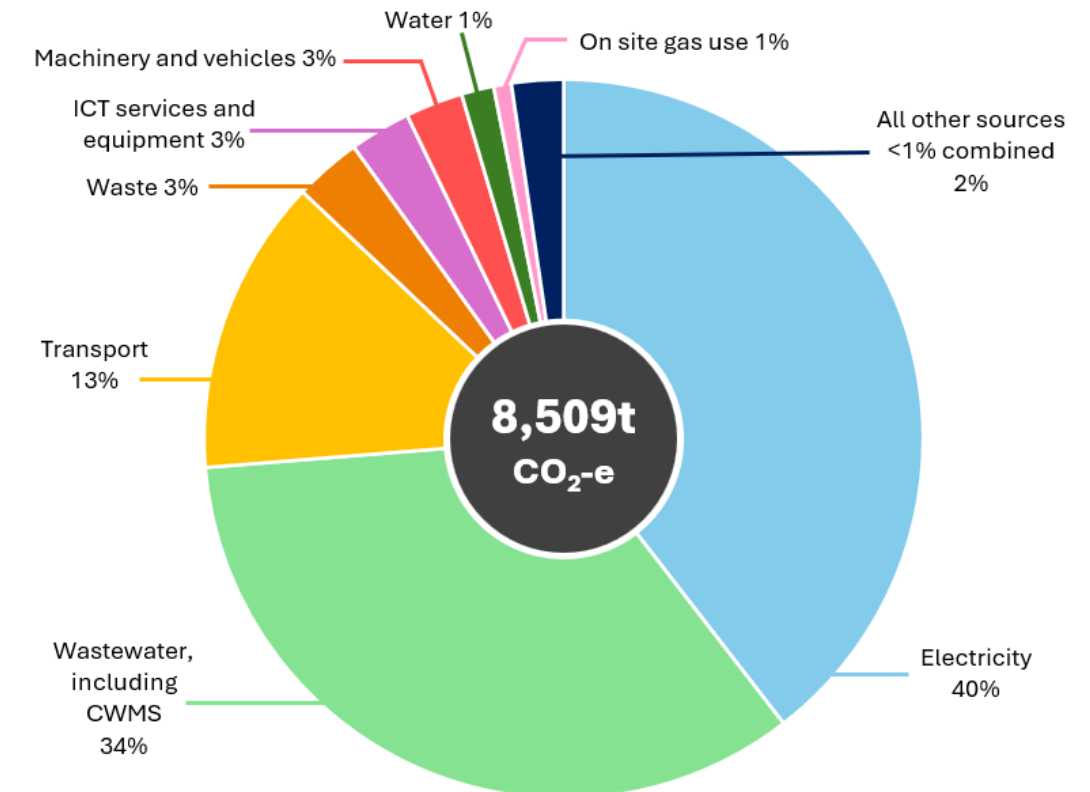
The following emissions inventories have been included for comparison:

Wastewater treatment

Mount Barker District Council operates a Community Waste Management System (CWMS). Given that this system services the community, it has been excluded from the main corporate emissions profile. This allows for alignment with other councils that do not operate a CWMS, particularly metropolitan councils, for comparison purposes. In addition, as Council are constructing a new wastewater treatment plant which is moving away from open settling ponds as the main form of treatment, it is expected that methane emissions will reduce when the plant is operational.

However, the CWMS is a significant source of scope 1 emissions, as a result of methane gases, **increasing total Council greenhouse gas (GHG) emissions by over 50%, or 2,866 tCO₂-e for FY2022/23** (refer adjacent). This is based on using the emissions profile in this Plan with the additional methane emissions applied.

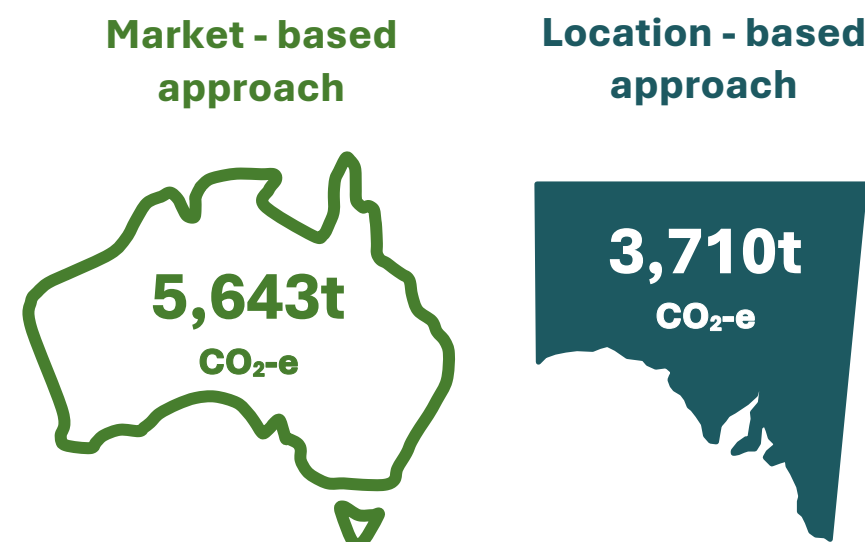
It is important to note that CWMS emissions are required to be included in the emissions inventory for formal Climate Active Carbon Neutral certification. However, in the event that Council creates a new subsidiary for the wastewater treatment plant to operate as its own entity (similar to SA Water), the emissions could be excluded if pursuing certification.



Location-based emissions factor

Adopting the Market-based emissions factor for electricity is currently optional if pursuing Climate Active certification and when using the GHG Protocol. If Council were to choose to use the Location-based approach, electricity emissions reduce significantly due to the calculation recognising South Australia's renewable energy generation share.

Total emissions using the Location-based approach are 3,710 tCO₂-e.



Mount Barker District Council

Corporate Emissions Plan

Asset Energy Efficiency Review

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Document Control

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01	21/05/2024	First Issue	MC	JP

Our Vision is to **think beyond the square**.

Our Mission is to create spaces, places, and communities that are positive for both the environment and for people. We will do this by providing our clients with sustainable and bespoke solutions that are innovative, challenge perceived ideas, and push the boundaries of achievement and excellence.

We confirm that all work has been undertaken in accordance with our ISO 9001 accredited quality management system.

Acknowledgement of country

The dsquared team wish to acknowledge the Traditional Custodians of all country throughout Australia, and their cultural, spiritual, physical, and emotional connection with their land, waters, and community. We pay our respects to all Elders past, present, and emerging.

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Executive summary

This report summarises the high-level site investigations conducted for the Mount Barker District Council on their five highest energy consuming facilities. The report provides recommendations for potential energy efficiency upgrades and operational strategies to be implemented to minimise energy use and operational expenditure.

An initial desktop review of Council energy data highlighted the following sites as the highest energy consuming buildings which are summarised in the following table. The total energy consumption at the five sites equates to over 50% of Council's total electricity consumption.

Asset	Annual Electricity Consumption (kWh)	Annual Gas Consumption (MJ)	Total Energy Consumption (kWh)	Percentage Share (%)
Wastewater Treatment Plant	1,745,146	-	1,745,146	69.3%
Caravan Park	280,655	499,063	419,284	16.6%
Sports Hub	93,455	192,119	146,821	5.8%
Mount Barker Civic Centre	116,850	-	116,850	4.6%
ESC & Council Depot	90,896	-	90,896	3.6%
Total	2,327,002	691,182	2,518,997	

The following summarise the key findings of this analysis:

- Despite being the highest energy consumer, no significant actions are recommended for the Wastewater Treatment Plant due to its imminent decommissioning in the next 2 years. A review of the new wastewater treatment plant design has been undertaken and identified that the new facility includes a number of ESD initiatives including solar PV, an all-electric design and efficient systems. In addition, the new plant will remove the wastewater settling ponds which will reduce greenhouse gas (GHG) emissions significantly.
- Due to how the solar PV at the ESC & Council Depot has been connected and the SAPN metering structure, it has been identified that the PV generation is significantly underutilised. It is recommended that a commercial electrical contractor be engaged to consolidate all electricity meters into a single SAPN retail meter, allowing for the Solar PV generation to be utilised across the entire site. Presently it is expected that excess generation is being exported via the retailer meter only to be imported back via the remaining 3 meters when load matches generation.
- As part of the solar PV review, it was identified that Council facilities on the Iberdrola contract are subject to variable solar export charges, based on the electricity grid's demand for generation. Further review identified that multiple sites with large solar PV systems are often charged when exporting generation. As such, direct utilisation of solar PV generation must be prioritised. Where further utilisation is not possible, the settings within the existing solar PV inverters should be adjusted to enable "Zero Export". Key sites that this relates to include:
 - ESC & Council Depot
 - Sports Hub
 - 43 Little Dublin Rd Nairne (not assessed as part of this review)

It is recommended that Council investigate setting a zero-export limit on the inverters while a longer-term solution is investigated e.g., energy storage.

- Caravan Park to replace communal gas fired services (hot water and clothes dryers) with high efficiency electric alternatives. Hot water systems serving communal facilities within the Caravan Park should be transitioned from gas fired to high efficiency electric heat pump. This is estimated to save the Caravan Park approximately \$3,850 annually and reduce the park's carbon emissions by 10.3 TCO₂e per year.
- LED Lighting upgrade for communal sports oval adjacent to Caravan Park. Existing lighting appears to be original and replacement with modern LED technology is expected to reduce lighting energy consumption by 50%.
- Prior to significant investment in a mains gas connection for the Sports Hub, electrification of the Sports Hub's hot water and cooking services should be reviewed to remove the site's reliance on gas. Immediate electrification is not recommended due to the age of the existing services.
- It is recommended that Council IT services review their air-conditioning policy and whether a 19°C setpoint is required within server rooms. A 19°C setpoint is considered lower than standard practice, leading to greater energy consumption for server room air conditioning.

1 Introduction

1.1 Purpose

This report provides a summary of the energy site visits undertaken for Mount Barker District Council and the identified energy efficiency improvements. The report is based on a review of electricity and gas consumption retailer data, meter data, site and building plans provided by Council, and site visits undertaken Monday 15 April 2024.

1.2 Scope

The energy site visits were undertaken to identify energy efficiency improvements as part of developing a Corporate Energy and Emissions Reduction Plan for Council. Energy has been identified as a large source of greenhouse gas (GHG) emissions and a planned approach to energy improvements is required. Council's top 5 energy consuming facilities were selected for the energy audits following an analysis of energy consumption data.

1.3 Corporate GHG emissions

To provide context, Council's total corporate GHG emissions are as follows with energy contributing approximately 60% of Council's emissions in 2022/23. Total electricity consumption for buildings and facilities is approximately 4,337MWh equating to 3,363 tCO₂-e.

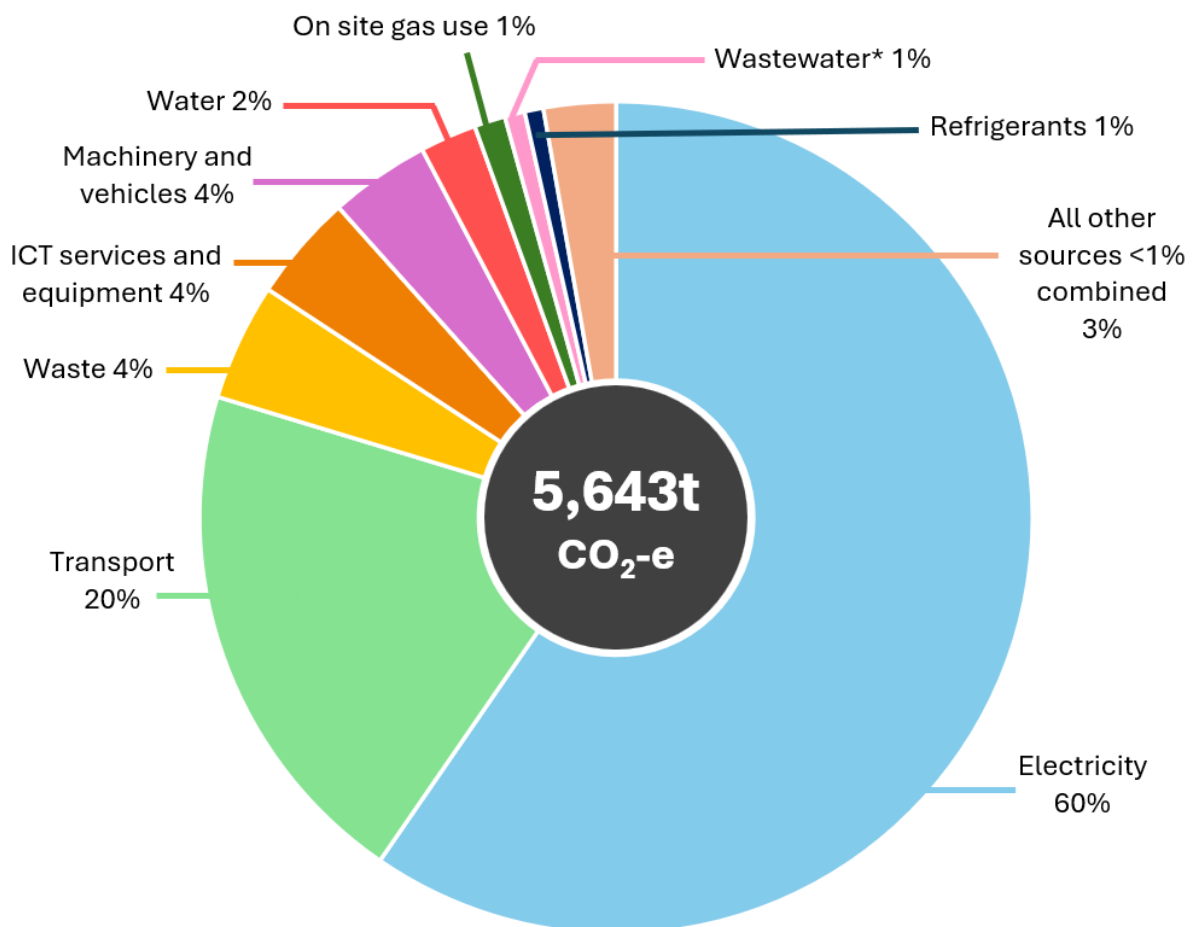


Figure 1: 2022/23 Emissions Inventory

2 Mount Barker Civic Centre

2.1 Energy Metering

Council is currently responsible for the following electricity meters serving Mount Barker Civic Centre.

NMI	Description
20021688911	DB 3.1 – Level 1 Light & Power
20021882677	DB 3.1 AC – Level 1 Air Conditioning
20021688951	DB 3.2 – Level 2 Light & Power
20021882685	DB 3.2 AC – Level 2 Air Conditioning

Upon detailed review of the Origin accounts received and retail meters on-site, it is understood that despite Council being a tenant and not the owner of the building, they are responsible for directly paying for base-building services, such as office air conditioning and ventilation systems.

There are no gas connections to the Civic Centre that Council are responsible for.

An 86kW solar PV system is currently connected to the building and distributed across three retail meters, DB 3.1, DB 3.1 AC, and DB 3.2. It could not be determined how the PV system is distributed across the connections.

2.2 Annual Energy Consumption

The following table summarises the annual energy consumption for the Civic Centre operations.

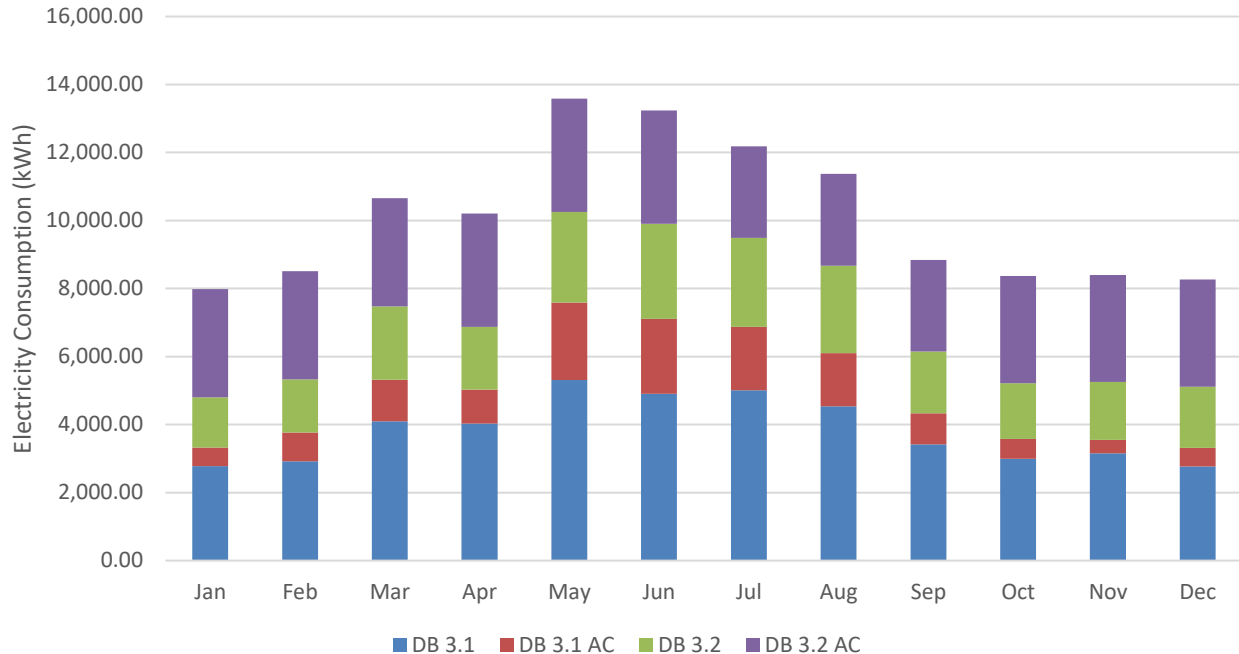
Meter	Grid Energy Consumption (kWh)	Solar PV Export (kWh)
DB 3.1 – Level 1 Light & Power	43,800	7,350
DB 3.1 AC – Level 1 Air Conditioning	12,650	19,250
DB 3.2 – Level 2 Light & Power	23,650	13,250
DB 3.2 AC – Level 2 Air Conditioning	36,750	0
TOTAL	116,850	39,850

The building's energy performance has been benchmarked against the NABERS Energy for Offices "Whole Building" standard, with the following inputs and results.

Postcode	5251
Office NLA	1,742m ²
Weekly Occupied Hours	50
Number of Workstations	130
Grid Energy Consumption	116,850 kWh
Estimated NABERS Rating (Whole Building)	6 Star

The building's NABERS Office Whole Building rating is currently estimated at a 6-star level of performance, which is the highest level of performance possible and is largely attributed to the 86kW Solar PV system. Without the Solar PV contribution, the building is estimated to perform at a 5-Star level.

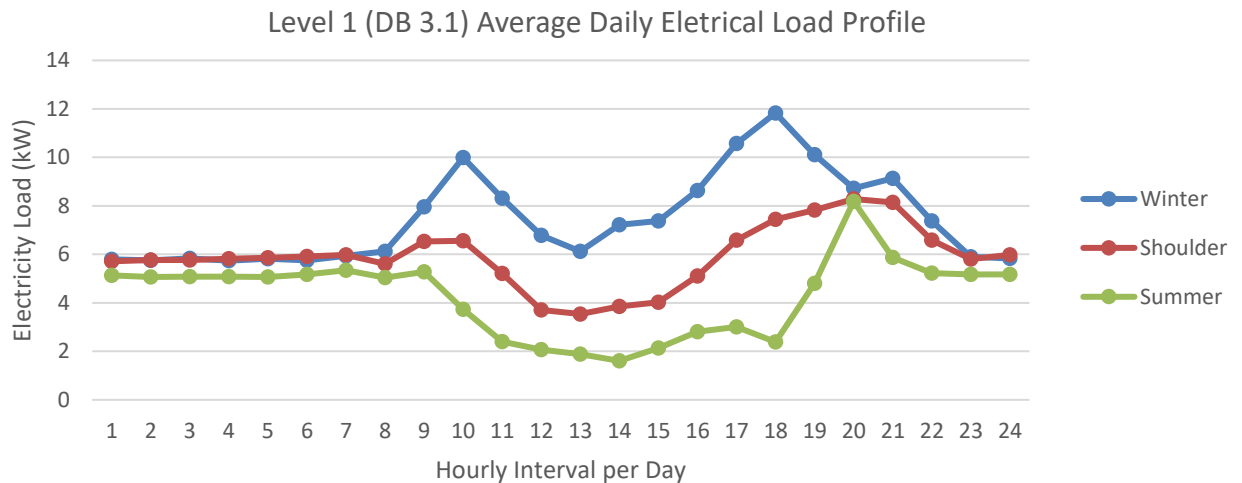
Civic Centre Monthly Electricity Consumption



2.3 Observations

Through analysis of the available data and site inspections conducted, the following observations have been made.

- It is estimated that 36% of Solar PV generation is currently exported and not utilised by site demand.
- HVAC units are ducted split systems of original construction and are approximately 17 years old.
- HVAC units are manually controlled through wall mounted control panels.
- Lighting is predominantly fluorescent tube fittings but are replaced with LED panel fittings as they fail.
- All lighting is manually switched throughout the building.
- Workstations generally utilise laptops which have a lower energy consumption; however some workstations still utilise traditional desktop PCs.
- All workstations have dual 27inch monitors.
- Server room air conditioning set to 19°C which is considered colder than typical.
- Level 1 Light and Power distribution board (DB 3.1) observed as having a consistent base load power consumption of approximately 6kW. This is double that of Level 2 Light and Power (3kW) which is expected to have a higher base-load demand due to 24/7 server room operation.



- Level 1 Air Conditioning meter occasionally observed to have higher than expected load overnight. This suggests that HVAC units are occasionally left running all night.

2.4 Recommendations

It is understood that Council is actively planning to relocate from the Civic Centre to a new facility as part of the City Centre project within the next 5 years. Energy efficiency recommendations are mindful of the impending relocation and have not considered significant plant or equipment replacements / upgrades.

- Continue replacing fluorescent light fixtures with high efficiency LED equivalents as required, however the differing colour temperatures between LED and fluorescent lighting should be considered in regard to occupant comfort.
- Investigate over-night base load consumption on DB 3.1 and determine whether this can be minimised.
- Review AC controls and potential for time-clock operation to ensure HVAC can not be left operational when unoccupied.
- Review server room air-conditioning requirements and whether the AC setpoint can be relaxed from 19°C to 21°C.
- Review ICT procurement policies from computers and monitors, with a preference to low energy consumption Laptops, and monitors with high energy star ratings. Consideration should be given to providing single computer monitors generally, and only providing dual monitors as required.

3 ESC & Council Depot

3.1 Energy Metering

Through a high-level site inspection, it was identified that the site is served by four individual retail meters which are outlined below.

NMI	Energy Coverage Description
20023296332	DB.West – Stage 1 Western Shed
20023296333	DB.MS – Stage 1 Community Shed
20023296331	DB.East – Stage 1 Eastern Shed & Depot Sheds
2002329633	ESC Admin – ESC Admin Building

The “Energy Coverage Descriptions” are based on discussion with site personnel and review of the Stage 2 “As-Built” electrical services documentation.

Through a detailed review of the provided Iberdrola electricity invoice for the 100 Springs Road Shed Complex (T1090729), it has been confirmed that Council are currently responsible for the electricity use under each of the four meters, with the total usage being combined and invoiced as a single usage amount.

There are no gas connections to the ESC / Council Depot.

A 99kW solar PV system is currently connected to the site, however it was not clear where the solar feed was connected to the site electrical network.

3.2 Annual Energy Consumption

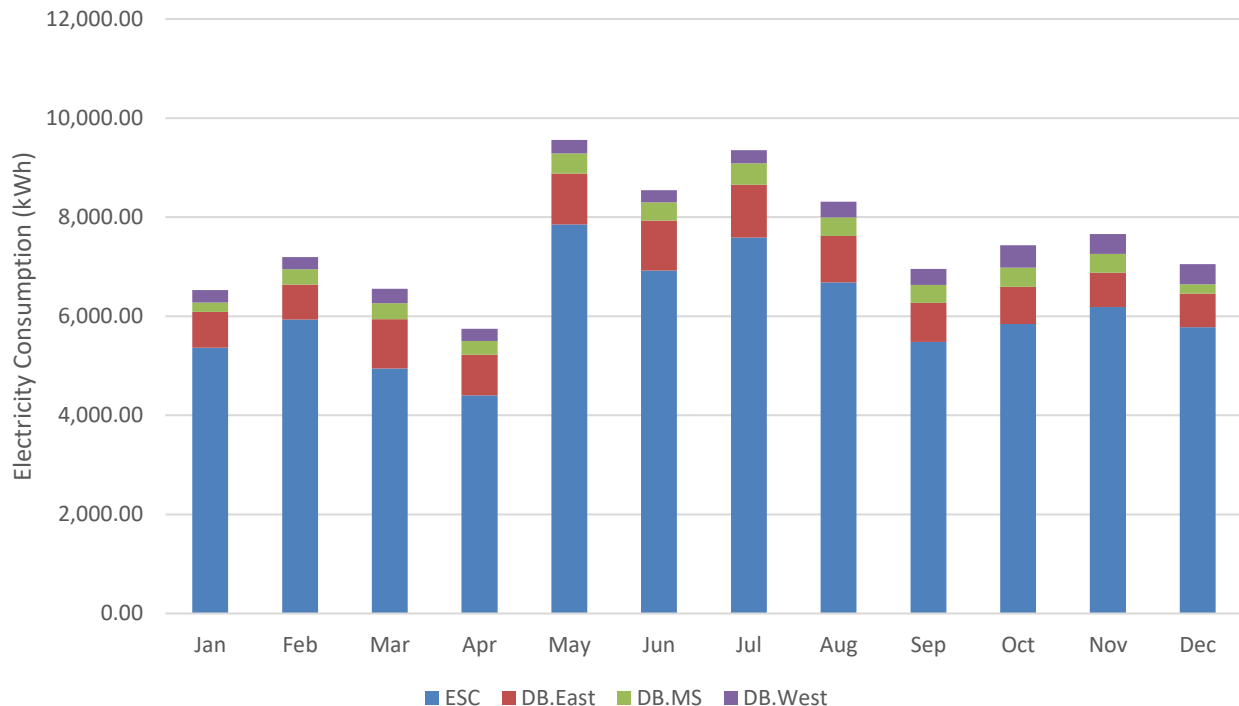
To understand the site energy profile further, the individual consumption for each meter feed has been assessed and summarised in the table below.

Meter	Grid Energy Consumption (kWh)	Solar PV Export (kWh)
DB.West – Stage 1 Western Shed	3,735	0
DB.MS – Stage 1 Community Shed	3,985	0
DB.East – Stage 1 Eastern Shed	10,182	115,092
ESC Admin – Stage 2	72,993	0
TOTAL	90,896	115,092

Through review of the site’s annual energy consumption, it has been identified that all Solar PV generation is currently feeding the DB.East meter. In the eyes of the energy network, “Behind the meter” solar PV generation can only be utilised by the retail connection that it supplies. As such, the current solar connection is unable to supply any generation to the ESC Admin connection, DB.West connection, and DB.MS connection. Once the Solar PV generation is exported out of the DB.East retail meter, it is viewed as grid energy by the network and provides no financial benefit to Council, even if it is subsequently consumed by the remaining site connections. This is resulting in significant under-utilisation of the Solar PV system, with approximately 85% of generation currently being exported to the grid.

Directly consuming Solar PV generation provides a much higher financial benefit than exporting to the grid. Based on the current Iberdrola contract, Council is paid/charged for solar generation depending on the wholesale market. In 2023, Council was ultimately charged \$651 for the exported solar energy. If the solar generation was utilised on site, it would prevent grid electricity being purchased at a cost of approximately 30 c/kWh. As such, restructuring the PV connection to cover the ESC meter is estimated to save council approximately \$1,500 in energy costs per month.

ESC & Depot Electricity Consumption



3.3 Observations

Through analysis of the available data and site inspections conducted, the following observations have been made.

- It is estimated that 85% of Solar PV generation is currently exported and not utilised by site demand.
- Buildings have been built recently and are of high quality.
- ESC building has openable windows and doors with no link to HVAC controls to prevent wasted energy.
- Openable sliding doors to office area are not self-closing and can be left ajar. This is non-compliant under Section J3 – Building Sealing of the National Construction Code (2016) which the building was built to.
- Kitchen and breakout areas utilise glass door fridges which have a much higher energy consumption than traditional solid door fridges.
- Shed/warehouse lighting is predominantly manually controlled with 15 minute timer switches currently being trialled on two sheds.
- All outdoor lighting currently operates from sunset to sunrise.
- All workstations provide dual monitors.
- Sever room is air-conditioned to 19°C 24/7.

3.4 Recommendations

- Engage an electrical contractor to provide further review of Solar PV connection and assess current utilisation.
- Consolidate 4 retail meters into one connection, allowing the Solar PV to be utilised across all buildings, maximising self-consumption and economic benefit. Implement sub-metering and EMS system to track consumption of individual facilities.
- Implement lighting timer switches to all remaining sheds and warehouse areas.
- Retro-fit self-closing devices to sliding doors to air-conditioned spaces to prevent wasted air-conditioning energy.
- Engage an air-conditioning contractor to review feasibility of linking window opening to the HVAC control system through reed switches or similar devices.
- Review server room air-conditioning requirements and whether the AC setpoint can be relaxed from 19°C to 21°C.
- Review opportunities to reduce outdoor lighting run hours and minimise external lighting to security requirements outside of operational times.
- Consider using standard fridges in lieu of glazed fridges in kitchens and breakout areas.
- Energy storage: During the audit energy storage (batteries) were raised as a potential solution to improve emergency management services and take advantage of the excess solar PV generation. It is recommended that the solar PV system configuration is rectified before investigating solar

4 Caravan Park

4.1 Energy Metering

Through a high-level site inspection, it was identified that the site is served by two individual retail meters which are outlined below.

NMI	Energy Coverage Description
SAAAAAE440	Main site feed, including toilet blocks, cabins, and powered sites.
SAAAAAB7912	Dunn Park oval lighting, new cabins (15-20)

The “Energy Coverage Descriptions” are based on a review of the energy consumption profile and inspections of the associated distribution boards.

There is no mains gas connection, however bottled gas is provided to site which supplies instantaneous hot water units on each cabin, multiple instantaneous hot water units on each shower block, gas fired clothes dryers, and caravan gas resupply.

The site currently has no Solar PV connection.

4.2 Annual Energy Consumption

To understand the site energy profile further, the individual consumption for each meter feed has been assessed and summarised in the table below.

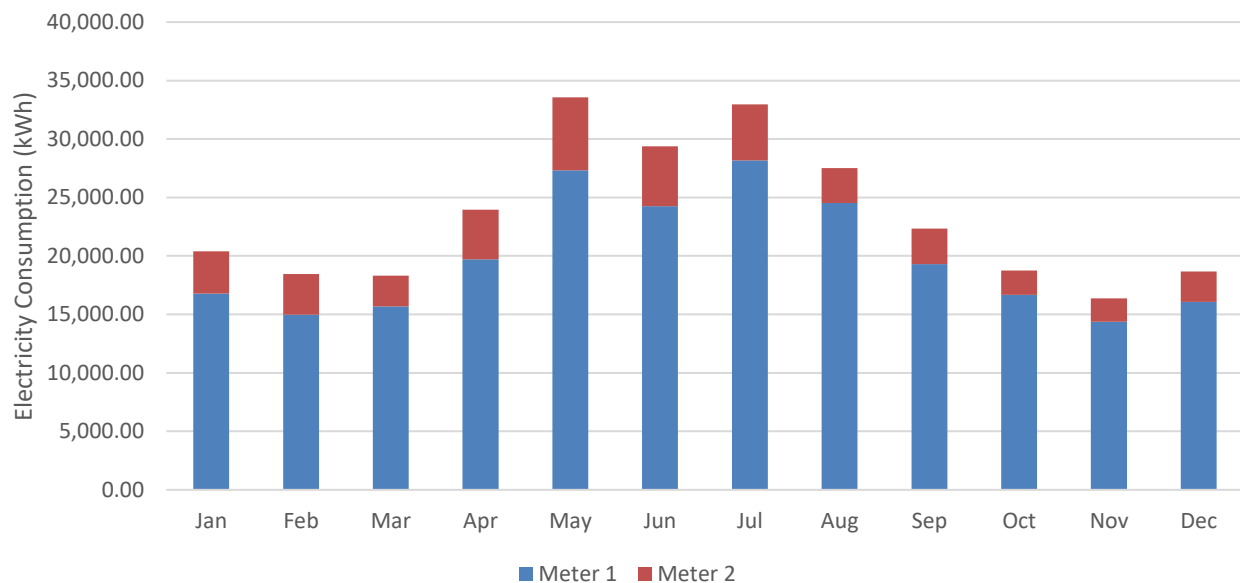
Electricity

Meter	Energy Consumption (kWh)
SAAAAAE440 – Main Feed	237,886
SAAAAAB7912 – Oval and Cabins	42,769
TOTAL	280,655

Gas

Meter	Energy Consumption (MJ)
Decant	17,526
Amenities A	171,163
Amenities B	156,488
Cabins and Residence	153,885
TOTAL	499,063

Caravan Park Electricity Consumption



4.3 Observations

Through analysis of the available data and site inspections conducted, the following observations have been made.

- Review of the smart meter data for the main electricity feed has identified that the load profile follows a conventional residential load, with high demand in the morning and evening. This suggests that the vast majority of electricity use is from park guests with minimal opportunity for improvement.
- New cabins under construction are being built to minimum code requirements with no energy efficiency measures incorporated within the design.
- Light poles to Dunn Park oval are using the original inefficient light fixtures and haven't been upgraded to LED. It is expected each light would consume approximately 250-400W.
- Street lighting within the caravan park have not been upgraded to LED.
- Glass door fridges were observed to be completely empty yet still operating. Glass door fridges have a much higher energy consumption than traditional solid door fridges.
- Significant tree coverage throughout the park limits the viability of Solar PV.

4.4 Recommendations

- Replace gas hot water units serving common shower blocks with high efficiency electric heat pump units. This is estimated to save the Caravan Park approximately \$3,850 annually and reduce the park's carbon emissions by 10.3 TCO₂e per year.
- Implement increased energy efficiency standards for any further cabin replacement projects, targeting a higher NatHERS performance level beyond minimum compliance and procuring energy efficient appliances.
- Pending review of typical cabin occupancy, review provision of heat pump domestic hot water units to cabins in lieu of instantaneous gas units.

- Replace oval lighting with high efficiency LED lighting e.g., 100-150W LED lights, which are expected to reduce electricity consumption by >50%.
- Replace caravan park external lighting with high efficiency LED lighting.
- Review whether glass door fridges are used and whether they should be retained. Especially the small external fridges located in the barbeque area. If used / retained, replace with solid door fridges to improve energy efficiency, aiming for a minimum 2.5 Star energy rating for bar fridges.
- Replace gas fired clothes dryers in laundry area with electric heat pump units.
- Review opportunities for small scale Solar PV, potentially to the southern toilet/shower block roof and cabin roofs if unshaded.

5 Sports Hub

5.1 Energy Metering

Through a high-level site inspection, it was identified that the site is served by a single retail electricity meter which is summarised below.

NMI	Energy Coverage Description
20023503712	Main site feed, including sports lighting, club rooms, street and carpark lighting, and maintenance shed.

There is no mains gas connection, however bottled gas is provided to site which supplies instantaneous hot water units to each clubroom building as well as kitchen cooktops.

The site is provided with renewable energy through a solar PV installation located on the roof of the maintenance shed. The Solar PV system size has been estimated at 20kW.

5.2 Annual Energy Consumption

To understand the site energy profile further, the energy consumption for both electricity and gas has been summarised in the table below.

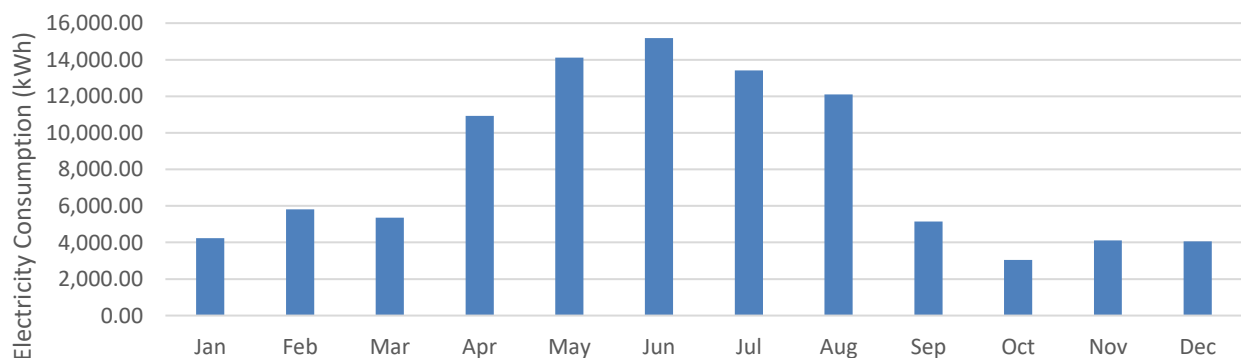
Electricity

Meter	Energy Consumption (kWh)	Solar PV Export (kWh)
20023503712	93,455	9,215
TOTAL	93,455	9,215

Gas

Meter	Energy Consumption (MJ)
MBRSH Site A	94,352
MBRSH Site B	97,768
TOTAL	192,119

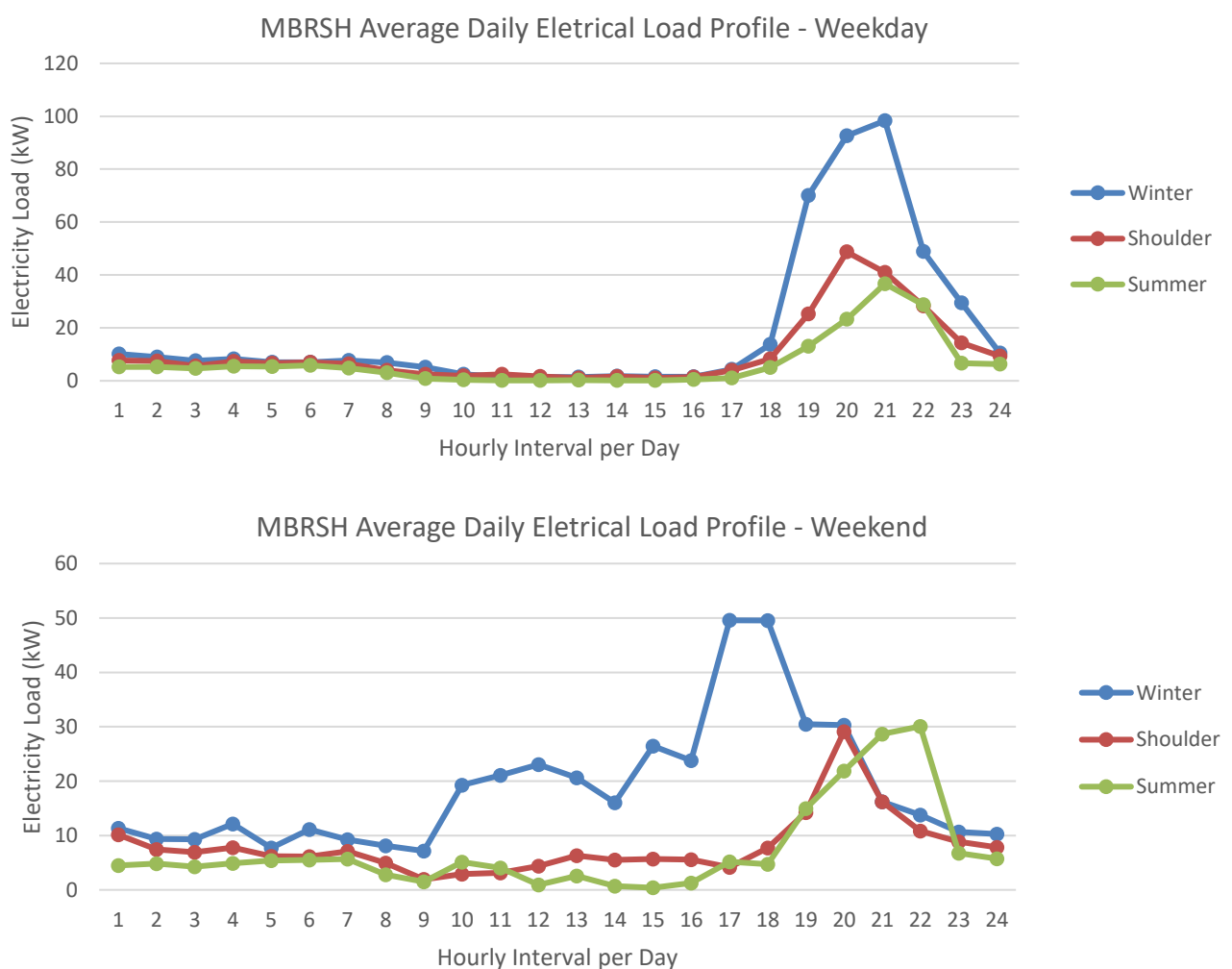
Sports Hub Monthly Electricity Consumption



5.3 Observations

Through analysis of the available data and site inspections conducted, the following observations have been made.

- Site electrical consumption is dominated by sports lighting. Average daily load profiles below show that almost all weekday electricity consumption occurs during the evening, corresponding with the use of sports lighting.
- Weekday daytime energy consumption is covered almost entirely by on-site solar PV energy generation.
- Weekend daytime energy consumption throughout summer and winter is supplied almost entirely by Solar PV energy generation but has a slight increase in consumption during shoulder months.
- Electricity consumption peaks throughout winter due to increased utilisation by sporting clubs and reduced output from the Solar PV system.



- Sports hub buildings are of recent construction and utilise energy efficiency LED lighting, advanced control systems, and have significant sub metering located within distribution boards.
- On-site solar PV system is well sized for minor daytime electricity consumption and only exports approximately 30% of generation.

- Gas is utilised for domestic hot water heating within both clubroom buildings, with five (5) instantaneous water heaters located within the plant enclosures. Gas stove tops are also provided in the kitchen facilities.
- Glass door beverage fridges are used within kitchen/kiosk areas.
- Extensive energy metering is in place which will provide increased visibility on usage patterns and electrical loads, however it was not known whether an Energy Management System (EMS) was in place or accessible by Council.

5.4 Recommendations

- Ensure all user groups are correctly using “training” mode for sports lighting during training times, and not more energy intensive game-day lighting settings.
- As the site has recently been constructed, we do not recommend immediately converting to electric hot water systems, but as gas systems begin to fail in the future or major infrastructure works are considered to further enable gas, moving to electric systems should be considered.
- It is estimated that high efficiency heat-pump hot water systems would reduce operational costs by \$2,100 annually and reduce carbon emissions by 6.8TCO₂e annually.
- It is recommended that Council investigate whether the electrical sub-metering system is currently being recorded by an Energy Management System (EMS). Analysis of EMS data would allow for further review of electrical efficiencies.

6 Wastewater Treatment Plant

6.1 Energy Metering

Through a high-level site inspection, it was identified that the site is served by a single retail electricity meter which is summarised below.

NMI	Energy Coverage Description
2002158837	Main site feed

There are no gas connections to the wastewater treatment plant.

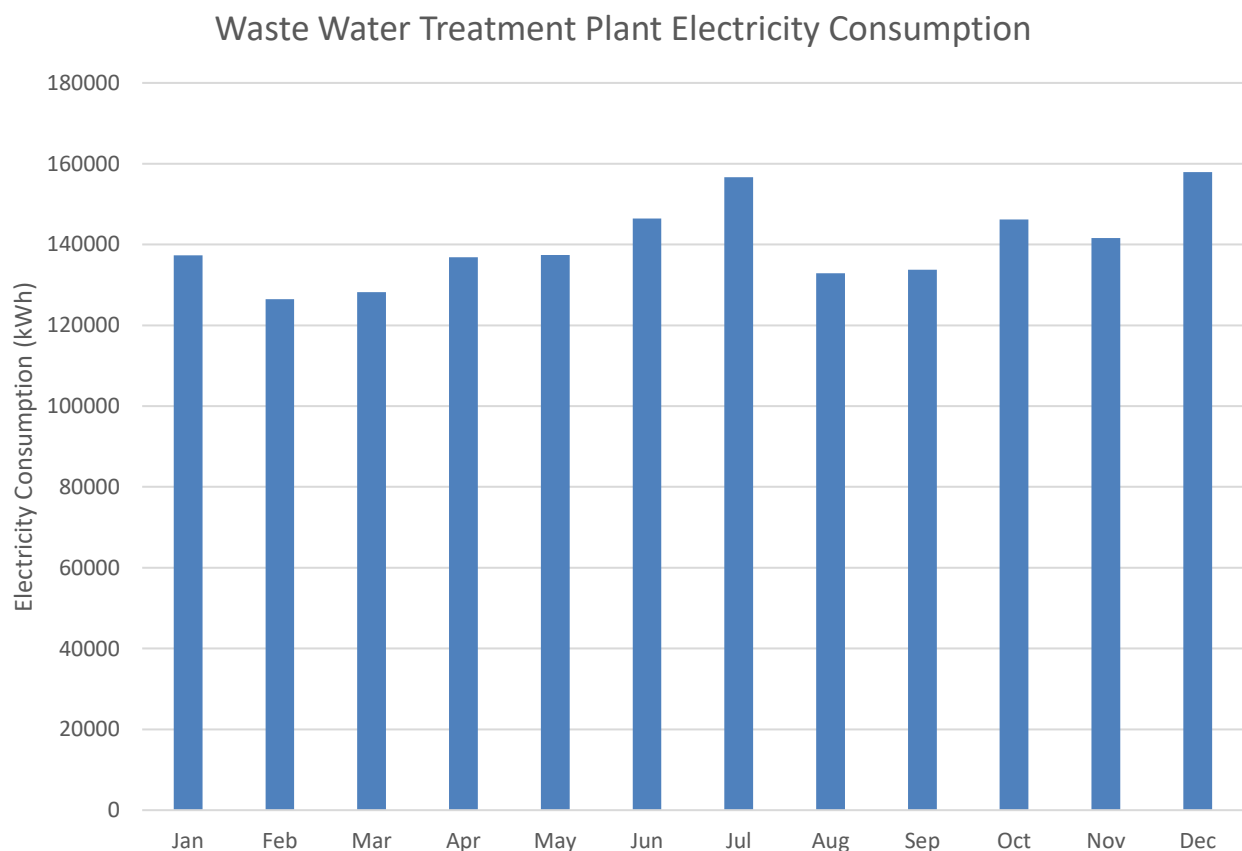
There is currently no Solar PV generation present.

6.2 Annual Energy Consumption

The energy consumption for the site has been summarised in the table below.

Meter	Energy Consumption (kWh)
2002158837	1,745,146

As the site is operational 24/7, the electrical load is generally consistent throughout the day.



6.3 Observations

Through analysis of the available data and site inspections conducted, the following observations have been made.

- The Wastewater Treatment Plant is Council's single highest energy consuming property.
- Through discussions with council personnel, it is understood that a new facility is currently being tendered and will entirely replace the existing facility.
- It is understood that the replacement facility will be operational by 2027.
- It was observed that as equipment fails, like for like replacements are utilised to ensure minimal downtime. No consideration is given to alternative equipment or energy efficient alternatives.

6.4 Recommendations

- Ensure energy efficient operations are engrained in the design and operation of the facility.
- No major investments are recommended for the WWTP due to decommissioning plans in the short term.
- As the majority of WWTP energy is estimated to come from lagoon aerators, aerator motors should be replaced with the most efficient options available as units fail.

7 Summary

The below table summarises the total energy consumption and distribution for the five sites that have been assessed as part of this review. The total energy consumption at the five sites equates to over 50% of Council's total electricity consumption.

Asset	Annual Electricity Consumption (kWh)	Annual Gas Consumption (MJ)	Total Energy Consumption (kWh)	Percentage Share (%)
Wastewater Treatment Plant	1,745,146	-	1,745,146	69.3%
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Total	2,327,002	691,182	2,518,997	

The following summarise the key findings of this analysis:

- Despite being the highest energy consumer, no significant actions are recommended for the Wastewater Treatment Plant due to its imminent decommissioning in the next 2 years. A review of the new wastewater treatment plant design has been undertaken and identified that the new facility includes a number of ESD initiatives including solar PV, an all-electric design and efficient systems. In addition, the new plant will remove the wastewater settling ponds which will reduce greenhouse gas (GHG) emissions significantly.
- Due to how the solar PV at the ESC & Council Depot has been connected and the SAPN metering structure, it has been identified that the PV generation is significantly underutilised. It is recommended that a commercial electrical contractor be engaged to consolidate all electricity meters into a single SAPN retail meter, allowing for the Solar PV generation to be utilised across the entire site. Presently it is expected that excess generation is being exported via the retailer meter only to be imported back via the remaining 3 meters when load matches generation.
- As part of the solar PV review, it was identified that Council facilities on the Iberdrola contract are subject to variable solar export charges, based on the electricity grid's demand for generation. Further review identified that multiple sites with large solar PV systems are often charged when exporting generation. As such, direct utilisation of solar PV generation must be prioritised. Where further utilisation is not possible, the settings within the existing solar PV inverters should be adjusted to enable "Zero Export". Key sites that this relates to include:
 - ESC & Council Depot
 - Sports Hub
 - 43 Little Dublin Rd Nairne (not assessed as part of this review)

It is recommended that Council investigate setting a zero-export limit on the inverters while a longer-term solution is investigated e.g., energy storage.

- Caravan Park to replace communal gas fired services (hot water and clothes dryers) with high efficiency electric alternatives. Hot water systems serving communal facilities within the Caravan Park should be transitioned from gas fired to high efficiency electric heat pump. This is estimated to save the Caravan Park approximately \$3,850 annually and reduce the park's carbon emissions by 10.3 TCO₂e per year.

- LED Lighting upgrade for communal sports oval adjacent to Caravan Park. Existing lighting appears to be original and replacement with modern LED technology is expected to reduce lighting energy consumption by 50%.
- Prior to significant investment in a mains gas connection for the Sports Hub, electrification of the Sports Hub's hot water and cooking services should be reviewed to remove the site's reliance on gas. Immediate electrification is not recommended due to the age of the existing services.
- It is recommended that Council IT services review their air-conditioning policy and whether a 19°C setpoint is required within server rooms. A 19°C setpoint is considered lower than standard practice, leading to greater energy consumption for server room air conditioning.

Appendix D Carbon sequestration & offsets

Introduction

The following section outlines how the Council could accelerate the net zero transition by supporting carbon sequestration projects as part of their own programs and outlines an option to purchase carbon offsets to achieve carbon neutrality.

What is a carbon offset

Carbon offsets are a trading mechanism that enable an organisation, project or individual to counterbalance the greenhouse gas (GHG) emissions that they generate due to their operations / actions, by supporting projects that reduce, avoid, or remove emissions elsewhere. Each carbon offset is equivalent to 1 tonne of carbon dioxide equivalent (CO₂-e) that has been emitted to the atmosphere.

When carbon offsets should be used

The approach to procuring carbon offsets should follow the below carbon management hierarchy, with carbon offsets the final option following all emission avoidance and reduction initiatives being implemented. This includes investigating opportunities for projects to sequester carbon as part of tree plantings and revegetation before purchasing carbon offsets.

Carbon offset types and issues

Carbon offsets are a key part of voluntary carbon neutral certifications such as the Climate Active Carbon Neutral Standards and the Greenhouse Gas (GHG) Protocol Corporate Standard which recognise that not all GHG emission sources can currently be reduced to zero. As a result, carbon offsets are required to cancel out the remaining emissions.

Offsets play a dual role; they enable companies to support decarbonisation beyond their own carbon footprint and they accelerate the broader low carbon transition by financing projects that reduce or remove GHG emissions from the atmosphere.

If a project meets these criteria—as specified by independent standards such as Australian Carbon Credit Units (ACCU), Gold Standard and Verified Carbon Standard (VCS)—credits can be issued which are equivalent to 1 tonne of CO₂. The impact of a carbon credit can only be claimed—that is, counted toward a Net Zero or Carbon Neutral commitment—once the credit has been retired (cancelled in a registry), after which it can no longer be sold. A carbon credit is considered a “voluntary carbon credit” when it is bought and retired on a voluntary basis rather than as part of a process of compliance with legal obligations.

Carbon offset types

There are a number of certified carbon offsets which can be voluntarily surrendered to achieve carbon neutrality as follows. The below offsets are eligible under the [Climate Active](#) Carbon Neutral standards. The [Green Building Council of Australia \(GBCA\)](#) also requires carbon offsets to be procured for some Green Star credits and maintain their own list of approved options, however each project is required to undertake its own due diligence and confirm the credibility of carbon offsets used.

Table 7: Carbon offset types

Offset type	Summary
Australian Carbon Credit Units (ACCUs)	ACCUs are issued by the Clean Energy Regulator (CER) and are managed under the Carbon Credits (Carbon Farming Initiative) Act 2011. There are a number of methodologies for creating ACCUs under the main categories of vegetation, agriculture, waste (landfill gas), savanna burning, energy efficiency, industrial fugitives, transport and carbon capture. ACCUs are typically held in higher regard than other carbon offsets due to being managed under Australian legislation and providing additional benefits for the environment and economy within Australia. In addition, additional legislation and regulations are in place outside of the CER that ensure there are other mechanisms for maintaining the integrity of ACCUs, including being a regulated financial product under the Australian Securities and Investments Commission (ASIC).
Certified Emission Reductions (CERs)	CERs are managed under the Australian National Registry of Emissions Units Act 2011 and are issued by the Clean Development Mechanism (CDM). The CDM operates in countries that are parties to the United Nations Framework Convention on Climate Change (UNFCCC) and Kyoto Protocol (developing country Parties).
Removal units (RMUs)	RMUs operate under the UNFCCC and Kyoto Protocol however specifically relate to Land Use, Land-Use Change and Forestry (LULUCF) activities. RMUs are used less frequently than most of the categories outlined in this paper.
Voluntary Emission Reduction (VER)	VERs are typically created outside of the Kyoto Protocol and are verified and audited under voluntary certification standards. The Gold Standard is a voluntary offset program for VERs initially developed by the World Wide Fund for Nature (WWF), SouthSouthNorth, and Helio International, however has grown to include a large number of supporter Non-Government Organisations (NGOs). Gold Standard offsets are directly aligned with and certified against the UN Sustainable Development Goals (SDGs) to ensure that the offsets are creating tangible environmental and economic impacts. From 2020, VERs and VCUs are no longer incorporating large scale renewable energy projects.
Verified Carbon Units (VCUs)	VCUs are typically created outside of the Kyoto Protocol and are verified and audited under voluntary certification standards. VCUs are one of the largest offset markets with over 956 million offsets issued across over 1,800 projects. From 2020 VERs and VCUs are no longer incorporating large scale renewable energy projects and therefore their market share will shift over time. This may increase prices or shift more organisations to purchasing ACCUs and may further increase prices in the Australia market however this is difficult to predict.

The most commonly used carbon offsets for carbon neutral certification include:

- **ACCUs**
- **VERs**
- **VCUs**

Known carbon offset issues

Carbon offsets are being increasingly scrutinised to ensure that they are achieving credible and real carbon reduction outcomes, with a number of investigations both in Australia and internationally being undertaken. Some of the main concerns raised in the reviews include:

Table 8: Summary of carbon offset concerns

Methodology	Concerns / issues
Avoided Deforestation	Some research has highlighted that the avoided deforestation method may not satisfy the offset integrity standards and may not be based on clear and convincing evidence; the main assumption that underpins the method is not conservative; and the method is likely to be predominantly crediting non-additional abatement. More than 20% of ACCU's generated have been via the Avoided Deforestation method under the Emissions Reduction Fund (ERF) and therefore there are some concerns with the overall legitimacy of ACCU's due to this approach.
Human-induced regeneration (HIR):	Research has shown that proponents of HIR projects may include land areas containing mature woody vegetation at project commencement in their carbon estimation areas and may be resulting in the over-crediting of HIR projects. The scale of this impact is however not easily understood as the modelling used by the CER is not publicly available and was not used by the research demonstrating potential issues.
Landfill waste methane capture	Evidence has shown that the majority of the abatement credited under the Emissions Reduction Fund's (ERF) landfill gas methods has not been additional. It is estimated that up to 60% of the abatement credited under this method would have occurred in the absence of the incentive provided by the issuance of ACCU's e.g. the projects would have proceeded regardless of generating ACCU's.
Energy efficiency	In line with other methodologies, there are some concerns about whether the energy efficiency projects would have occurred in the absence of ACCU's, however there has been very low uptake of this approach. It should be noted that energy efficiency is a priority for achieving net zero emissions by 2050.
Transport	Due to its relatively small take-up (<1%) there is less information available on the credibility of this method and there is only one ACCU project in South Australia relating to marine vessels. It is expected that the same concerns with additionality will be applicable to the transport methodology e.g. transport will transition due to the operational and cost saving benefits regardless of generating ACCU's.

Verra REDD+ VCUs

In addition to the inquiries undertaken in Australia, some of the Verra REDD+ Project VCUs are currently under investigation with studies alleging that over 90% of their rainforest carbon offsets were not achieving additional and real carbon sequestration. As a result, Climate Active and the Green Building Council of Australia (GBCA) have temporarily suspended any certifications that use these credits while additional investigations are undertaken.

What to consider when purchasing carbon offsets

Based on the above approach, methodologies and concerns raised about carbon offset credibility, it is recommended that projects follow the below guidance when choosing carbon offsets:

Table 9: Carbon offset approach

Principle	Summary
1. Avoid and reduce emissions first	Measuring, avoiding, and reducing emissions should be the first priority, minimising the need for carbon offsets e.g. energy efficiency, onsite renewables, electric vehicles, low Global Warming Potential (GWP) refrigerants, water efficiency, and waste. Incorporate increased vegetation and tree planting as part of projects to support carbon sequestration and improved biodiversity.
2. Carbon removal should be the focus	Carbon offsets that remove carbon from the atmosphere, both in the short and long term should be the priority. Offsets that "avoid" the generation of carbon such as avoided deforestation are expected to provide reduced benefits and may have lower credibility compared to carbon removal projects.
3. Partner with credible and transparent organisations	Carbon offsets should be chosen based on their transparency and are: • Preferably ACCUs and from local South Australian projects, with Australian ACCUs the second priority. • From credible organisations that have additional due diligence checks and transparent reporting, in particular for international carbon offsets e.g. the WWF Gold Standard who publish reports that are aligned with the UN Sustainable Development Goals (SDGs). • Certified in line with legislation, regulatory requirements, and best practice standards such as approved offsets under the Australian Government Climate Active Carbon Neutral Standards and Green Building Council of Australia. • Generated by credible, like-minded organisations that align with the organisations or project's vision and values. Carbon offset traders should also be chosen based on whether they meet these criteria.
4. Select offsets with social and environmental co-benefits	Carbon offsets should be selected based on their environmental and social co-benefits. This includes offset projects that: • Partner with local Aboriginal communities to listen, learn from, and support a connection to Country. • Improve climate resilience such as reducing urban heat island effect, providing respite from extreme temperatures, and supporting vulnerable members of the community. • Improve biodiversity and habitat for threatened and endangered species. • Create employment and education opportunities. • Support programs and research to improve or develop carbon removal projects and technologies.

Can Council generate their own carbon offsets

Organisations and projects will often incorporate energy efficiency and revegetation initiatives (refer carbon offset types), or organisations may own vacant land that could be used to self-generate carbon offsets e.g., ACCUs. For local councils, street trees and revegetation projects as part of landscaping and reserves are often identified as an opportunity for self generating carbon offsets.

However, generating carbon offsets / ACCUs is typically more complex than what most projects can incorporate without engaging specialist consultants, and the costs to setup and generate carbon offsets are usually significantly more than purchasing carbon offsets from established projects. Challenges with self-generating carbon offsets include:

- Meeting permanency requirements with most projects requiring a formal commitment, ongoing planning, and regular reporting to manage the carbon offsets for at least 25 years, and up to 100 years.
- To achieve economies of scale, most carbon offset projects are significantly larger than what a council can achieve with street trees and reserves.
- The amount of land required to plant enough trees and vegetation to offset the equivalent amount of GHG emissions. For example, approximately 1 hectare (10,000m²) of trees is able to sequester approximately 8-12t CO₂-e per annum on average (depending on the vegetation type / mix). The Council's emissions profile is approximately 3,000 tCO₂-e which would require significant amounts of trees to sequester the equivalent amount of CO₂-e.
- Ensuring projects achieve all of the carbon offset / ACCU criteria and registering / reporting with the [Clean Energy Regulator](#). For example, some ACCU methodologies have minimum criteria for over 15 hectares of revegetation to be achieved before ACCUs are eligible.
- Trees and vegetation that sequester higher amounts of carbon may not align with the Council's landscaping and vegetation requirements or provide high levels of improved biodiversity. For example, a project may incorporate landscaping and vegetation to support local threatened species which doesn't sequester large amounts of carbon.
- Ongoing management and auditing requirements to ensure the project is achieving the carbon sequestration outcomes.
- Offsets can only be claimed / surrendered when the carbon has been sequestered which can take many years. This is based on a detailed methodology which takes into account the vegetation type and average sequestration over the life of the plantings.
- Maintaining credibility and transparency with public reporting which is becoming an increasing focus when organisations purchase carbon offsets.

As a result, we typically recommend projects partner with organisations that manage carbon sequestration projects to explore opportunities to support local and Australian projects while also enabling the purchase / surrender of carbon offsets.

However, incorporating increased trees and landscaping will provide carbon sequestration benefits for the community and it is recommended that projects demonstrate the outcomes being achieved including the number of trees planted and improved biodiversity outcomes. Maximising the amount of tree plantings and carbon sequestration opportunities should be the priority before procuring carbon offsets in line with the carbon management hierarchy.

Carbon offset pricing

Carbon offset prices are based on supply and demand and spot price markets. Prices will depend on the offset type (ACCU, VER, VCU), project type / methodology, project ownership, as well carbon trading prices which are in addition to the spot price e.g. carbon traders will add an administration and trading fee on top of the spot market. The spot market should be used to guide price reviews however are an average of all ACCU types and do not include administration and trading fees.

Based on recent pricing, the following price ranges per tonne are expected for projects:

- **International (VCU / VER):** \$10-\$15 per t CO₂-e (lower prices are available for projects that have less environmental and social co-benefits).
- **ACCU:** \$40-\$55 per t CO₂-e for revegetation projects. \$50-80 per t CO₂-e for indigenous fire management projects.
 - **Note:** Indigenous fire management projects typically require approval from the project owners who request information about the organisation / project prior to approving the purchase.

The below graph shows ACCU spot market prices over 2 years (Source: [Clean Energy Regulator](#)), with prices fluctuating significantly due to both supply and demand, as well as changes in ACCU policy by the Australian Government. Pricing has trended upwards since early 2022 (below prices exclude trading / brokerage fees).

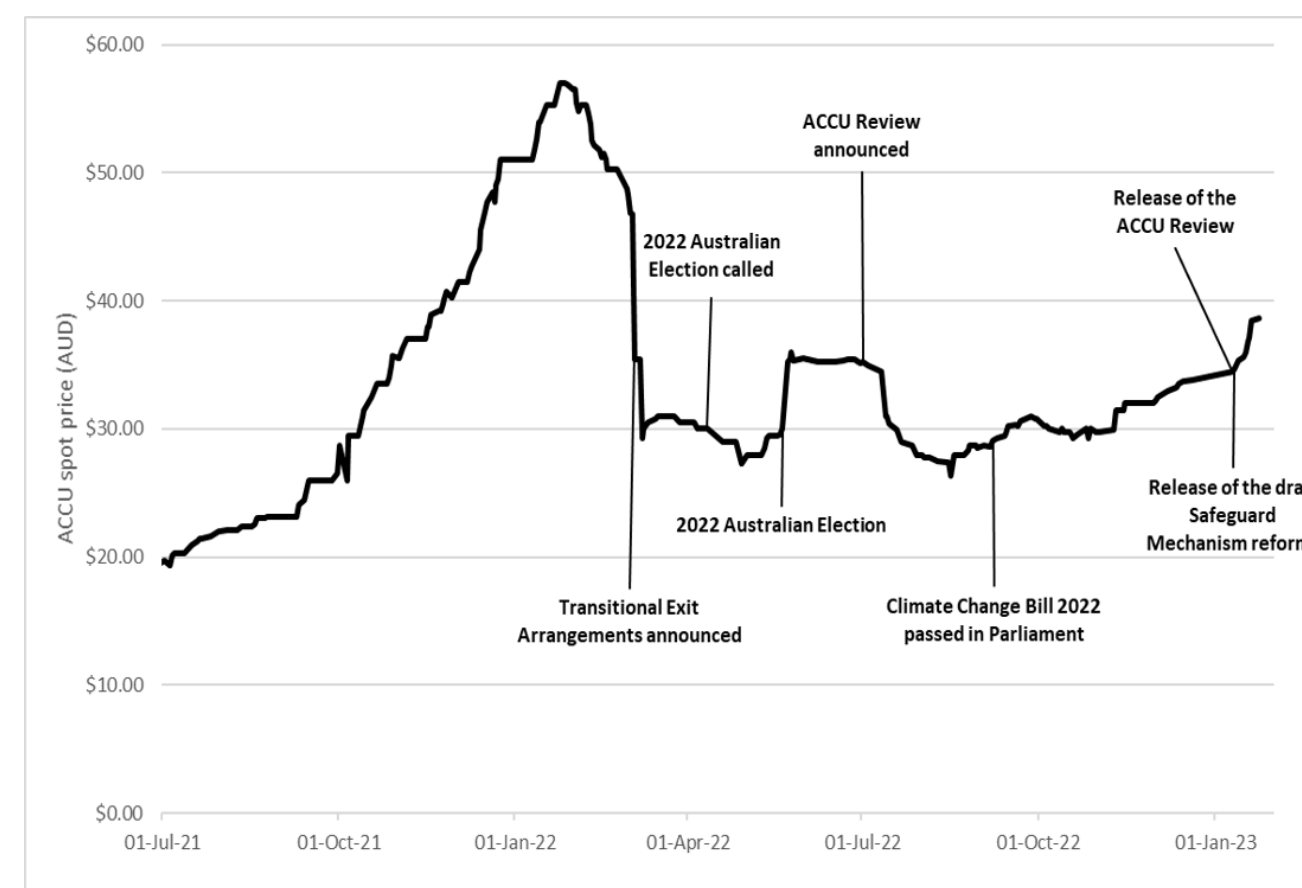


Figure 27: ACCU spot market prices^{xvi}

Carbon sequestration recommendations

It is recommended that the Council continue to support street trees and plantings as part of its programs and Tree Strategy which will support carbon sequestration while also increasing climate resilience and reduce the impact of urban heat island effect. However, it is expected that the Council would not be able to sequester a sufficient amount of carbon to make an impact on the Council's emissions profile as part of these programs. It is therefore recommended that the Council investigate opportunities to partner with organisations that specialise in tree planting and revegetation programs with a focus on opportunities within the Council's boundary .

Carbon offset recommendations

Carbon offsets require a considered approach to ensure credible and transparent offsets are purchased that align with the organisation's vision and values. If the Council choose to purchase offsets, it is recommended that projects follow the guidance in this paper and the following summary of the key steps. It is recommended that ACCUs are considered as a first priority as the reporting and transparency requirements are typically higher than international offsets. The following key stages are recommended for carbon offsets:

1. **Avoid and reduce emissions first**
2. **Carbon removal should be the focus**
3. **Partner with credible and transparent organisations**
4. **Select offsets with social and environmental co-benefits**

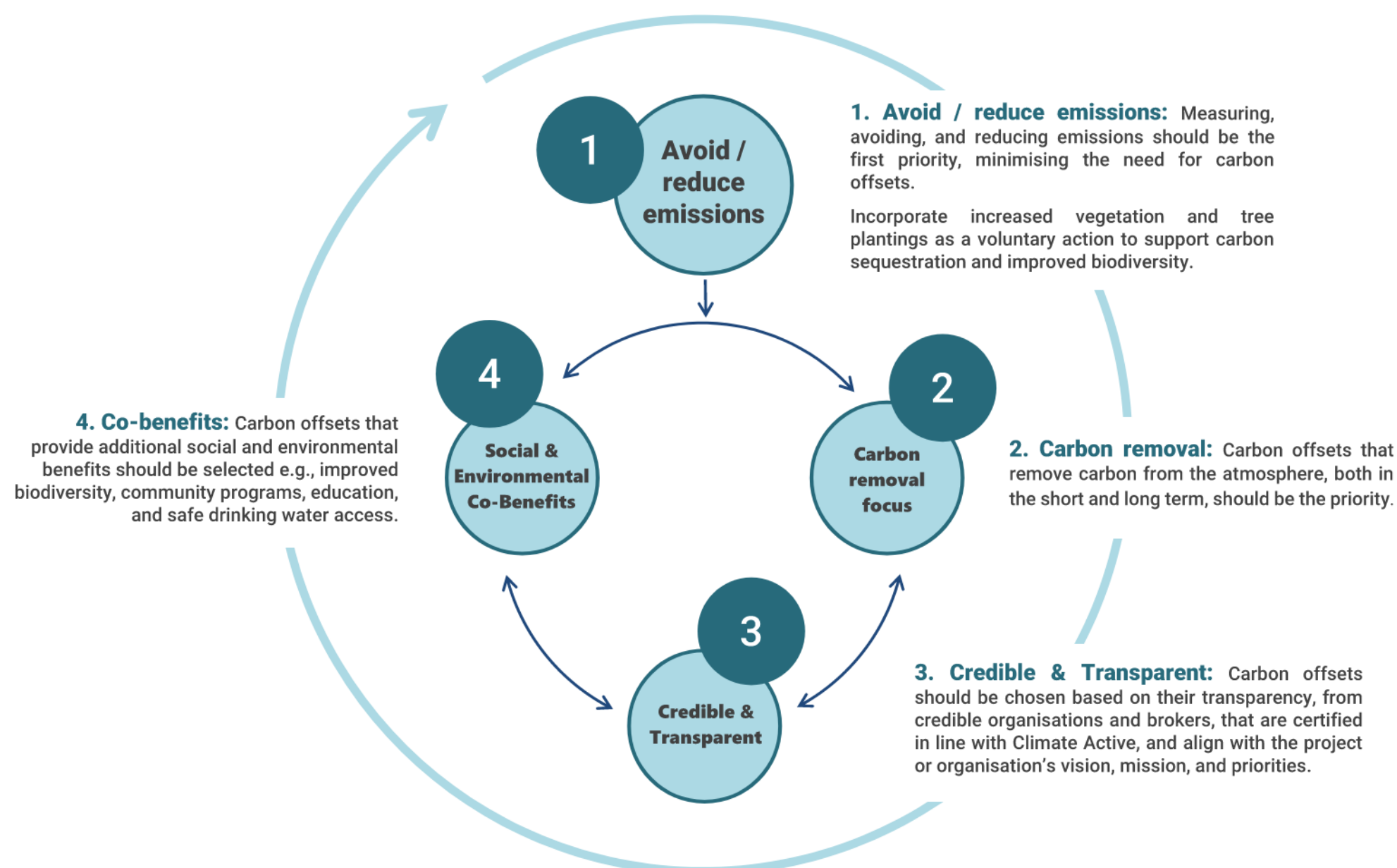


Figure 28: Carbon offset approach (Source: dsquared)

Appendix E Sources & references

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- ⁱ UN Net Zero Coalition - <https://www.un.org/en/climatechange>
 - ⁱⁱ Institute of Environmental Management and Assessment (IEMA) - [IEMA: Transforming the world to sustainability](#)
 - ⁱⁱⁱ UN Net Zero Coalition - <https://www.un.org/en/climatechange>
 - ^{iv} Australia's Emissions Projections - [Australia's emissions projections 2022 - DCCEEW](#)
 - ^v Per capita GHG emissions per capita - [Per capita greenhouse gas emissions, 2022 \(ourworldindata.org\)](#)
 - ^{vi} Carbon intensity of electricity generation, 2023 - [Carbon intensity of electricity generation, 2023 \(ourworldindata.org\)](#)
 - ^{vii} Insurance Council of Australia - [EV-Industry-Paper-final_-FINAL_MAY2024.pdf \(insurancecouncil.com.au\)](#)
 - ^{viii} EV FireSafe - [01 - Home | EV Fire Safe](#)
 - ^{ix} Flinders University - [All systems go for landmark energy project – News \(flinders.edu.au\)](#)
 - ^x IRENA - [Hydrogen \(irena.org\)](#)
 - ^{xi} Volkswagen - [Battery or fuel cell, that is the question | Volkswagen Newsroom \(volkswagen-newsroom.com\)](#)
 - ^{xii} RMI - [Hydrogen Reality Check: Distilling Green Hydrogen's Water Consumption - RMI](#)
 - ^{xiii} University of Adelaide - [Seawater split to produce green hydrogen | Newsroom | University of Adelaide](#)
 - ^{xiv} Snapshot Climate - [Mount Barker, SA :: Snapshot \(snapshotclimate.com.au\)](#)
 - ^{xv} Australian Energy Update 2023 - [Australian Energy Update 2023 | energy.gov.au](#)
 - ^{xvi} Clean Energy Regulator - [https://www.cleanenergyregulator.gov.au/Infohub/Markets/Pages/qcmr/december-quarter-2022/Australian-carbon-credit-units-\(ACCUs\).aspx](https://www.cleanenergyregulator.gov.au/Infohub/Markets/Pages/qcmr/december-quarter-2022/Australian-carbon-credit-units-(ACCUs).aspx)