



Attachment IS252

Achieving Net Zero

Corporate Climate Change Mitigation Plan

City of Greater Geraldton

4 November 2021

→ The Power of Commitment

GHD Pty Ltd | ABN 39 008 488 373

999 Hay Street, Level 10

Perth, Western Australia 6000, Australia

T +61 8 6222 8222 | **F** +61 8 6222 8555 | **E** permail@ghd.com | **ghd.com**

| | |
|-------------------------|---|
| Printed date | 16/11/2021 4:04:00 PM |
| Last saved date | 16 November 2021 |
| File name | D-21-127469 Climate Change Mitigation Plan |
| Author | Nicola Hoey |
| Project manager | Nicola Hoey |
| Client name | City of Greater Geraldton |
| Project name | Climate Change Mitigation Plan for CGG Operations |
| Document title | Achieving Net Zero A Climate Mitigation Plan |
| Revision version | Rev 0 |
| Project number | 12547691 |

Document status

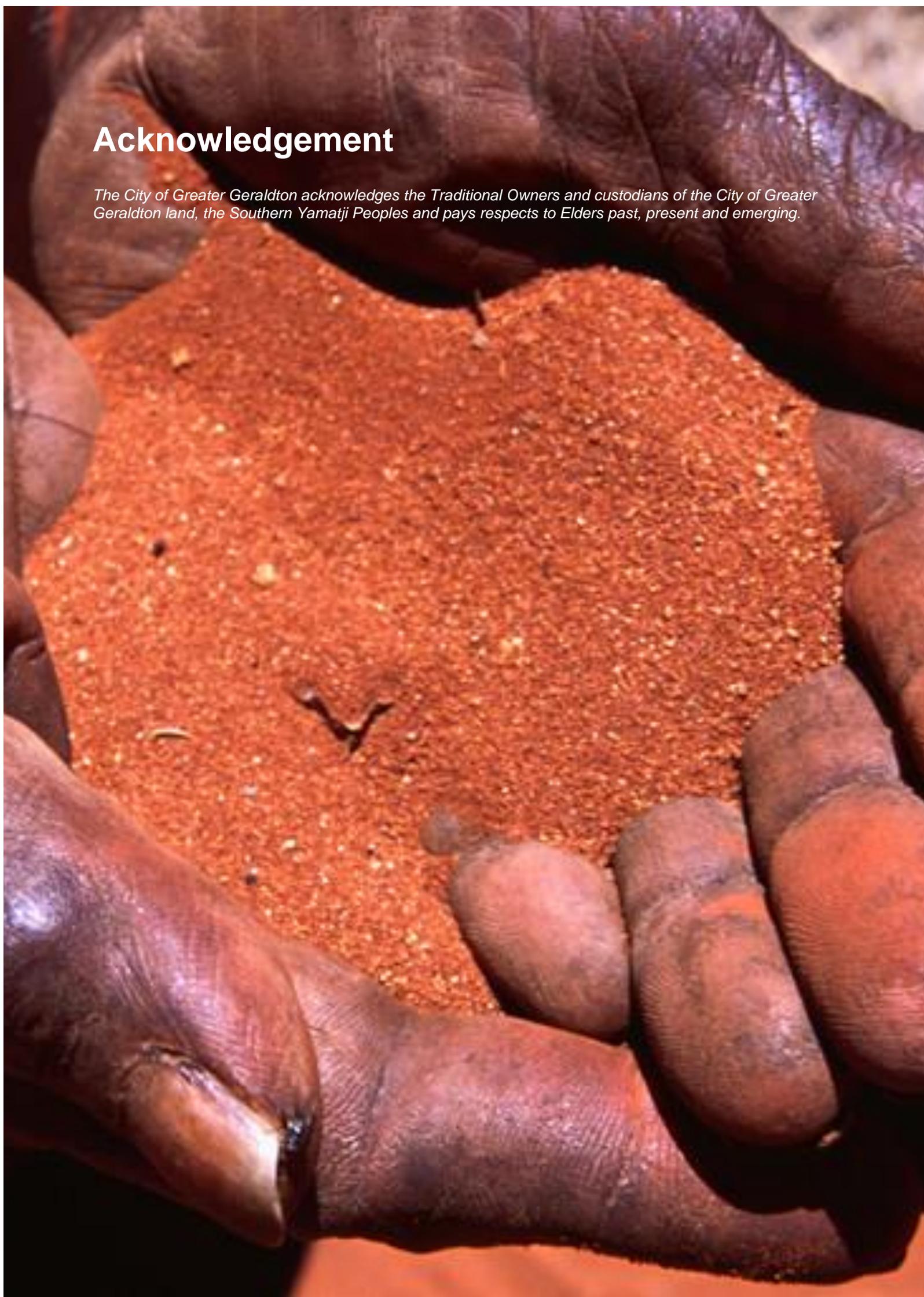
| Status Code | Revision | Author | Reviewer | | Approved for issue | | |
|-------------|----------|--------------------|----------|-----------|--------------------|-----------|------------|
| | | | Name | Signature | Name | Signature | Date |
| | A | C Norris N Hoey | H Knight | | A Krause | | |
| S4 | 0 | C Norris N Hoey | A Krause | | A Krause | | 04.11.2021 |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

© GHD 2021

This document is and shall remain the property of GHD. The document may only be used for the purpose for which it was commissioned and in accordance with the Terms of Engagement for the commission. Unauthorised use of this document in any form whatsoever is prohibited.

Acknowledgement

The City of Greater Geraldton acknowledges the Traditional Owners and custodians of the City of Greater Geraldton land, the Southern Yamatji Peoples and pays respects to Elders past, present and emerging.



Executive summary

The impacts of climate change are already being felt by communities around the world, including increasing temperatures, longer droughts, more frequent and intensive natural disasters such as heatwaves, bushfires, sea level rise, and associated increases in coastal erosion and inundation. With these impacts projected to further increase over the coming years and decades, the City of Greater Geraldton needs to take action now to safeguard the future.

The risks associated with climate change are becoming more important to local governments, and the need for local governments to respond to, and manage the impacts of climate change has never been greater. With local governments on the front line of addressing climate change the City has an important role to play. At the Ordinary Council Meeting on the 15 December 2020, the City’s Councillors declared a Climate Emergency. This declaration establishes our support for and commitment to climate change action.

As outlined in the City’s Climate Change Declaration it is recognised that climate change will continue to have a significant effect on the Western Australian environment, society and economy. The City is committed to addressing climate change within the local government area to minimise these impacts by developing this Climate Mitigation Plan to move the City’s operations towards a Net Zero Carbon position by 2030.

The City of Greater Geraldton acknowledges the importance of taking action, and as such is committed to finding practical ways to address climate change risks and impacts within the City. The Corporate Climate Change Mitigation Plan has been developed to present current emissions with actions to be undertaken to tackle climate change, build resilience and minimise the vulnerability of our area.

The overall goal of this plan is to reach net zero greenhouse gas emissions by 2030. Acting on and responding to climate change is an ongoing process, and this Plan will be reviewed and updated every two years to reflect changing circumstances and emerging information.

Figure 1 Summary of key actions to mitigation of greenhouse gas emissions

| Objective | Top Actions |
|---|---|
|  <p>Strong Climate Leadership</p> | <ul style="list-style-type: none"> – Develop a Climate/Sustainability Strategy incorporating Corp/Community Mitigation/Adaptation Plans – Develop Climate Change Communication and Engagement Plan for Climate Mitigation/Adaptation Plans – Explore climate change program membership/ accreditation opportunities – Establish a Revolving Energy Fund – Investigate potential for CGG renewable projects to generate ACCU (carbon credits) – Purchase of ethical, accredited carbon offsets for residual emissions 2030 |
|  <p>Reduce Energy Consumption</p> | <ul style="list-style-type: none"> – Improved metering – Energy efficiency improvements – Investigate green building design criteria/minimum standards for new Council buildings |
|  <p>Transition to Renewables</p> | <ul style="list-style-type: none"> – Install proposed solar based on priority (high/low) – Proposed Geraldton Airport solar PV & battery – Investigate proposed Aquarena additional solar / electric pool heat pump – Investigate hydrogen/electric replacement for gas/diesel sources (non fleet) – Investigate power purchase agreements for green power |

| | |
|---|---|
|  <p>Zero Emissions Fleet</p> | <ul style="list-style-type: none"> - Gradual replacement of unleaded vehicles with hybrids - Investigate feasibility/location installation of EV charging stations aligned with renewable energy (e.g. Airport solar & battery) - Investigate potential replacement of electric/hydrogen fleet vehicles - Ensure a zero emissions fleet by purchasing carbon offsets for residual transport emissions |
|  <p>Reduce Emissions from Waste</p> | <ul style="list-style-type: none"> - Meet targets to avoid and recover (CGG Waste Plan) - FOGO implementation and rollout - Landfill emissions Flaring/Biogas Capture and additional mitigation/benefit opportunities |

For further detail on all key actions refer to Appendix A.

Contents

| | |
|--|-----------|
| Acknowledgement | i |
| Contents | iv |
| Acronyms | 2 |
| 1. Introduction | 3 |
| 1.1 Purpose of this report | 3 |
| 1.2 Scope and limitations | 3 |
| 1.3 Assumptions | 3 |
| 2. Context | 5 |
| 2.1 Climate science | 5 |
| 2.2 Climate scenarios | 6 |
| 2.3 Projected climatic changes | 6 |
| 2.3.1 Role of Government | 7 |
| 2.4 Adaptation and mitigation | 8 |
| 3. Approach to Climate Change | 11 |
| 3.1 Climate Declaration | 11 |
| 3.2 Framework for Climate Mitigation | 13 |
| 3.2.1 Strategic Alignment | 13 |
| Greater Geraldton 2031 - Strategic Community Plan | 13 |
| Climate Change Policy 2021 | 13 |
| 4. Corporate Emissions | 15 |
| 4.1 Baseline Emissions and Energy Profile | 16 |
| 4.1.1 Waste | 18 |
| 4.1.2 Electricity & Gas | 19 |
| 4.1.2.1 Gas | 21 |
| 4.1.3 Fleet and Plant | 22 |
| 5. Achieving Net Zero | 24 |
| 5.1 Mitigation Approach | 24 |
| 5.1.1 Mitigation Objectives | 24 |
| 5.1.2 Mitigation Hierarchy | 25 |
| 5.1.3 Identification, Evaluation and Prioritisation | 25 |
| 5.1.3.1 Identification and Prioritisation Matrix | 25 |
| 5.2 Emissions Abatement | 26 |
| 5.2.1 Projected Emissions Abatement | 27 |
| 5.3 Strong Climate Leadership | 30 |
| 5.3.1 Strong Climate Leadership Action Plan | 30 |
| 5.3.2 Leadership and Advocacy | 31 |
| 5.3.3 Funding | 31 |
| 5.3.3.1 Revolving Energy Fund | 31 |
| 5.3.3.2 Grants and other Government Funding | 31 |
| 5.3.4 Purchasing Offsets | 32 |
| 5.3.5 Potential Australian Carbon Credit Units (ACCU) Generation | 32 |
| 5.3.6 Monitoring and Reporting | 33 |
| 5.4 Reduce Energy Consumption | 34 |
| 5.4.1 Reduce Energy Consumption Action Plan | 34 |
| 5.4.2 Energy Efficiency Improvements | 34 |
| 5.4.2.1 Improved Metering | 34 |

| | | | |
|-----------|---------|--|-----------|
| | 5.4.2.2 | Streetlight LED Replacement | 34 |
| | 5.4.2.3 | LED Lighting Upgrade | 35 |
| | 5.4.2.4 | Energy Efficiency Audits | 35 |
| | 5.4.3 | Green Building Design | 36 |
| 5.5 | | Transition to Renewables | 37 |
| | 5.5.1 | Transition to Renewables Action Plan | 37 |
| | 5.5.2 | Renewables and Solar PV | 37 |
| | 5.5.2.1 | Proposed Solar | 37 |
| | 5.5.2.2 | Geraldton Airport Solar PV | 38 |
| | 5.5.2.3 | Aquarena Pool Heating Electric Heat Pumps Powered by Solar | 38 |
| | 5.5.3 | Alternative Fuels | 39 |
| | 5.5.4 | Green Energy Power Purchase Agreements (PPA) | 39 |
| 5.6 | | Zero Emissions Fleet | 40 |
| | 5.6.1 | Zero Emissions Fleet Action Plan | 40 |
| | 5.6.2 | Electric Vehicles and Alternative Fuels | 40 |
| | 5.6.2.1 | Unleaded Petrol (ULP) Vehicles | 40 |
| | 5.6.3 | Ensuring an Efficient Fleet | 41 |
| | 5.6.4 | Offsetting Fuel Emissions | 41 |
| 5.7 | | Reduce Emissions from Waste | 42 |
| | 5.7.1 | Reduce Emissions from Waste Action Plan | 42 |
| | 5.7.2 | Avoid and Recover | 42 |
| | 5.7.2.1 | Waste Transfer Station Upgrade at Meru Waste Disposal Facility | 43 |
| | 5.7.3 | FOGO Implementation | 43 |
| | 5.7.4 | Landfill Gas Flaring/Biogas Capture | 44 |
| | 5.7.5 | Other Opportunities | 44 |
| 5.8 | | Offsets | 45 |
| 6. | | References | 46 |

Table index

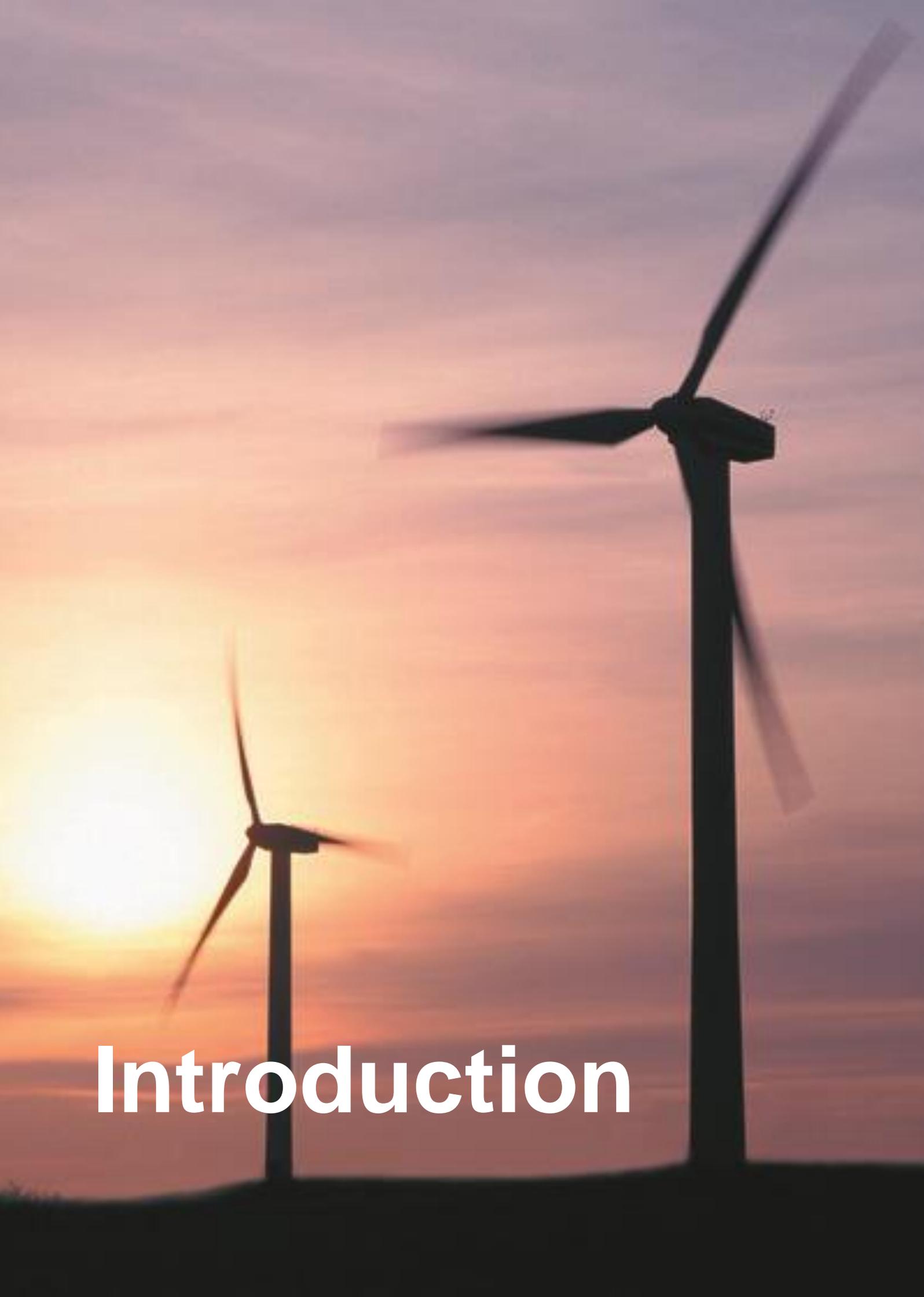
| | | |
|----------|---|----|
| Table 1 | Climate Change Action Planning Principles | 13 |
| Table 2 | Emissions Reduction and Cost Savings for Renewables | 21 |
| Table 3 | Emissions Reduction from Current Renewables | 21 |
| Table 4 | Climate change action practices | 25 |
| Table 5 | Projected Emissions and Abatement | 26 |
| Table 6 | Projected estimated financial implications of purchasing offsets (with and without abatement) | 29 |
| Table 7 | Strong Climate Leadership Action Plan | 30 |
| Table 8 | Reduce Energy Consumption Action Plan | 34 |
| Table 9 | Zero Emissions Fleet Action Plan | 37 |
| Table 10 | High priority solar installations with estimated emissions and financial savings | 37 |
| Table 11 | Low priority solar installations with estimated emissions and financial savings | 37 |
| Table 12 | Zero Emissions Fleet Action Plan | 40 |
| Table 13 | Reduce Emissions from Waste Action Plan | 42 |

Figure index

| | | |
|-----------|--|----|
| Figure 1 | Summary of key actions to mitigation of greenhouse gas emissions | ii |
| Figure 2 | Climate Mitigation and Adaptation, GHD 2021 | 9 |
| Figure 3 | Corporate Emissions Boundaries Summary | 15 |
| Figure 4 | Total Emissions by Source (excluding waste) | 16 |
| Figure 5 | Baseline Emissions by Source 2019 Waste Breakdown | 16 |
| Figure 6 | Total Emissions by Source (excluding non -CGG waste) | 17 |
| Figure 7 | Total Emissions by Scope per Year | 17 |
| Figure 8 | Total FY19 Energy Demand (GJ) by Source | 18 |
| Figure 9 | Total FY21 Energy Demand (GJ) Source | 18 |
| Figure 10 | Baseline FY19 Total Waste Emissions | 18 |
| Figure 11 | Western Australian electricity generation fuel mix 2019 (Australian Government, Department of Industry, Science, Energy and Resources, 2021) | 19 |
| Figure 12 | FY19 Baseline Electricity Consumption kWh per Facility | 20 |
| Figure 13 | Percentage of Renewable Electricity Energy Use (GJ) | 20 |
| Figure 14 | FY19 Electricity & Gas Emissions per Facility (tCO ₂ -e) | 21 |
| Figure 15 | Fleet and Plant Baseline Emissions FY19 | 22 |
| Figure 16 | Climate objectives to achieve the overall target of net zero emissions | 24 |
| Figure 17 | Mitigation Hierarchy | 25 |
| Figure 18 | Roadmap to Net Zero Emissions by 2030 | 26 |
| Figure 19 | Projected Waste Emissions Abatement (tCO ₂ -e) – Mitigation Opportunities Achieving 2030 Net Zero | 27 |
| Figure 20 | Non-Waste Carbon Emission Abatement (tCO ₂ -e) Mitigation Opportunities Achieving 2030 Net Zero | 28 |
| Figure 21 | Resource Recovery Projections, Strategic Waste Management and Recycling Plan 2020-2030 (Ask Waste Management Consultancy Service, 2020) | 43 |
| Figure 22 | Three Bin System Example, Strategic Waste Management and Recycling Plan 2020-2030 (Ask Waste Management Consultancy Service, 2020) | 44 |
| Figure 23 | Opportunity/Action Prioritisation Matrix | 55 |
| Figure 24 | Marginal Abatement Cost Curve (MACC) – Proposed Renewables | 56 |

Appendices

| | |
|------------|---|
| Appendix A | Detailed Mitigation Actions |
| Appendix B | Opportunity/Action Identification, Evaluation and Prioritisation Matrix |



Introduction

Acronyms

| | |
|--------------------------|--|
| ACCU | Australian Carbon Credit Units |
| CGG | City of Greater Geraldton |
| CO₂ | Carbon dioxide |
| CoP | Coefficient of Performance |
| CSIRO | Commonwealth Scientific and Industrial Research Organisation |
| DWER | Department of Water and Environmental Regulation |
| FOGO | Food and Garden Organics |
| FY | Financial year |
| GJ | Gigajoule |
| IPCC | Intergovernmental Panel on Climate Change |
| kW | Kilowatts |
| kWh | Kilowatt-hour(s) |
| LED | Light emitting diode |
| MACC | Marginal Abatement Cost Curve |
| NGER | National Greenhouse and Energy Reporting |
| PPA | Power Purchase Agreement |
| RAMPP | Regional Australia Microgrid Pilots Program |
| RCPs | Representative Concentration Pathways |
| tCO₂-e | Tonnes of carbon dioxide equivalent |
| WALGA | Western Australian Local Government Association |
| 4WD | Four wheel drive |

1. Introduction

1.1 Purpose of this report

The purpose of this document is to establish corporate mitigation actions for the City of Greater Geraldton. Through the implementation of these actions, the City can reduce greenhouse gas emissions from operations to avoid the future impacts of climate change beyond what is already projected and improve the resilience of the City's operations to climate change.

1.2 Scope and limitations

This report: has been prepared by GHD for City of Greater Geraldton and may only be used and relied on by City of Greater Geraldton for the purpose agreed between GHD and City of Greater Geraldton as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than City of Greater Geraldton arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

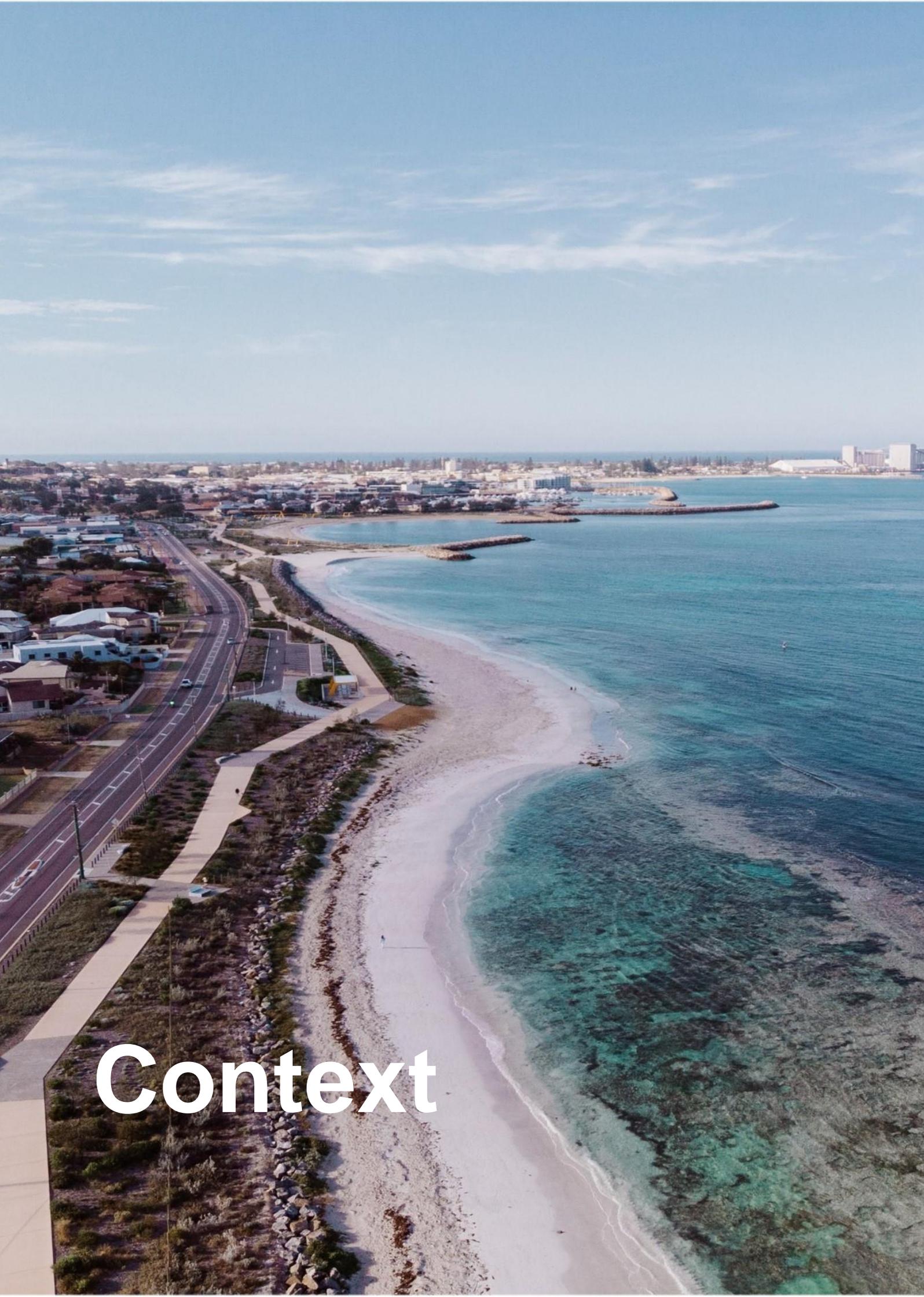
The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

1.3 Assumptions

- A specific climate change risk assessment has not been included. Climate risks have been assumed from the 2015 Regional Climate Change Adaptation Action Plan.
- Greenhouse gas emission calculations and mitigation reduction savings are based upon data provided by the City of Greater Geraldton, where data is unavailable assumptions have been agreed with the City. Accuracy is reliant on the quality of data provided.
- Baseline emissions were collated and relevant NGER determination method year applied.
- Opportunities to achieve the net zero target by 2030 are an initial high level assessment, further analysis is required for more accurate emission savings.

Assumptions related to different methodologies and data applied to the project are detailed in the relevant sections.

The Marginal Abatement Cost Curve (MACC) Tool used is the WALGA MACC Tool and its accuracy is based on data provided by City of Greater Geraldton and is dependent on the approach and method for each opportunity. The model is intended to be a guide and has potential for further refinement.



Context

2. Context

2.1 Climate science

International scientific consensus is that climate change is occurring, and it is driven by anthropogenic (human) causes, with human activities having a profound impact on the concentration of greenhouse gas emissions since the start of the industrial revolution. Ultimately, these activities, such as the burning of fossil fuels, land clearing and agriculture, have increased greenhouse gas concentrations in the atmosphere, leading to changes in the climate system over long periods of time.

The Intergovernmental Panel on Climate Change (IPCC) is an international body responsible for assessing the science related to climate change. IPCC assessments provide a scientific basis for governments at all levels to develop climate related policies, and they are fundamental inputs to negotiations at the United Nations Climate Conferences and the negotiation of international climate agreements. The IPCC's latest report, the Fifth Assessment Report, found that:

“Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased.

Most aspects of climate change will persist for many centuries even if emissions of CO₂ are stopped.”



**Human influence
on the climate
system is clear**

Australia State of the Environment
Report, 2016

2.2 Climate scenarios

In order to make projections of future climate change, the scientific community develop climate models, using advanced computer simulations, for a range of different greenhouse gas emissions scenarios (i.e., projections of what the global greenhouse emissions may be in future years). These scenarios are used to inform policy and decision makers to plan for the future.

In the Fifth IPCC Assessment, a set of four possible scenarios, also known as Representative Concentration Pathways (RCPs), were proposed. These RCPs represent possible pathways based on global atmospheric greenhouse gas emissions concentrations and predict how concentrations of greenhouse gases in the atmosphere will impact the climate.

- **Very low emissions scenario** – based on the IPCC’s RCP2.6. Under this scenario, significant collaborative effort will be made to drive decarbonisation and lower emissions, which will result in a temperature increase of 1°C, a 0.4 metre sea level rise and a minor increase in extreme weather events (by 2081-2100, relative to 1986-2005).
- **Low emissions scenario** – based on the IPCC’s RCP4.5. Under this scenario, collaborative efforts will be made to drive decarbonisation and lower emissions, which will result in a temperature increase of 1.8°C, a 0.47 metre sea level rise and a moderate increase in extreme weather events (by 2081-2100, relative to 1986-2005).
- **High emissions scenario** – based on the IPCC’s RCP6.0. Under this scenario, minimal efforts will be made to drive decarbonisation and lower emissions, which will result in a temperature increase of 2.2°C, a 0.48 metre sea level rise and a moderate increase in extreme weather events (by 2081-2100, relative to 1986-2005).
- **Very high emissions scenario** – based on the IPCC’s RCP8.5. Under this scenario, very low efforts will be made to drive decarbonisation and lower emissions, which will result in a temperature increase of 3.7°C, a 0.63 metre sea level rise and a large increase in extreme weather events (by 2081-2100, relative to 1986-2005).

2.3 Projected climatic changes

In the 20th century the impacts of climate change have become increasingly visible, with observed impacts including increases in global average air and ocean temperatures, rising global sea level, long-term sustained widespread reduction of snow and ice cover, and changes in atmospheric and ocean circulation and regional weather patterns, which influence seasonal rainfall conditions.

These changes threaten both human and natural systems, both directly and also through increased extreme weather events, such as heat waves, cyclones and other natural disasters, coastal inundation due to sea level rise, and disruptions to rainfall patterns.

In Australia, the 2018 Bureau of Meteorology State of the Climate Report (CSIRO and Australian Government Bureau of Meteorology 2018) noted that Australia has experienced increases to sea and air temperatures, sea level rises and ocean acidification, along with observed declines in rainfall amounts in the southwest and southeast of Australia.

Australia is the driest inhabited continent on earth, and even in the absence of climate change is characterised by variability and extremes. With the impacts of climate change projected to place additional stress on our natural and human systems, there is an urgent need to address climate change.

For the City of Greater Geraldton, projected changes to our climate in the future include:

- Further increase in temperatures, with more extremely hot days and fewer extremely cool days
- More heat waves that will be longer and hotter
- More frequent, extensive, intensive and longer-lasting marine heatwaves
- Ongoing sea level rise
- Further warming and acidification of the oceans
- Reduced annual rainfall and associated increase in number of dry days

- More intense heavy rainfall, particularly for short-duration extreme rainfall events (storms)
- An increase in the number of high fire weather danger days and a longer fire season
- Fewer tropical cyclones, but a greater proportion of high-intensity storms, with large variations from year to year
- Through a combination of many of these impacts, changes to biodiversity including increased species extinction

These changes will have impacts on our environment, our infrastructure and assets, and our communities.

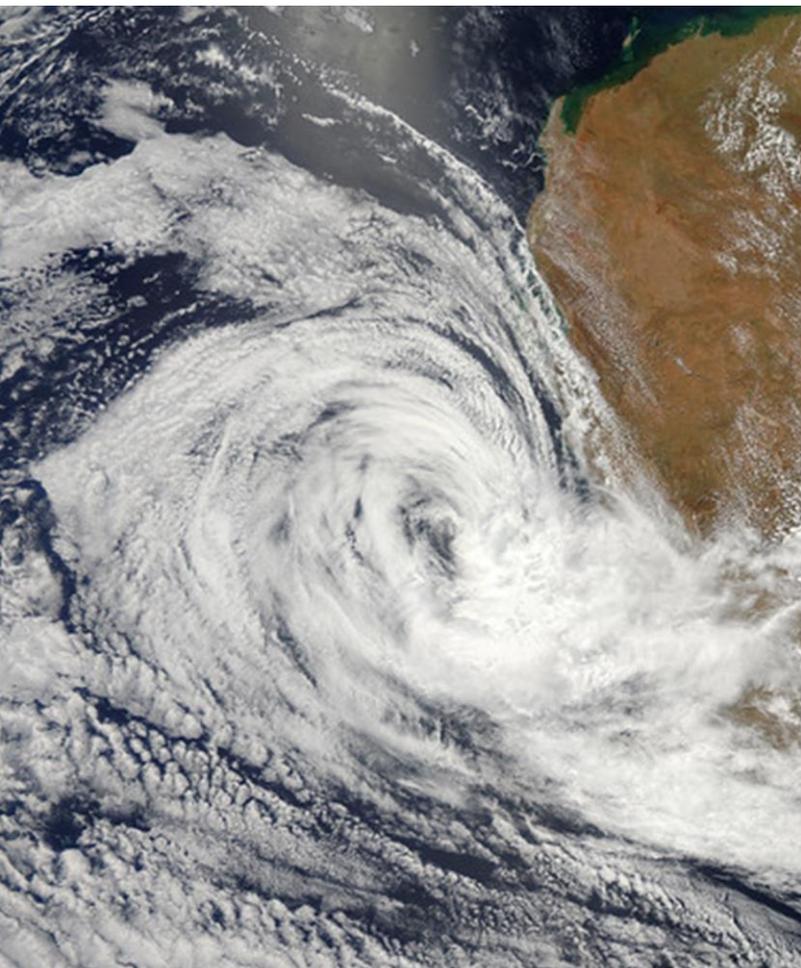
2.3.1 Role of Government

As a signatory to the Paris Agreement under the United Nations Framework Convention on Climate Change and the United Nations Sustainable Development Goals (SDGs), Australia has committed to taking action on climate change and to ensuring that mitigation and adaptation action is equitable and consistent with the aims of the SDGs. The Paris Agreement expressly recognises the importance of engagement at all levels of government. As such, the management of climate-change risks is spread across the three tiers of government: Commonwealth, State and Territory and Local.

In 2012, the Council of Australian Governments (COAG) formally agreed on the roles and responsibilities for climate-change adaptation in Australia.

The Commonwealth Government is responsible for:

- Managing climate change science and national adaptation research to allow Australia to effectively adapt to the impacts of climate change
- Providing leadership on national adaptation reform, and collaborating with States and Territories in setting and implementing national priorities and regional priorities
- Managing climate change risks and impacts across the Commonwealth's portfolio of assets and programs
- Maintaining a strong, flexible economy and social safety net that will help Australia adapt to climate change impacts by ensuring resources are available to respond to climate change and can be deployed efficiently



***Greater Geraldton
is predicted to have
a greater
proportion of high
intensity storms***

The State and Territory Governments are responsible for:

- Providing local and regional science and information
- Managing climate change risks and impacts across State and Territory assets and programs
- Working with the Commonwealth to implement the national adaptation reform
- Encouraging climate resilience and adaptive capacity

Local governments are on the frontline in addressing climate change impacts and have a critical role to play in ensuring that mitigation and adaptation responses are suitably tailored to the specific risks in our area, and that our local communities and stakeholders are consulted and involved in our efforts. They have the capacity to implement planning and development measures that reduce the impacts of climate change on all aspects of the community, and therefore have more hands-on responsibilities than the Commonwealth Government and complementary responsibilities to State and Territory governments.

Local governments are responsible for:

- Administering relevant state and territory and/or Commonwealth legislation to promote adaptation as required including the application of relevant codes
- Managing risks and impacts to public assets owned and managed by local governments
- Managing risks and impacts to local government service delivery
- Collaborating across local governments and with State and Territory Governments to manage risks of regional climate change impacts
- Ensuring policies and regulations under their jurisdiction, including local planning and development regulations, incorporate climate change considerations and are consistent with State and Commonwealth Government adaptation approaches
- Facilitating building resilience and adaptive capacity in the local community, including providing information about relevant climate change risks
- Working in partnership with the community, locally based and relevant NGOs, business and other key stakeholders to manage the risks and impacts associated with climate change
- Contributing appropriate resources to prepare, prevent, respond and recover from detrimental climatic impacts

2.4 Adaptation and mitigation

The impacts of climate change will impact the City of Greater Geraldton in a variety of ways. These impacts are predicted to increase in severity and frequency in the future, which will pose increasing risks to the community, environment, assets and infrastructure. To respond to these impacts there are two main categories of climate change response: adaptation and mitigation, both of which are essential, and equally as important in addressing climate change. It is important local governments consider adaptation responses that are specific to local risks and that local communities and stakeholders are involved in responses.

Climate change **mitigation** involves actions that are intended to reduce and remove human induced causes of greenhouse gas emissions to minimise the severity of climate change or enhance the sinks for these emissions. For example, mitigation actions may include switching to renewable forms of energy such as wind and solar, implementing energy efficiency initiatives, and supporting emission sinks such as investing in revegetation and or modified landscape management (e.g., fire management) to improve carbon capture.

Climate change **adaptation** consists of actions undertaken to reduce the consequences of the physical impacts of climate change, as well as to harness any opportunities as a result of these actions. Through adaptation actions we will become more prepared and able to adapt to the impacts of climate change, reducing our vulnerability. For example, adaptation actions may include building seawalls to protect infrastructure from erosion, raising the height of houses in flood prone areas, or behaviour change initiatives, such as monitoring vulnerable segments of the community during heatwaves.

This plan outlines the City's **mitigation** actions that will be required to achieve the corporate commitment to achieve net zero emissions by 2030. For a complete plan to address climate change, it is recommended that the City also:

- Prepare a corporate climate adaptation plan
- Prepare a community emissions profile and action plan to assist in community mitigation and adaptation

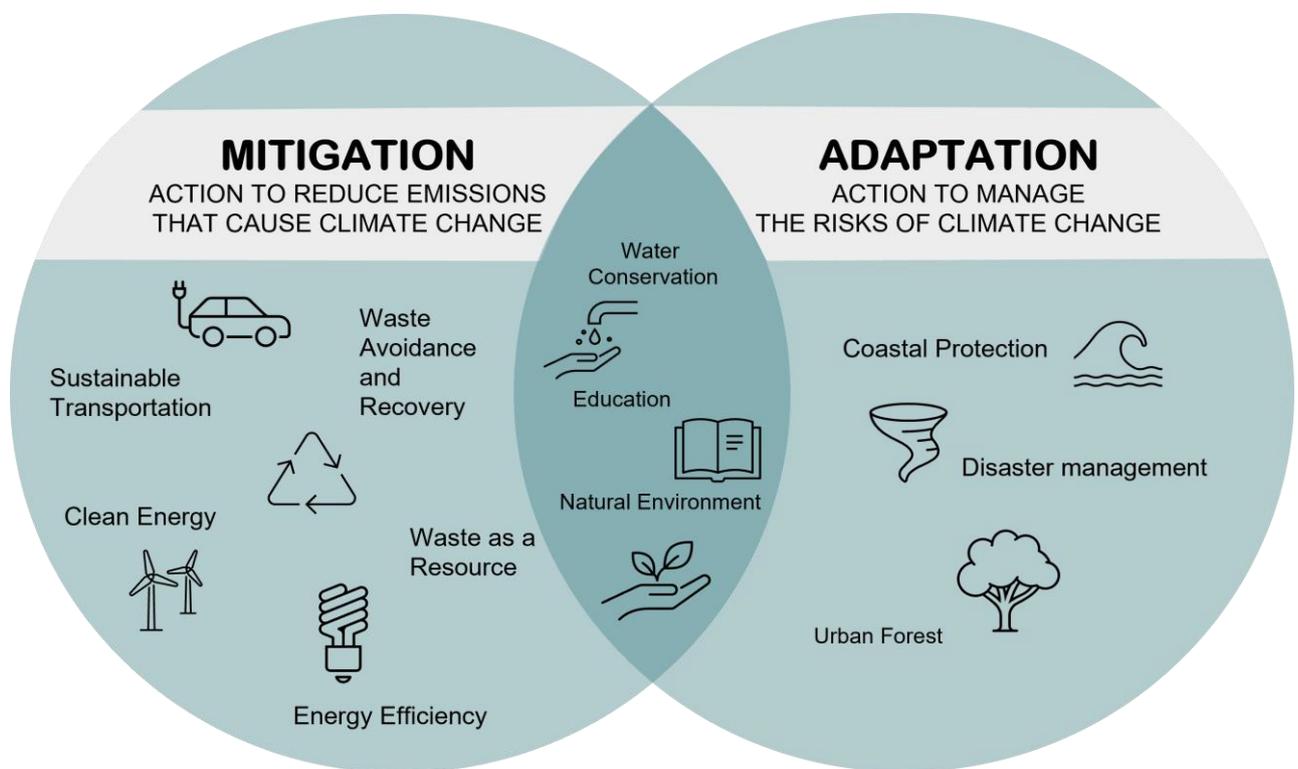
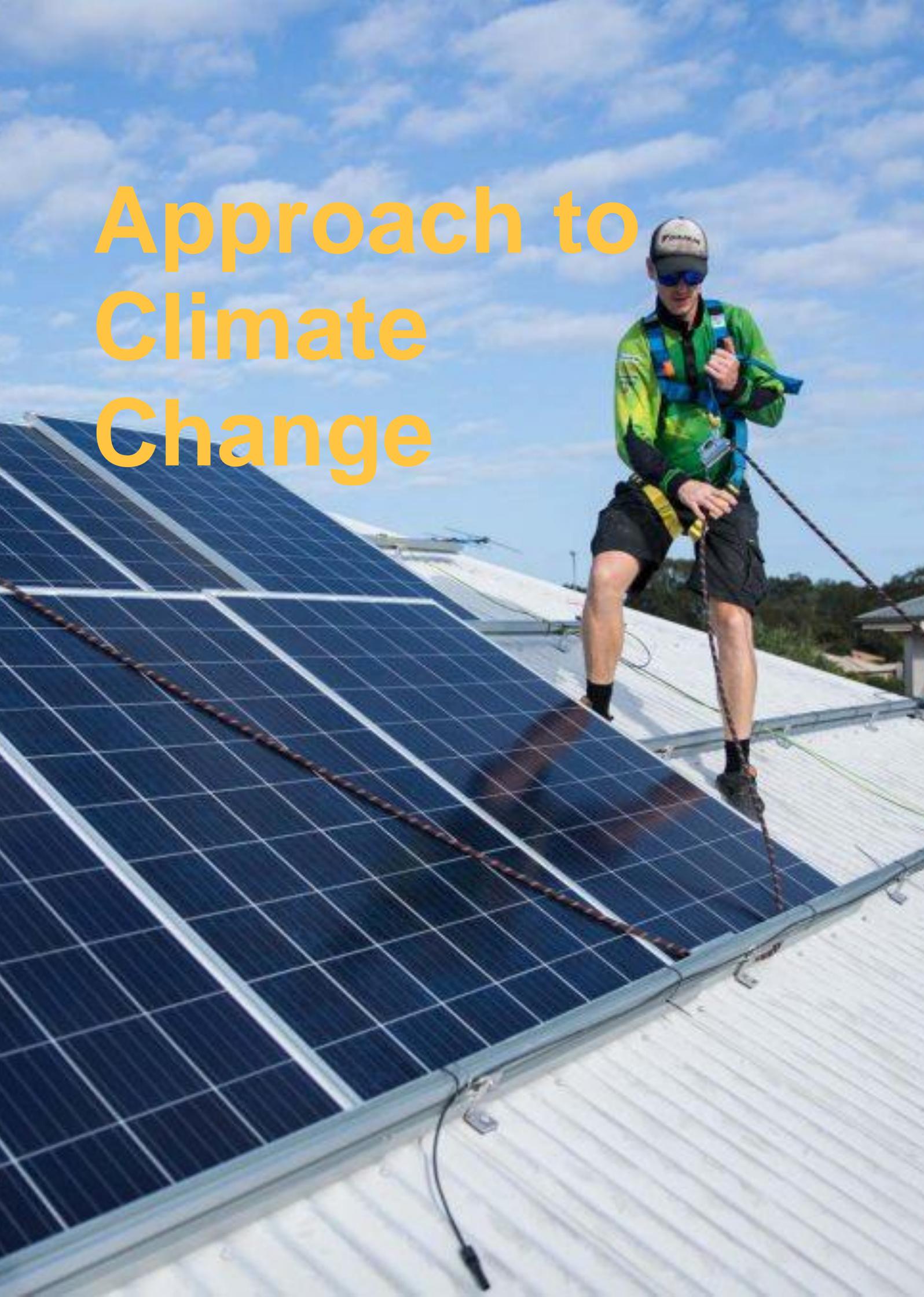


Figure 2 Climate Mitigation and Adaptation, GHD 2021

Approach to Climate Change



3. Approach to Climate Change

The City has a strong history of climate change action. This plan builds on this foundation to expand climate action, specifically targeting mitigation. The City's response to the impacts of climate change, so far, includes:

- Developing a Regional Climate Change Adaptation Plan in 2010 including a climate change risk assessment.
- Implementing climate mitigation projects across Council facilities – including six solar installations, two geothermal projects, various LED lighting projects in Council parks and car parks, and energy efficiency audits and upgrades.

Further information is provided in the adjacent timeline.

3.1 Climate Declaration

In 2020 the City joined 101 other Australian local governments (including 11 in Western Australia) in declaring a Climate Emergency. As part of this declaration the City committed to:

- Updating the City's Climate Adaption Plan to detail actions required to move the City's operations towards a net zero position by 2030
- Providing preliminary financial costs to undertaking action on climate
- Recognised the Council's leadership role on climate change

This also supports WALGA:

- To work with State and Federal Government to ensure achievement of greenhouse gas emissions reduction targets as set out in key National and International agreements through the demonstration of local government commitment.
- To work with State and Federal Government to implement key actions and activities for climate change management at a local level.

The Council has committed to review the plan every two years. This ensures that the document can continually be amended to incorporate the latest climate science, and to reflect the climate change management priorities and progress achieved to date. Progress of mitigation actions can also be monitored and communicated to the community.

Climate Change Action To Date

TIMELINE

Mitigation

Adaptation

2012

Council's 1st solar installation



2014

Geothermal installation at CGG Regional Art Gallery



2015-19

Multiple solar installations at Aquarena (2015) CMC (2017) QPT (2018) CGG Regional Art Gallery (2018) CGG Library (2019)



2019

Additional large scale solar installation at Aquarena



2020

Council endorse the Strategic Waste Management and Avoidance Action Plan



2021

Development of the Corporate Mitigation Plan



2010

Regional Climate Change Adaptation Plan



2013

Council adopts the Local Biodiversity Strategy



2019

Coastal Hazard Risk Management and Adaptation Plan and Coastal Adaptation Policy endorsed by Council



2020

Council Declares a Climate Emergency and commits to investigating the pathway to net zero emissions



2021

Climate Change Policy Endorsed by Council



2010
The City has been taking climate action since 2010

3.2 Framework for Climate Mitigation

3.2.1 Strategic Alignment

Greater Geraldton 2031 - Strategic Community Plan

Using the values identified in the Greater Geraldton Strategic Community Plan, principles, practices and objectives have been developed to guide climate change mitigation action (refer to Table 1).

Table 1 Climate Change Action Planning Principles

| Community Value | Climate Change Action Planning Principle |
|-------------------------------------|--|
| Transparency and Accountability | We follow an open decision-making process, and set actions that can be measured, reported, verified, and evaluated. |
| Inclusion, Accessibility and Equity | We involve multiple departments, stakeholders and communities in planning and implementation. We seek solutions that equitably address the risks of climate change and share the costs and benefits of action across the City |
| Unity | We aim to coherently undertake actions across a range of sectors within the City, as well as supporting broader regional initiatives and the realisation of priorities of higher levels of government when possible and appropriate. |
| Diversity and Prosperity | Our actions seek to deliver local benefits and support local development priorities. |
| Leadership | Our goals and actions work towards an ambitious vision. |

Climate Change Policy 2021

In May 2021 the City of Greater Geraldton published its Climate Change Policy. The objectives of the Climate Change Policy outline the City of Greater Geraldton's commitment to addressing climate change through:

- Acknowledging causes and understanding its impacts in a local, regional and international context
- Reducing green-house emissions through sustainable decision-making and actions
- Developing appropriate adaptation strategies

“The City of Greater Geraldton recognises that it has an ethical obligation and an opportunity to play a leadership role for addressing the impacts of what is now considered to be a climate emergency.”

Mitigating Climate Change – Emission Reductions

“The City of Greater Geraldton acknowledges that meeting emission reduction targets is ongoing. No single policy measure or technology provides the solution to climate change. The City of Greater Geraldton is committed to:

- Reducing its operational greenhouse gas emissions
- Supporting the reduction of greenhouse gas emissions in the community
- Contributing towards agreed national emission reduction targets
- Using appropriate research frameworks and data to inform its own strategies, decision-making and leadership activities
- Encouraging and supporting community and business in the transition towards sustainable lifestyles that reduce climate change impacts

Corporate Emissions

Baseline



4. Corporate Emissions

Corporate emissions come from activities or sources that are owned or controlled by the City, whereas community emissions are all the other emissions produced within the area including those from residents and businesses. Across all local governments in Australia, community emissions typically represent around 99% of local government emissions (Beyond Zero Emissions, Ironbark Sustainability, ICLEI, 2018), however, this plan focusses on the City's corporate emissions (where the City has operational control). In this plan, the focus is on actions to address scope 1 and scope 2 emissions, scope 3 emissions are out of scope for this project. Refer to Figure 3 below for further detail of the emission boundaries and associated Council business areas.

| Business Area | Corporate emissions (City) | Community emissions | Other Corporate /organisation emissions |
|---|---------------------------------------|---------------------|---|
|  Waste decomposition | ✓ | ✓ | ✓ |
|  Fleet fuel and plant (petrol and diesel) | ✓ | | |
|  Pool heating (natural gas) | ✓ | | |
|  Buildings and facilities owned and occupied by the City (electricity) | ✓ | | |
|  Buildings and facilities leased by Community/sporting groups (electricity) | | ✓ | |
|  Buildings and facilities with combined occupancy – City and community use (electricity) | ✓ | | Needs further metering |
|  Park assets (e.g. toilets, barbeques) | ✓ | | |
|  Floodlighting (electricity) | ✓ | ✓ | ✓ |
|  Irrigation (electricity used in pumps) | ✓ | | |
|  Streetlighting (City owned) | ✓ | | |
|  Streetlighting (Western Power owned) | | | ✓ |
|  Use of materials (e.g. paper) | Not currently measured and/or Scope 3 | | |
|  Business Travel (e.g. flights) | | | |
|  Air conditioning refrigeration | | | |
|  Transmission and distribution | | | |

Figure 3 Corporate Emissions Boundaries Summary

4.1 Baseline Emissions and Energy Profile

The City has used the emissions from 2018/19 to quantify abatement actions required to reach the goal of net zero by 2030. Waste is the most significant source of corporate emissions with 87 percent of emissions generated from solid waste to landfill. Other than waste emissions, electricity is the next largest source of emissions at approximately 50- 54 percent.

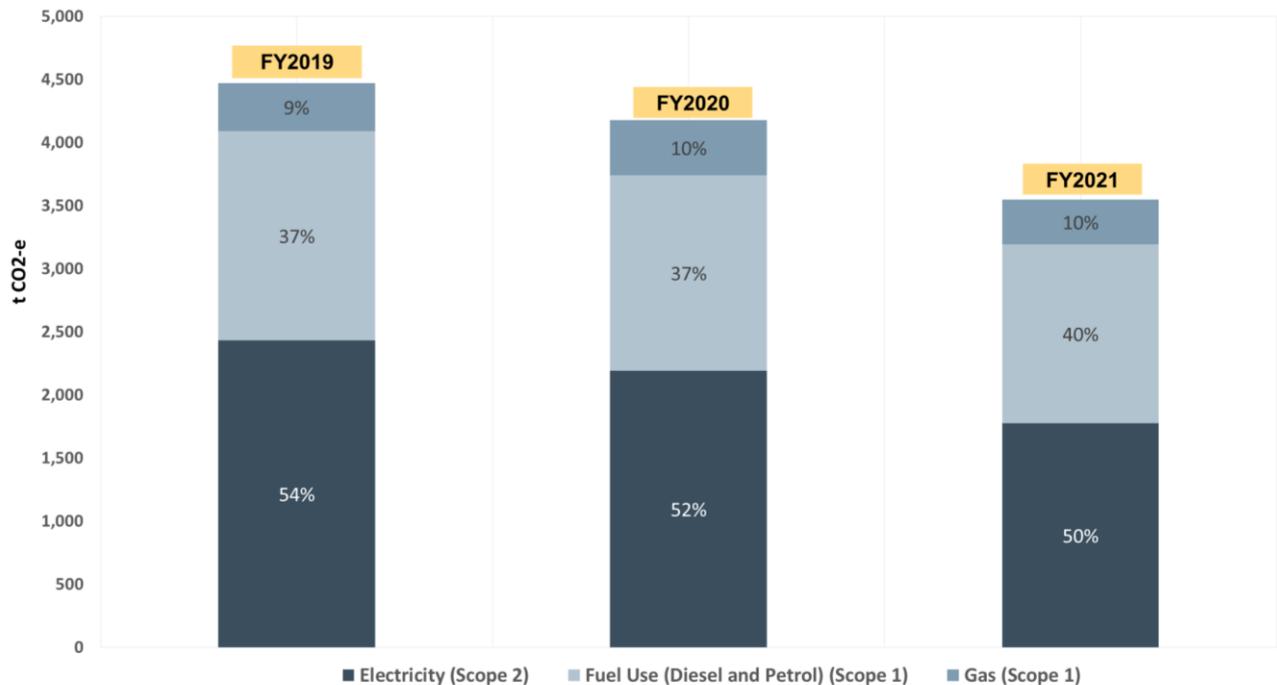


Figure 4 Total Emissions by Source (excluding waste)

Over the past three years, emissions from waste have remained consistent, however, emissions from electricity use and fuel have decreased. This is likely due to a combination of normal usage variation year to year, with the majority of the decrease due to increases in renewable energy generation (solar). A minor contributor could be attributed to COVID-19 impacts.

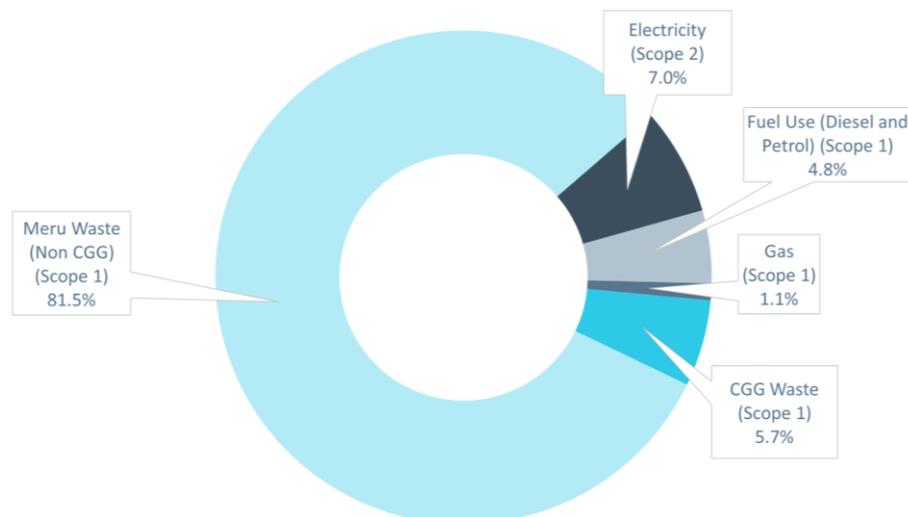


Figure 5 Baseline Emissions by Source 2019 Waste Breakdown

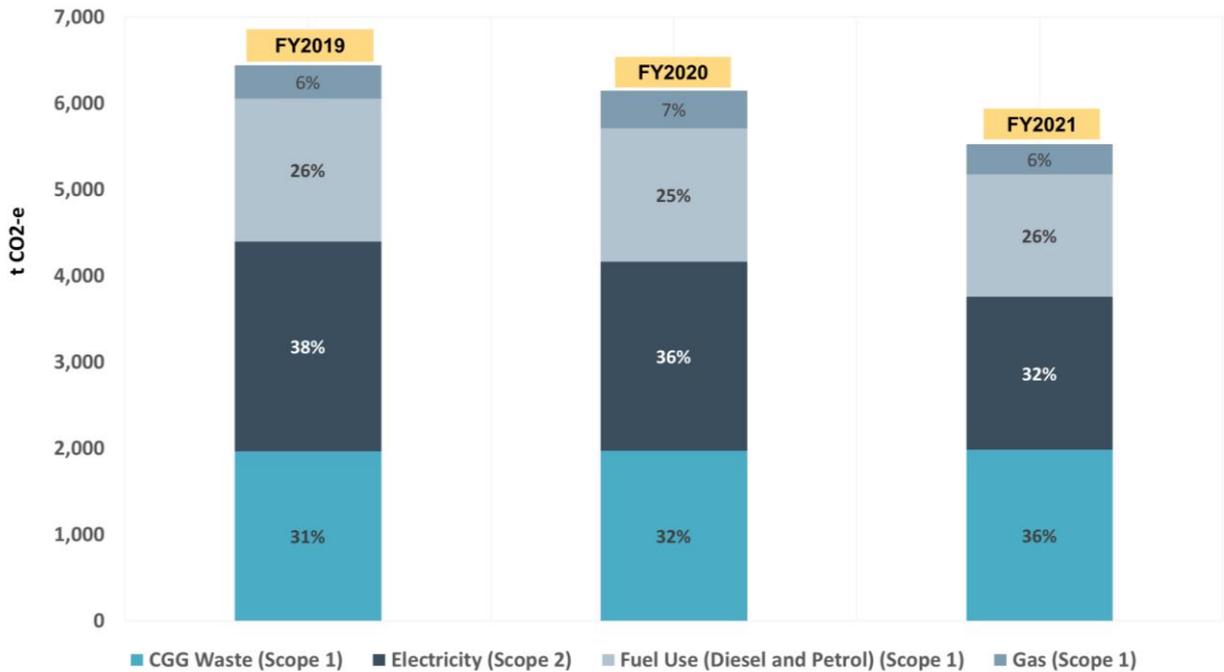


Figure 6 Total Emissions by Source (excluding non -CGG waste)

Defining emissions by ‘scopes’ helps delineate direct and indirect emission sources and improves transparency. Scope 1 greenhouse gas emissions are the emissions released to the atmosphere as a direct result of an activity, or series of activities at a facility level. Scope 1 emissions are sometimes referred to as direct emissions (Australian Government, Clean Energy Regulator, 2021). The City’s main scope 1 emissions are:

- Emissions from the decomposition of waste at Meru landfill
- Emissions from fuel used in trucks, passenger vehicles and large plant
- Natural gas used to heat the public swimming pool

Scope 2 greenhouse gas emissions are the emissions released to the atmosphere from the indirect consumption of an energy commodity (Australian Government, Clean Energy Regulator, 2021). The City’s main source of corporate scope 2 emissions is electricity usage at City facilities such as at the airport, in our municipal offices, in leisure centres and other community facilities as well as consumption from City owned street lighting.



Figure 7 Total Emissions by Scope per Year

The City's energy demand for the FY2019 baseline year total 44,552 GJ comprised primarily of energy related to fuel usage at 52.8 percent, electricity at 28.9 percent and gas at 16.6 percent, with renewables making up the remainder 1.6 percent (Figure 8). Since then renewables account for 5.5 percent in FY2021 with minimal changes to gas and fuel energy demand the 38,486 GJ total (Figure 9).

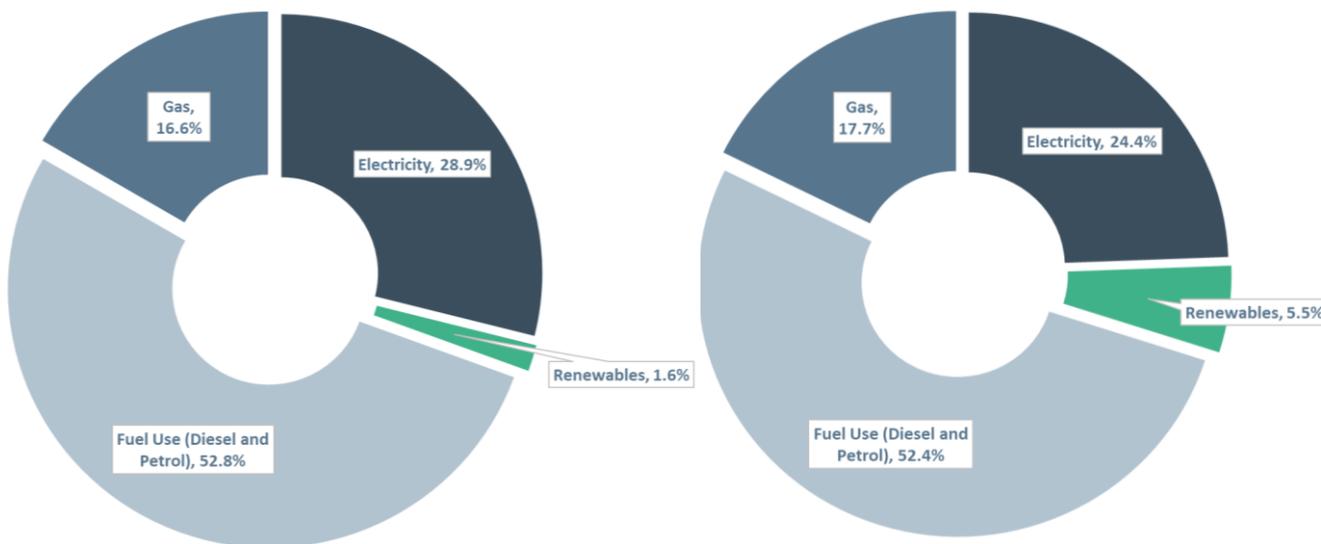


Figure 8 Total FY19 Energy Demand (GJ) by Source Figure 9 Total FY21 Energy Demand (GJ) Source

4.1.1 Waste

Methane emissions resulting from decomposition of waste from the Meru Waste Management Facility contribute 87.1 percent of the total City corporate greenhouse gas emissions in FY2019, which equates to approximately 30,241 tCO₂-e. These emissions are included in the City corporate emissions profile as the City of Greater Geraldton has operational control and is responsible for the Meru Waste Management Facility. Of the total emissions from landfill the emissions that the City contributes directly from waste generated by its own activities, accounts for approximately 6.5 percent each year. The remaining 93.5 percent of total waste emissions comes from waste received at the landfill from the community and other local government areas. For more detail on the City's waste management, refer to the City's Strategic Waste Management and Recycling Action Plan 2020-2030.

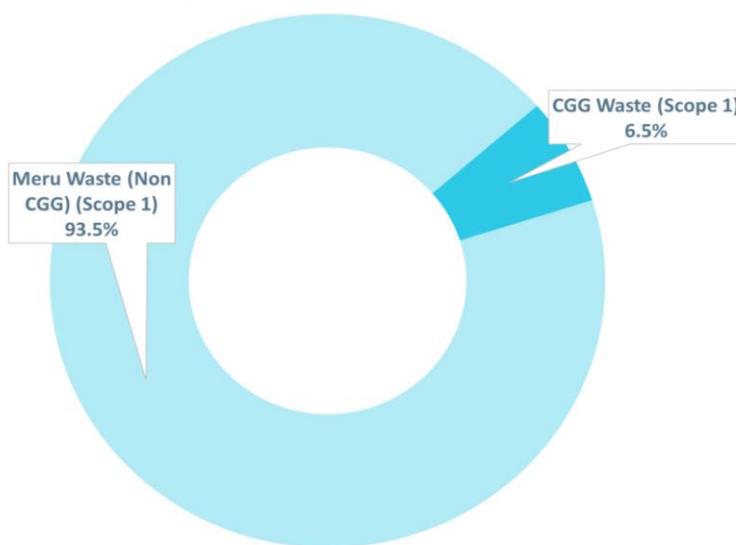


Figure 10 Baseline FY19 Total Waste Emissions

4.1.2 Electricity & Gas

In Western Australia, electricity is largely generated from fossil fuels, with hydro and other renewables making up 10 percent of the mix (Figure 11). Electricity is the second highest contributor to corporate emissions. This is due to grid electricity use (from fossil fuel sources) across City operations such as in Council facilities, offices and for sports lighting.

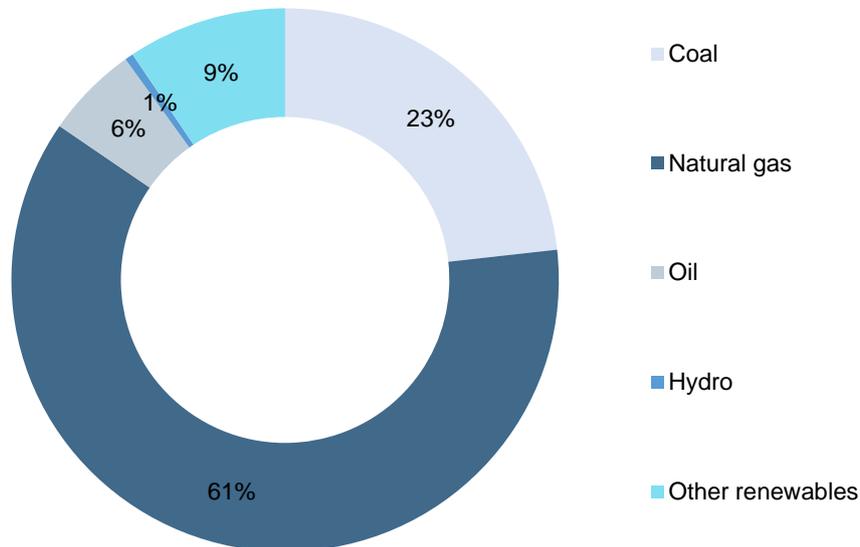


Figure 11 Western Australian electricity generation fuel mix 2019 (Australian Government, Department of Industry, Science, Energy and Resources, 2021)

The City's facilities which are the largest consumers of electricity (Figure 12) for the FY2019 baseline year of this analysis are:

- Aquarena (28% total emissions from electricity)
- Geraldton Airport (14%)
- Sports/Recreation and Leisure (grouping) (12%)
- Civic Centre (9%)
- Geraldton Regional Art Gallery (6%)
- Queens Park Theatre (5%)
- Geraldton Library (4%)

This equates to 2,432 tCO₂-e making a total of 7 percent of the City's total greenhouse gas emissions. Since 2019, the City has added to their renewable energy sources including an extra 120kW solar photovoltaic system at Aquarena, a 60kW system at the City of Greater Geraldton Library. This has contributed to the overall 27 percent decrease in kWh consumption of electricity between 2019 and 2021.

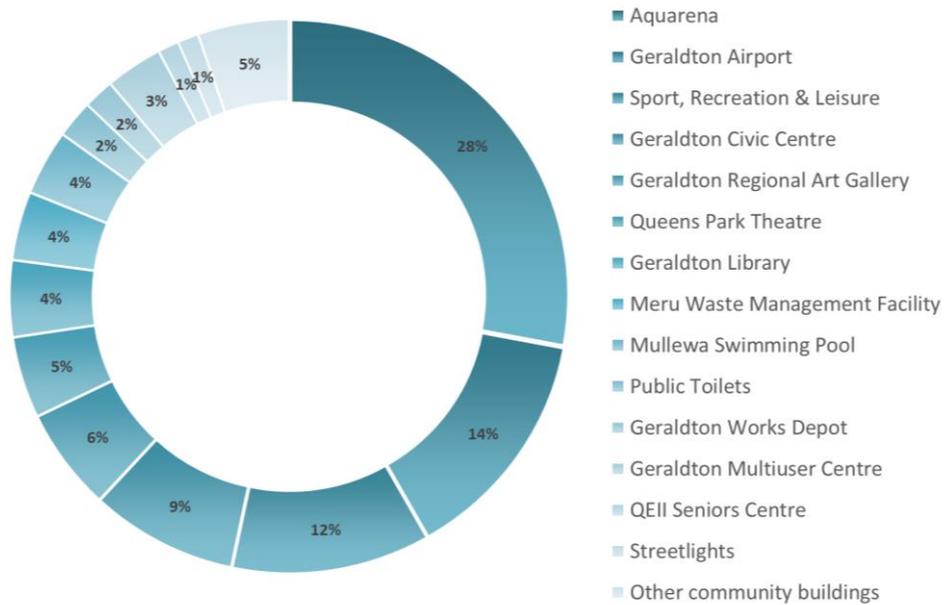


Figure 12 FY19 Baseline Electricity Consumption kWh per Facility

Error! Reference source not found.

The City has taken a number of actions to reduce electricity use and generate renewable energy (Figure 13). These include:

- Energy efficiency audits
- Installation of solar photovoltaic systems on Council buildings
- Installation of geothermal heating at Geraldton Regional Art Gallery
- Installation of geothermal pool heating at Aquarena (failed project)

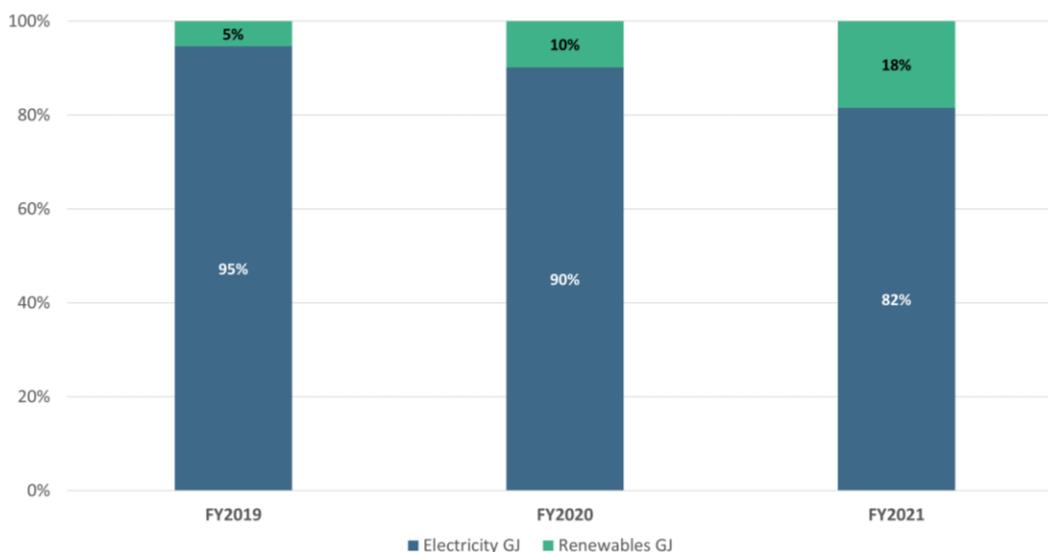


Figure 13 Percentage of Renewable Electricity Energy Use (GJ)

All facilities where action has taken place have seen decreases in emissions and reduced energy bills. The energy source supplies the electricity is the South West Interconnected System (SWIS).

Table 2 Emissions Reduction and Cost Savings for Renewables

| Renewables | Estimated Emissions Savings (tCO ₂ -e) | Estimated Electricity Savings (\$) |
|--------------|---|------------------------------------|
| 2019 - 2021 | 778 | \$251,000 |
| Until 2030 | 2,701 | \$874,000 |
| Total | 3,479 | \$1,125,000 |

Table 3 Emissions Reduction from Current Renewables

| Facility | FY2018/9 (tCO ₂ -e) | FY2019/20 (tCO ₂ -e) | FY2020/21 (tCO ₂ -e) |
|--------------------------------|--------------------------------|---------------------------------|---------------------------------|
| Aquarena | 41.4 | 95.0 | 231.1 |
| Geraldton Regional Art Gallery | 35.5 | 36.6 | 35.2 |
| Queens Park Theatre | 35.4 | 34.8 | 34.4 |
| Geraldton Library | 0.0 | 45.8 | 72.3 |
| Geraldton Multiuser Centre | 26.0 | 26.7 | 28.2 |
| Total | 138.2 | 238.9 | 401.2 |

4.1.2.1 Gas

While natural gas is the lowest source of corporate emissions at just over 1 percent, 96 percent of that is generated from one activity – heating the pool at Aquarena. Other sources are Queens Park Theatre and Queen Elizabeth II Centre as well as LPG from BBQ gas bottles at parks and recreation areas. A new gas boiler was installed in 2021 at the Aquarena which will likely improve efficiency.

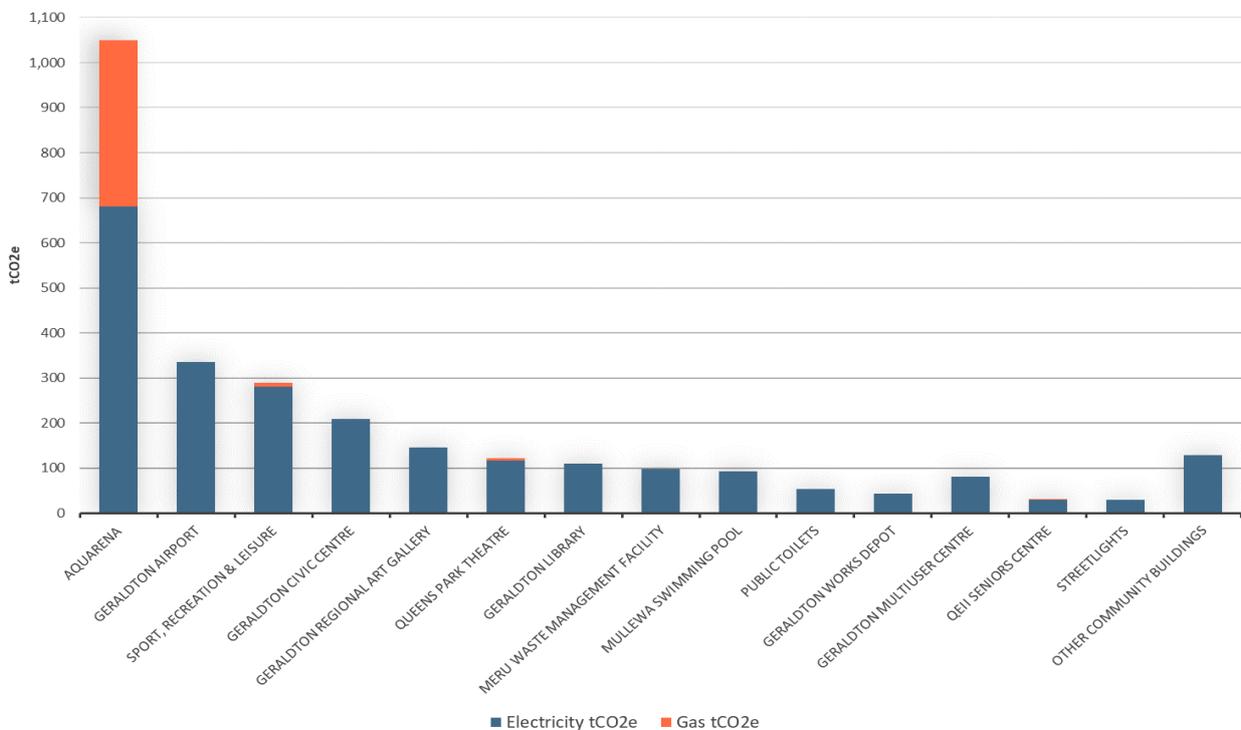


Figure 14 FY19 Electricity & Gas Emissions per Facility (tCO₂e)

4.1.3 Fleet and Plant

The City has operational requirements for a range of vehicles, plant and equipment which deliver essential services such as maintenance of the City's roads, parks, and reserves.

Overall, emissions from fleet and plant consumption of petrol and diesel fuel contribute approximately five percent of the City's total emissions. In 2018/19, over 99 percent of fuel use was diesel and under 1 percent unleaded petrol. Of the diesel used, approximately 77 percent was used in heavy fleet and plant (including graders and wheel loaders) and 22 percent in the light fleet (including 4x4 ranger vehicles) (Figure 15). In addition to transport related diesel consumption there is also stationary consumption from equipment such as generators and water pumps.

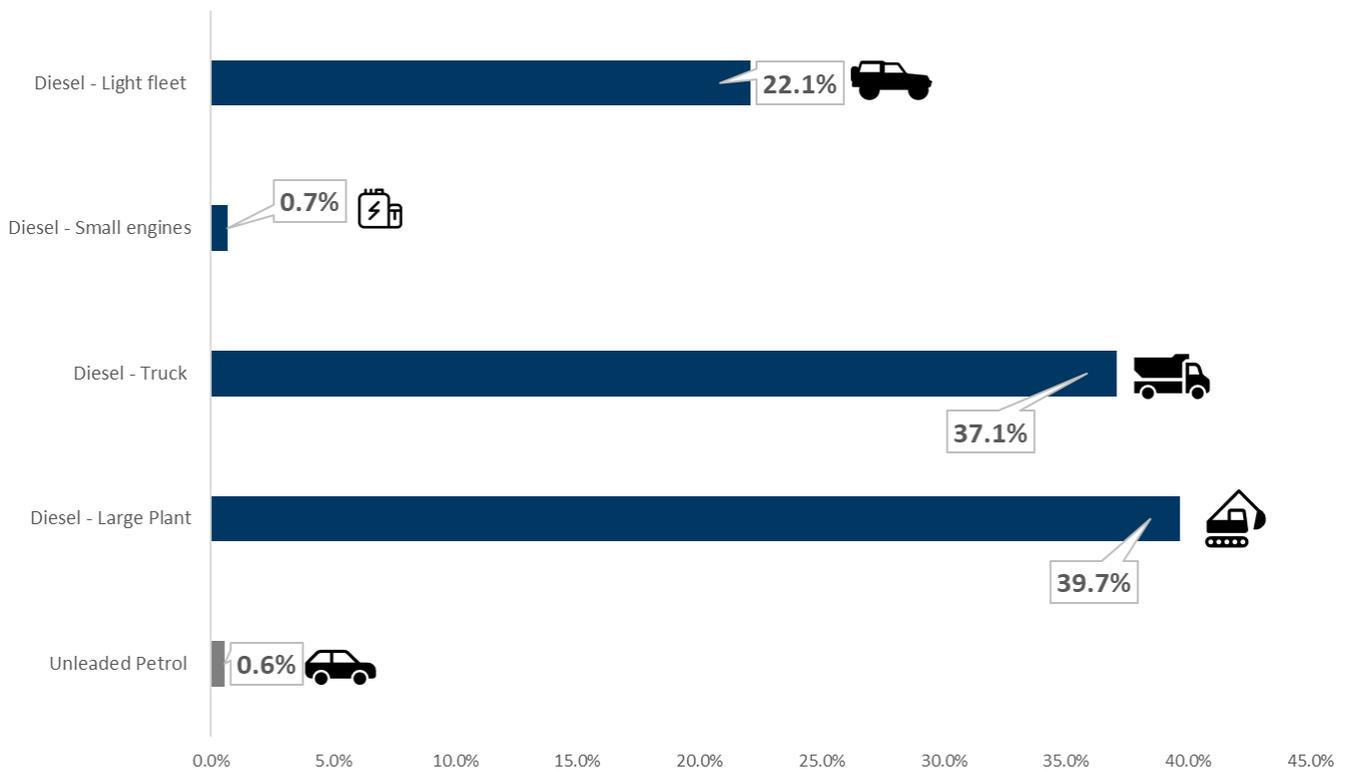


Figure 15 Fleet and Plant Baseline Emissions FY19

Achieving Net Zero



5. Achieving Net Zero

5.1 Mitigation Approach

5.1.1 Mitigation Objectives

The overarching target for this plan has been taken from the Council Climate Declaration – to achieve net zero emissions by 2030. The achievement of this target will support Federal and State Government commitments to reduce greenhouse gas emissions. Five objectives have been developed to support the achievement of the net-zero target. Actions developed to support removal and reduction of greenhouse gas emissions have been grouped under each objective, refer to Action Plan for each objective or to Appendix A for all detailed key actions.

- Objective 1:** Strong Climate Leadership - Demonstrating commitment and leadership in taking action to reduce carbon emissions and contribute to the global effort towards climate change by working together and having an adaptive management approach.
- Objective 2:** Reduce Energy Consumption - Reduce energy consumption and improve efficiency
- Objective 3:** Transition to Renewables - Aims to progressively transition to renewables by increasing generation and utilisation of renewable energy
- Objective 4:** Zero Emissions Fleet - Along with carbon offsets the City aims to improve efficiency and explore electric and hydrogen alternatives aiming for a zero emissions fleet by 2030
- Objective 5:** Reduce Emissions from Waste - Aim to avoid and reduce emissions from landfill while maximising benefits associated with emissions from landfill.

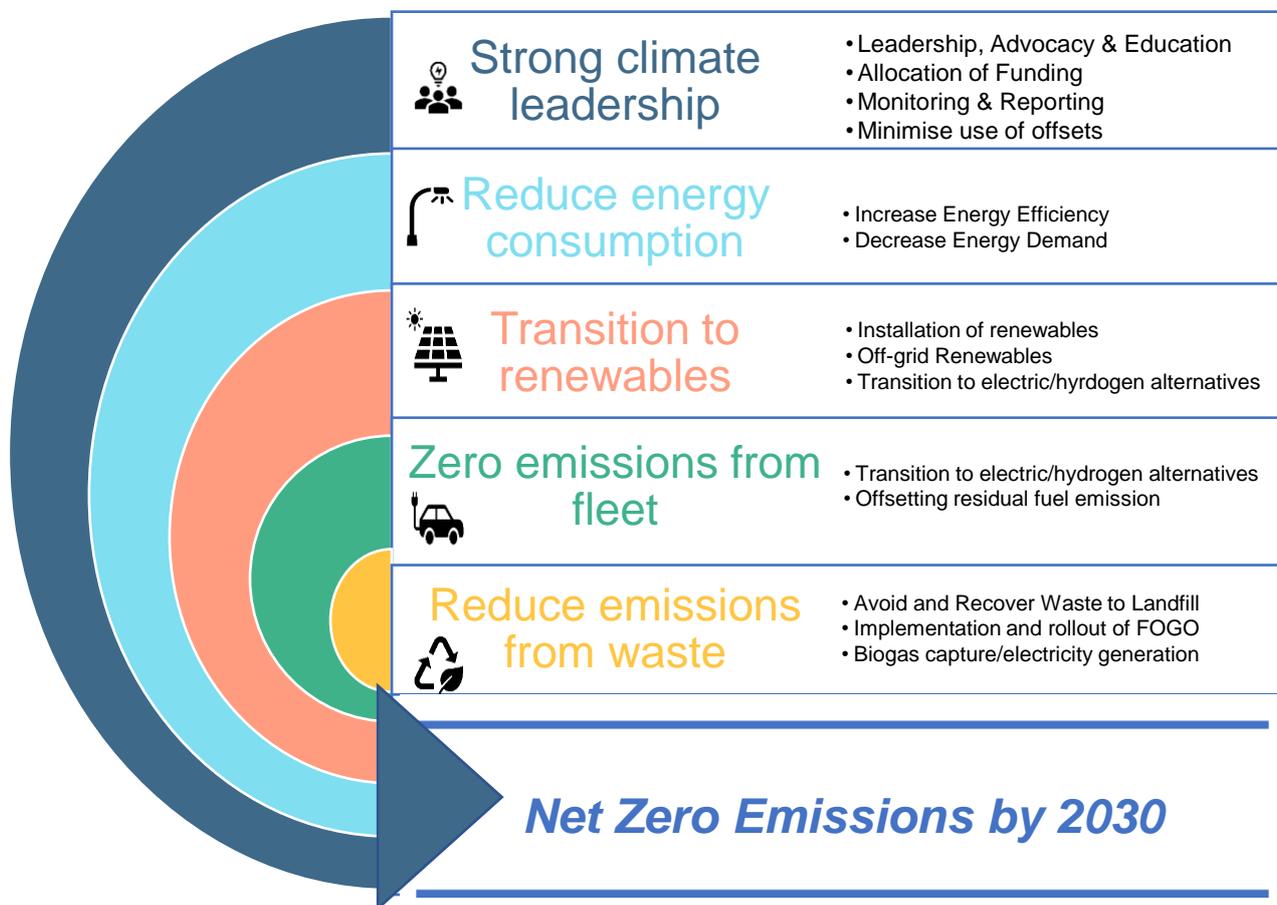


Figure 16 Climate objectives to achieve the overall target of net zero emissions

5.1.2 Mitigation Hierarchy

Once the emissions inventory was determined and the overall emissions profile of the City of Greater Geraldton developed, the mitigation hierarchy was then applied to provide a step-by-step approach in order of priority to mitigate emissions. The first priority in the hierarchy and initial focus for action, is **reducing** energy consumption through efficiency, this is followed by **replacing** energy sources with renewable alternatives and lastly **offsetting** of emissions through accredited carbon offsets. The intention is that the process to reach net zero by 2030 only applies carbon offsets for residual emissions that cannot be mitigated through other opportunities.

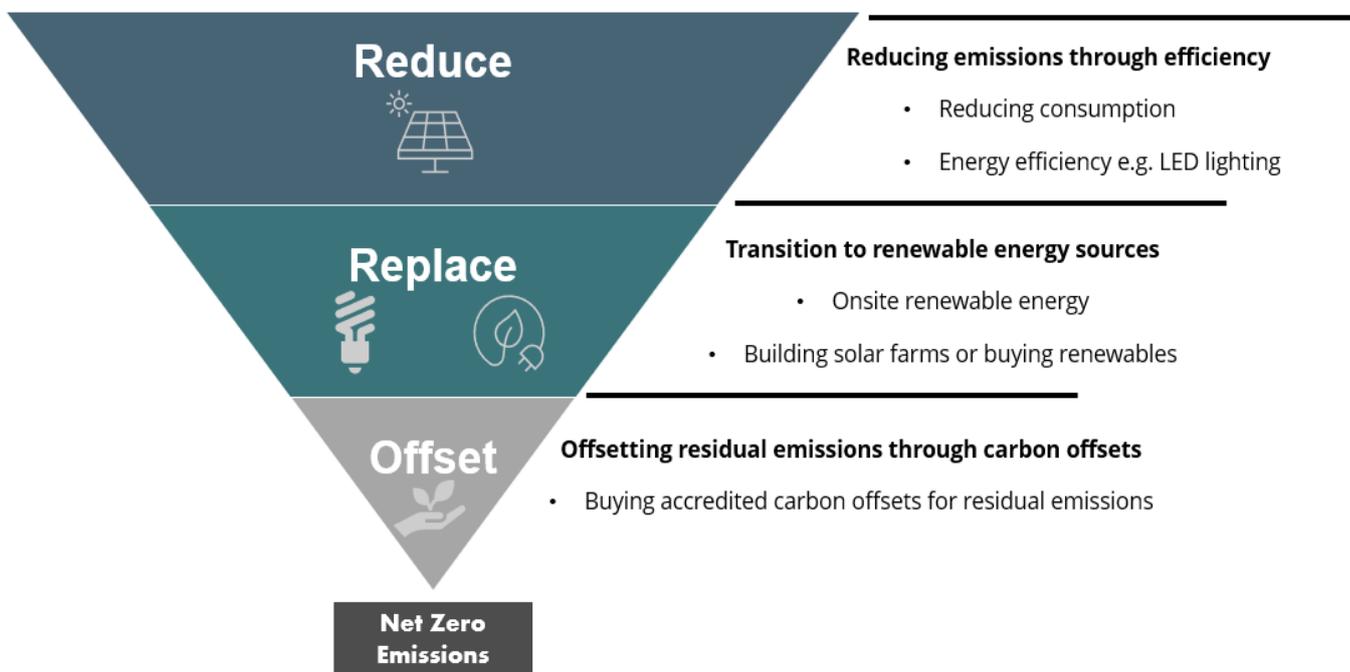


Figure 17 Mitigation Hierarchy

5.1.3 Identification, Evaluation and Prioritisation

Actions to achieve net zero emissions by 2030 have been developed using the baseline data and the Mitigation Hierarchy. Actions have been applied to the baseline emissions profile to project emissions reductions due to abatement activities.

When developing our actions, the City also seeks to adopt the practices identified in Table 4.

Table 4 Climate change action practices

| Principle | |
|------------------------------|---|
| Opportunity | Actions provide co-benefits to the local government's broader objectives. |
| Resourcing | We have the appropriate level of resourcing. |
| Implementation | Actions are integrated into the local government's existing activities |
| Flexibility and adaptability | Actions are adaptable and flexible. |
| Evaluation and monitoring | Implementation of actions can be effectively evaluated and monitored. |

5.1.3.1 Identification and Prioritisation Matrix

Opportunities to abate emissions were identified based on the City's specific emissions sources and activities. Once identified, the opportunities were assessed using an Evaluation and Prioritisation Matrix. This matrix (refer to Figure 23 in Appendix B) assesses an opportunity based on the impact or benefit to the overall goal, being net zero by 2030, and the relative ease of implementation. The ease of implementation considers aspects such as costs, complexity, effort and resources. This is a high level, initial assessment of the abatement opportunities and

actions. The results have been used to determine opportunities and actions of maximum benefit to focus on first, as well as those that may have potential future benefit.

In addition to the matrix, for opportunities associated with proposed solar photovoltaic systems, an additional analysis was applied to the most suitable options using the WALGA Marginal Abatement Cost Curve (MACC) Tool (Western Australian Local Government Association, n.d.), refer to Figure 24 in Appendix B.

This process allowed the identification of 36 specific actions, including the 21 priority actions (listed in Appendix A) and their associated timing for completions. Each action aligns with the key objectives of the City's goal of net zero by 2030 (Section 5.1.1).

5.2 Emissions Abatement

To determine how the City is to reach net zero by 2030 the projected emissions were estimated based on the average emissions by source of FY2019, FY2020 and FY2021. With the exception of waste emissions which were determined based on the projected waste generation figures in relation to population growth as detailed in the City's Strategic Waste Management and Recycling Action Plan 2020-2030 and provided by the City. The projected emissions and abatement are estimates and are an initial assessment intended to be used as a guide in formulating the impact of abatement opportunities in achieving the target of net zero by 2030 and to direct focus and resources going forward.

Table 5 Projected Emissions and Abatement

| FY19 Baseline Emissions (tCO ₂ -e) | Do Nothing Scenario Total Emissions Projected 2030 (tCO ₂ -e) | With All Abatement Actions Scenario Total Emissions Projected 2030 (tCO ₂ -e) |
|---|--|--|
| 34,713 | 38,107 | 8,759 |

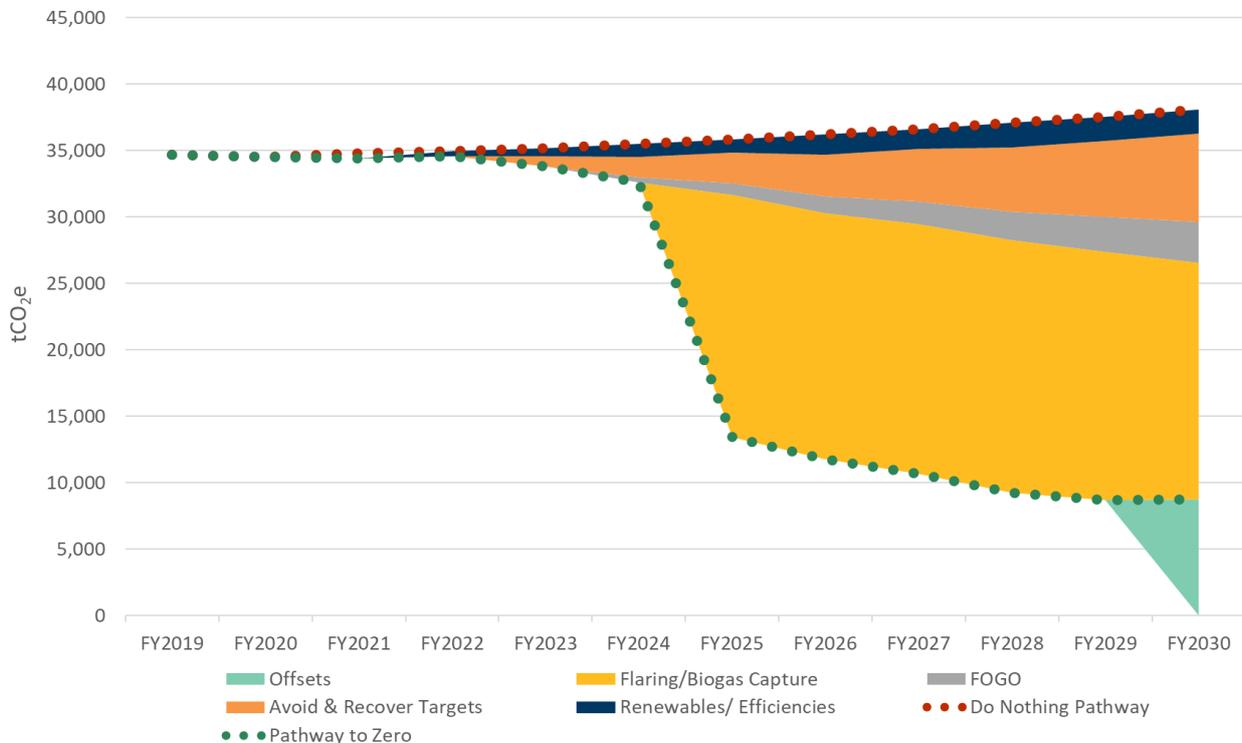


Figure 18 Roadmap to Net Zero Emissions by 2030

5.2.1 Projected Emissions Abatement

To highlight the key emissions abatement considerations, the mitigation opportunities have been separated to emphasise those related to the City's primary emissions source, waste. Mitigation opportunities associated with waste emissions are presented in Figure 19, the non-waste related mitigation opportunities are presented in Figure 20.

Of all proposed emission mitigation opportunities, the flaring/biogas capture has the most significant impact in reducing the City's total annual emissions with approximately 47 percent.

With all abatement opportunities identified, approximately 77 percent of total projected 2030 emissions would be mitigated. Of that, 72 percent is attributed to reduction from waste related opportunities as identified on Figure 19. Approximately 6 percent or 1,840 tCO₂-e of abatement identified is attributed to non-waste related emissions including electricity, fuel and gas emission sources. A total of 23 percent of total emissions would be residual and at this stage only able to be mitigated through purchasing of offsets.

Although the non-waste mitigation opportunities equate to less emissions reduction, many are associated with being easier to implement with high to low positive impact. Refer to Appendix B for further details. Note energy efficiency improvement opportunities in Figure 20. Figure 20 includes both electricity and fuel (ULP hybrid replacement) emission reduction opportunities.

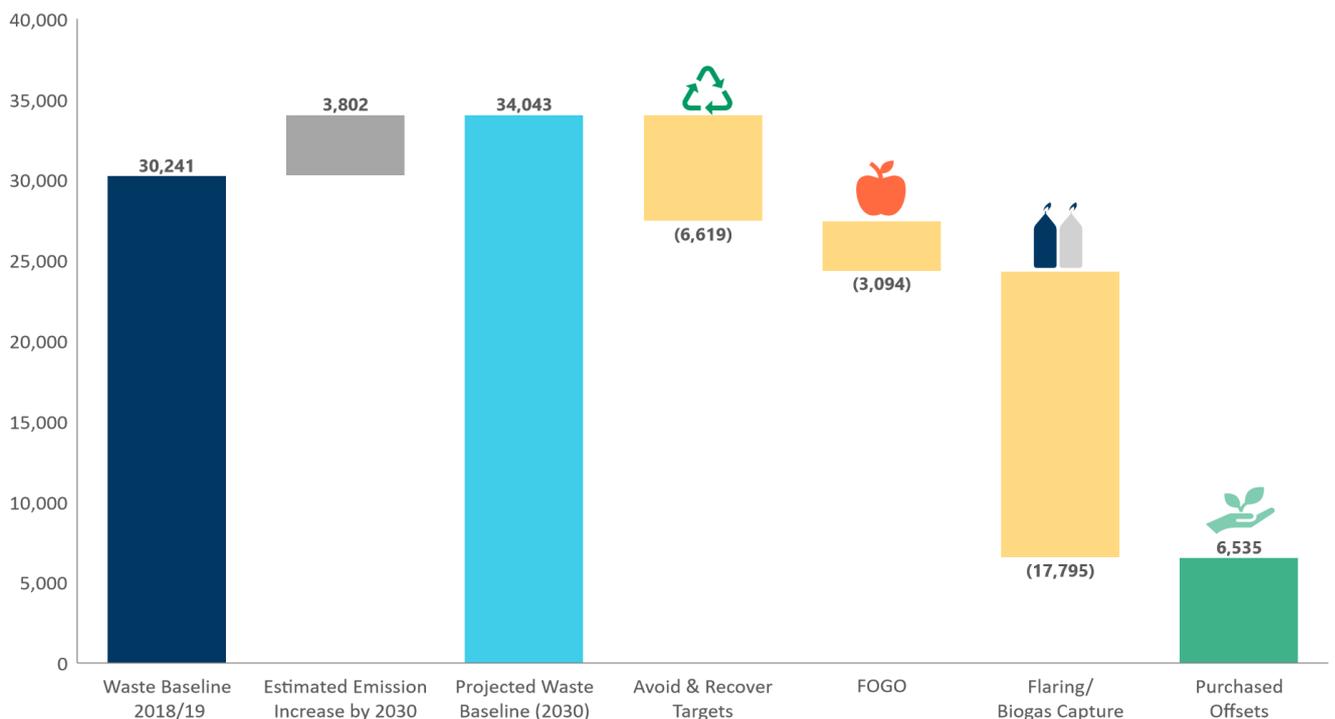


Figure 19 Projected Waste Emissions Abatement (tCO₂-e) – Mitigation Opportunities Achieving 2030 Net Zero

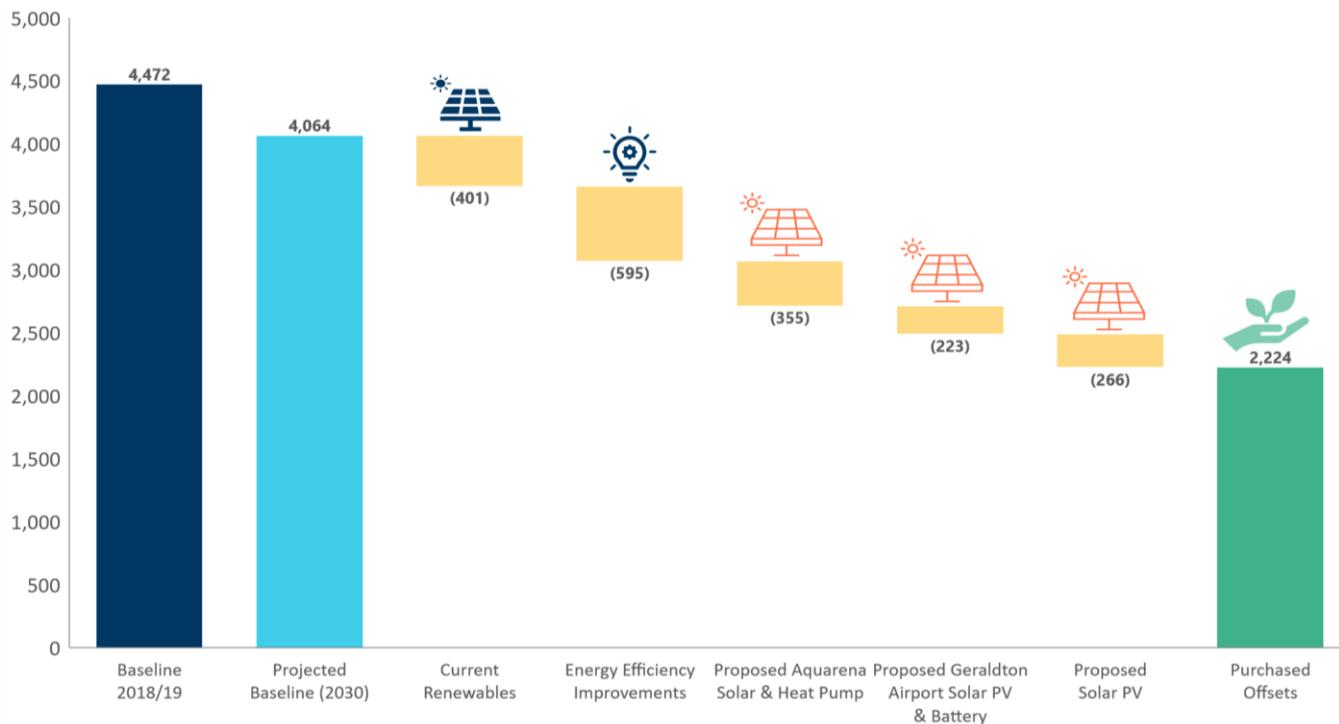


Figure 20 Non-Waste Carbon Emission Abatement (tCO₂-e) Mitigation Opportunities Achieving 2030 Net Zero

Without any abatement applied it is estimated that to achieve net zero by 2030 using offsets alone, it will cost the City approximately \$1.9M. This is a conservative estimate, the actual price of offsets may be significantly higher by 2030 and that the figures presented below could be considered the likely minimum cost. Refer to section 0

Offsets for further details.

Table 6 *Projected estimated financial implications of purchasing offsets (with and without abatement)*

| | FY30 |
|--|--------------------|
| Total emissions (tCO ₂ -e) | 38,107 |
| Total emissions after abatement (residual emissions) (tCO ₂ -e) | 8,759 |
| Estimate price of offset per tonne ¹ | \$50.00 |
| Cost of offsets without abatement actions (Do nothing scenario) | \$1,905,357 |
| Cost of offsets after abatement actions (Pathway to zero scenario) | \$437,960 |

¹ Assumption of \$10 increase in carbon credit prices every 2 years (FY23 & 24, \$20, FY25 & 26 \$30, FY27 & 28 \$40, FY29 & 30 \$50. Refer to Offsets section.

5.3 Strong Climate Leadership

Through the development of the City’s Strategic Community Plan 2021-2031 it became evident that the community supports becoming more energy and water efficient, led by a Council with visionary leadership. The identified values for the community include sustainability and providing support for the increasing the City’s action on climate change.

Sustainability – Our community values sustainability. Sustainability should be raised across a number of areas including corporate responsibility and governance; management of public open spaces and built environment; increased recycling and waste management; climate change and carbon neutrality.

Mitigation against climate change will also help meet the Strategic Community Plan outcomes identified relating to environment and leadership. The first objective “Strong Climate Leadership”, has been developed to assist in the achievement of these wider strategic outcomes.

5.3.1 Strong Climate Leadership Action Plan

Table 7 Strong Climate Leadership Action Plan

| | Action | Timing |
|---|--|---|
|  <p>Strong Climate Leadership</p> | Develop a Climate/Sustainability Strategy incorporating Corp/Community Mitigation/Adaptation Plans | Short-term |
| | Emissions inventory recording and reporting requirements | Ongoing / Immediate |
| | Resource the delivery of the Climate Change Mitigation Plan (corporate and community) | Immediate |
| | Develop Climate Change Communication and Engagement Plan for Climate Mitigation/Adaptation Plans | Short-term |
| | Establish an Internal Climate Change Working Group | Immediate |
| | Establish a Green Office program | Short-term |
| | Undertake a Council Policy review for climate change mitigation considerations | Short-term (align with existing policy review timeframes) |
| | Explore climate change program membership/accreditation opportunities | Immediate |
| | Review Climate Mitigation Plan (corporate and community) | Biennially |
| | Establish a Revolving Energy Fund | Immediate |
| | Investigate potential for CGG renewable projects to generate ACCU (carbon credits) | Immediate |
| | Investigate grant opportunities | Ongoing |
| Purchase ethical, accredited carbon offsets for residual emissions 2030 | Long-term | |

Note: Short term: FY22 – 24, Medium-term: FY25 – 27, Long-term: FY28 – 30

For further detail on all key actions refer to Appendix A and Sections 5.3.1 to 5.3.6 below.

5.3.2 Leadership and Advocacy

Achievement of the community aspirations relating to climate change will be supported through the development of a corporate culture that embraces climate change action, invests in climate change mitigation opportunities and incorporates new technology and solutions as they become available. Internal structures will be adapted to ensure climate action is supported and Council can easily demonstrate its achievements.

The City is already part of the local government community working to reduce greenhouse gas emission from the sector. Further collaboration and opportunities to participate in knowledge hubs should be explored. This includes programs such as the Cities Power Partnership, Zero Carbon Communities, and achieving Climate Active Accreditation.

5.3.3 Funding

To achieve the goal of net zero emissions, Council will be required to invest in the initiatives outlined in the action plan. Many of the actions align to existing strategies and plans which provide guidance on resources and funding. However, the following outlines some opportunities which will remove reliance on continual annual budget submissions.

5.3.3.1 Revolving Energy Fund

A Revolving Energy Fund is an internal fund that provides financing to implement energy efficiency, renewable energy and other sustainability projects that generate cost savings. These savings are tracked and used to replenish the fund for the next round of investments, thus establishing a sustainable funding cycle while cutting operating costs and reducing the environmental impact of an organisation (100 Percent Renewables, 2017).

The advantages of a Revolving Energy Fund are that it cements commitment to sustainability goals and provides a tangible vehicle to achieve it. However, there might be internal hurdles in setting up and running the fund, such as:

- Officer time and expertise in setting up the fund and consistently tracking cost savings
- Awareness of this financing vehicle and the way it operates (leading to sustainability aspects not being included in capital works projects)

To remove some of these hurdles, the City of Cockburn, for example, simply includes an annual budget of \$200,000 each year to its Greenhouse Action Fund (recognising ongoing savings from existing projects). This money is used to finance new projects.

With the recent large scale photovoltaic solar installation at Aquarena and the success of other solar projects, the establishment of a Revolving Energy Fund is a viable option for the City.

Aquarena is providing approximately \$75,000 per annum in electricity savings, and together with other solar projects is currently providing an overall estimated \$130,000. This saving could be used to establish an ongoing annual budget of \$100,000 to implement this plan (rather than a variable amount based on tracked savings). This approach does not account for the payback period of existing systems and the money already spent would therefore be considered the seed capital for the fund.

Some projects may still require a budget submission e.g. large scale solar projects where initial investment is greater than \$100,000, however, provides a way to implement smaller scale projects and efficiency programs.

5.3.3.2 Grants and other Government Funding

Federal and State Government grant opportunities may offer further opportunities to fund initiatives. These are subject to change and should be researched regularly. Recent examples include:

- The **Regional Climate Alliance Program** – This program aims to support local governments in Western Australia to take action on climate change, energy and sustainability through regional partnerships. The program is an initiative under the State Government's Western Australian Climate Policy. The Department of Water and Environmental Regulation (DWER) has partnered with WALGA to administer the Program. The City may be eligible for future rounds of funding under this program, however, would be required to partner with other regional local governments (Western Australia Local Government Association, 2021).

- The **Regional Australia Microgrid Pilots Program (RAMPP)** – Announced in the 2020-21 Federal Budget and administered by Australian Renewable Energy Agency (ARENA), this is a \$50 million six-year program that aims to improve the resilience and reliability of power supply for regional and remote communities. This program may be specifically relevant for the Airport solar and battery opportunity recommendation in section (5.5.2.2).
- The **Clean Energy Finance Corporation**, through the Local Government Finance Program, can help councils invest in projects to reduce energy costs and lower carbon emissions (this is an investment loan option rather than a grant).

5.3.4 Purchasing Offsets

As per the Mitigation Hierarchy (Section 0), offset should only be considered following implementation of 'Reduce' and 'Replace' opportunities. To contribute to the target of net zero emissions and mitigate residual emissions that cannot be reduced by 2030, only ethical and accredited carbon offsets should be invested in by the City. Additionally, this also involves developing a Carbon offsets strategy/policy that commits to investing in accredited carbon offsets and sets expectations of Australian/local offsets. Refer to Offsets (Section 5.8).

5.3.5 Potential Australian Carbon Credit Units (ACCU) Generation

An ACCU is a unit issued to a person by the Clean Energy Regulator (Regulator) by making an entry for the unit in an account kept by the person in the electronic Australian National Registry of Emissions Units (Registry). Each ACCU issued represents one tonne of carbon dioxide equivalent (tCO₂-e) stored or avoided by a project. An ACCU can only be issued to a person if the person has a Registry and a Registry account can only be opened by a person after the Regulator has considered whether they are a 'fit and proper person' (Australian Government, Clean Energy Regulator, 2020).

The Clean Energy Regulator issues ACCU for eligible greenhouse gas abatement activities undertaken as part of the Australian Government's Emissions Reduction Fund. There are a number of opportunities for industry to participate in the Emissions Reduction Fund by reducing emissions, improving energy efficiency, avoiding emissions of methane and nitrous oxide, or by converting methane into carbon dioxide which is a less potent greenhouse gas (Australian Government, Clean Energy Regulator, 2016). Participation in these opportunities allows industry to generate ACCU.

Opportunities for the City to generate ACCU, to either surrender which contributes towards the City's net zero or alternatively to sell with the money going towards a renewable energy fund, include:

- Roll out of FOGO waste collection across the City (source separated organic waste)
- Collection and flaring of landfill gas generated by the Meru Waste Disposal Facility (landfill gas method)
- Landfill gas collection for electricity generation (landfill gas (generation method))
- New renewable energy projects
- Electric heat pumps for pool heating

To qualify, new projects must be registered with the Clean Energy Regulator prior to implementation, otherwise they will be considered business as usual.

ACCU issued to a project proponent in relation to an eligible offsets project can be sold to the Commonwealth under a carbon abatement contract. At the time of publishing this report, the spot price of an ACCU had recently passed \$20 per tonne (Mazengarb, 2021).

The City can consider allowing external suppliers to undertake these projects so that project set-up costs, ongoing maintenance and reporting is undertaken by a third party. This may, however mean that ACCU generated are not retained by the City but will belong to the third party. It is important to consider this option carefully to ensure the best outcome for the City. For example, it may be possible to partner with a third party or require a percentage of ACCU remain with the City to ensure external offsets do not need to be purchased. The City will also need to ensure it undertakes due diligence to prevent double counting of their own Net Zero target if this option is pursued and offsets are sold. The creation of these offsets is likely to lead to a high quality, auditable method of offsetting the City's own emissions at a fixed cost, which protects against volatility and shortages in the ACCU market.

It is recommended to investigate, compare, and prioritise the potential of new renewable energy, efficiency and waste projects for ACCU generation, with specific consideration of the timing of projects to allow it to be registered with the Clean Energy Regulator. Those projects relating to reducing or utilising waste emissions are of the highest priority due to the significant volume of landfill emissions and the potential it may provide for the ability for purchasing offsets not to be required for residual emissions and/or possible future income generation from ACCU.

5.3.6 Monitoring and Reporting

It is important that this plan is reviewed to remain up-to-date with changes in Federal and State policy, new technologies and climate science. Annual greenhouse gas emission inventory reports will be required to track performance towards the City's progress to net zero emissions. The Climate Change Mitigation Plan should be reviewed and updated biennially, to ensure that it is based on current emission calculation methods and to update the action plan as the progresses and evolves.

It is fundamental to undertake annual greenhouse gas emission corporate inventory, this allows the accurate recording and reporting of progress towards net zero but also provides essential data for feasibility assessments of mitigation opportunities.

The FY2019 baseline assessment was the City's initial assessment of the amount of and sources of corporate greenhouse gas emissions. In doing so this has highlighted that there may be NGER reporting requirements that are relevant based on minimum thresholds for reporting, therefore there may be an obligation to report to the Clean Energy Regulator. The waste contribution emissions indicate they may be significant enough to trigger thresholds for reporting, therefore it is recommended to further investigate NGER reporting requirements and the responsibility of the City as a 'controlling corporation' in relation to their operational control of the Meru Waste Management Facility.

5.4 Reduce Energy Consumption

Following the Mitigation Hierarchy, and prioritising the reduction of emissions, the objective to reduce energy consumption has been developed. The purpose of this objective and the key actions are to reduce energy consumption and improve energy efficiency.

5.4.1 Reduce Energy Consumption Action Plan

Table 8 Reduce Energy Consumption Action Plan

| Objective | Action | Timing |
|---|---|--------------------------|
|  <p>Reduce Energy Consumption</p> | Improved metering | Short-term |
| | Energy efficiency - Streetlight LED replacement CGG owned & advocate to Western Power | Ongoing / Medium-term |
| | Energy efficiency - Progressive LED lighting upgrade at parks/council buildings based on high/low priority. | Short-term / Medium-term |
| | Energy efficiency - Energy efficiency improvement audits (20% improvement) | Ongoing |
| | Investigate green building design criteria/minimum standards for new Council buildings | Short-term |

Note: Short term: FY22 – 2024, Medium-term: FY25 – 27, Long-term: FY28 – 30

For further detail on all key actions refer to Appendix A and Sections 5.4.2 to 5.4.3 below.

5.4.2 Energy Efficiency Improvements

5.4.2.1 Improved Metering

Improved metering is highlighted as crucial to be able to have accurate and specific electricity usage records. It was identified that some facilities needed improvements to their current metering to allow for the correct allocation of electricity usage and to minimise manipulation of the data for emission calculations. Metering audits and implementing actions from those are highlighted as a specific action. Additionally, installing or improving metering in relation to solar usage will also allow for easier and more accurate data collection as well as for potential future new or changes to solar installations. Facilities which were identified as requiring metering improvements were the Geraldton Multiuser Centre, HMAS Sydney II Memorial Park and Alexander Park.

5.4.2.2 Streetlight LED Replacement

Replacing all City owned streetlighting with LED by 2030 would mean an emissions saving of 140 tCO₂e. This would involve increasing the current yearly maintenance schedule replacing 55 per year to 85 per year to allow all to be changed out by 2030. This estimation was based on an assumed 60% efficiency improvement based on current electricity consumption of City owned streetlight.

For the streetlights that are not owned by the City it is recommended that in collaboration with WALGA the City advocate to Western Power to upgrade Western Power streetlights to LED, smart street lighting and further investigate the contestability of street lighting.

5.4.2.3 LED Lighting Upgrade

It is recognised that LED replacement is occurring in the City's parks, recreation and building facilities. In order to estimate the approximate emissions savings without having to undertake a lighting audit, an assumption of 60% decrease in electricity consumption with the improved efficiency was applied.

It is recommended to progressively upgrade high priority lighting in identified parks and recreation areas as well as council buildings to LED efficient lighting (by priority recommendation). High priority are those parks or facilities which are between 9,000 and 40,000 kWh consumption per year, while it is assumed those greater than 40,000kWh consumption already have LED efficient lighting. Those less than 9,000kWh consumption per year are considered low priority LED replacement however still remain a viable action to undertake. For calculation the emission savings the assumption of all high priority being replace by FY2026 and low priority by FY2028 was applied.

The total emission savings from LED replacement at parks and recreation areas based on priority equated to 113 tCO₂-e and 61 tCO₂-e for other council facilities and buildings. A total of 174 tCO₂-e each year could be saved and an estimated \$56,400 of savings from decreased electricity usage.

5.4.2.4 Energy Efficiency Audits

It is recommended to undertake energy efficiency audits and implement improvements at identified priority facilities. These are to be conducted at all facilities greater than 20,000kWh consumption per year (listed below) or those deemed suitable for an energy audit i.e. building. There should be a priority focus on revisiting previous energy audits or conducting new audit on facilities/buildings/infrastructure over 40,000kWh consumption. Part of this process involves incorporating energy efficiency audits into maintenance processes to ensure it is part of normal operational process. For some priority facilities identify a schedule of works and develop building optimization plans to reduce operating costs, better manage energy demand and reduce consumption.



***LED Streetlight
replacement has
the potential to
improve energy
efficiency by
approximately 60%***

For this assessment an assumption of 20% improvement in energy usage would be achieved if all actions were implemented. The estimated emissions savings is approximately 276 tCO₂-e by 2030 if all proposed priority facilities were completed by FY2028. This is an estimated saving of approximately \$81,300 per year in electricity cost savings. Average consumption of electricity to calculate the 20% improvement with the exception of those that recently had solar installed in which case the FY2021 electricity consumption was used to estimate improvement. Note that Aquarena was not included due to an energy audit being recently conducted and many energy improvements have already been implemented.

Facilities identified for energy efficiency audits include; Geraldton Airport, Geraldton Civic Centre, Geraldton Regional Art Gallery, QEII Seniors Centre, Queens Park Theatre, Geraldton Library, Geraldton Works Depot, Geraldton Multiuser Centre, Meru Waste Management Facility, Emergency Services Facilities, Mullewa Recreation Centre, Mullewa Swimming Pool, Mullewa Civic Centre & Library.

5.4.3 Green Building Design

Our built environment is currently the world's single largest contributor to greenhouse gas emissions, it consumes around a third of our water, and generates 40 per cent of our waste. Sustainable Building design can help:

- Reduce the impact of climate change
- Enhancing health & quality of life
- Restore and protect biodiversity and ecosystems
- Drive resilient outcomes for buildings, fit outs, and communities
- Contribute to market transformation and a sustainable economy

(Green Building Council of Australia, 2021)

Specifying minimum design criteria for new Council buildings will help ensure that the City is creating environmentally sustainable buildings with lower operating costs that are healthier to be within. It is also a demonstration of corporate responsibility and meets community leadership expectations.

Using a trusted, well-known standard such as green star will help ensure the standard is accepted. On average, Green Star rated new buildings produce 55 percent less greenhouse gas emissions than standard practice new buildings. New Green Star buildings also use an average of 66 percent less electricity, 51 percent less water and send 96 percent less waste to landfill during construction than standard practice (Green Star Building of Australia, 2021).

Design and construction contracts with the City should specify the minimum standards that the City expects for new Council buildings (such as a 4-star Green Star rating).²

² Certification may or may not be required, however, documentation describing how the standard has been achieved should be provided.

5.5 Transition to Renewables

This objective aims to progressively transition to renewables by increasing generation and utilisation of renewable energy and solar PV.

5.5.1 Transition to Renewables Action Plan

Table 9 Zero Emissions Fleet Action Plan

| Objective | Action | Timing |
|--|--|-------------------|
|  <p>Transition to Renewables</p> | Install proposed solar based on priority (high/low) | Short/Medium-term |
| | Proposed Geraldton Airport solar PV & battery | Short/Medium-term |
| | Investigate proposed Aquarena additional solar / electric pool heat pump | Short/Medium-term |
| | Investigate hydrogen/electric replacement for gas/diesel sources (non fleet) | Long-term |
| | Investigate power purchase agreements for green power | Medium/Long-term |

Note: Short term: FY22 – 2024, Medium-term: FY25 – 2027, Long-term: FY28 – 2030

For further detail on all key actions refer to Appendix A and sections 5.5.2 to 5.5.4.

5.5.2 Renewables and Solar PV

5.5.2.1 Proposed Solar

Installation of small scale solar photovoltaic systems on identified Council buildings as recommended based on priority, those that were high priority were identified based on annual consumption of over 40,000kWh, those that were identified as low priority had lower annual electricity consumption but were a facility that would be suitable for solar installation. Facilities which were deemed as not applicable by the City were not included in the final proposed solar recommendations. Those that are high priority, with the assumption that the systems are installed and running by FY2026 for low priority by FY2028. Total emissions savings for proposed high and low priority solar equates to approximately 266 tCO₂e per year. The individual facilities are included in the Marginal Abatement Cost Curve Tool assessment refer to Appendix B.

Table 10 High priority solar installations with estimated emissions and financial savings

| High Priority | Estimated Emission Savings (tCO ₂ -e) | Estimated \$ Savings Electricity Consumption (per year) |
|--------------------------------|---|--|
| Geraldton Civic Centre | 130.4 | \$36,600 |
| Mullewa Swimming Pool | 28.7 | \$10,700 |
| Meru Waste Management Facility | 57.5 | \$16,140 |
| Geraldton Works Depot | 27.3 | \$7,600 |
| Total | 243.9 | \$71,040 |

Table 11 Low priority solar installations with estimated emissions and financial savings

| Low Priority | Estimated Emission Savings (tCO ₂ -e) | Estimated \$ Savings Electricity Consumption (per year) |
|-------------------------------|---|--|
| Mullewa Recreational Centre | 13.7 | \$4,000 |
| Emergency Services Facilities | 8.9 | \$2,500 |
| Total | 22.6 | \$6,500 |

5.5.2.2 Geraldton Airport Solar PV

One specific solar project already identified by the City as a potential mitigation opportunity, the microgrid at the airport and the assumptions provided by the City were used to calculate the emissions savings on installing solar. Additionally, two other options were also assessed which included installation of a battery to support the solar and utilisation of a single charging (fast charge) located at the airport. A separate feasibility study is already underway for the microgrid project, any assessment within this report is solely for the purposes of displaying the potential emissions reductions. The emission savings between solar installation and solar with battery support were comparable. The option for solar with battery was the chosen option to present in this report, with emission savings of approximately 223 tCO₂-e each year.

It is understood that there will be additional considerations when selecting the optimal solar set-up, other than emissions reductions. These may be reliable power to the Airport precinct during emergency response, and future electric vehicle charging abilities.

Total potential abatement to 2030 is approximately 3,480 tCO₂-e, refer to the Figure 24 MACC Tool in Appendix B for further details. The assumption for the calculated savings for the solar and battery option at the airport was based on a 225kW installation supported by a 90kW battery and inverter, this being completed by FY2026.

5.5.2.3 Aquarena Pool Heating Electric Heat Pumps Powered by Solar

Currently the Aquarena pool is heated using a gas boiler, gas consumed is 96 percent of all gas consumption related emissions for the City. In 2021, the gas boiler was replaced and will be more efficient in its consumption of gas. The cost of this gas boiler replacement was approximately \$60,000 and is expected to last approximately ten years, therefore when assessing options this was taken in to account.

The Aquarena currently has 150kW of solar PV capacity, 100kW of which was installed in 2020. There is available roof space for more solar to be added, however this is dependent on a structural assessment for the roof to support the weight of an additional solar PV system.

In recognition that reducing gas use is part of the City's road to net zero, the City installed a geothermal system at Aquarena to heat the indoor pools and air temperature inside the buildings. This project also included the installation of variable speed drives, pump upgrades and pool blankets. It was hoped that this project would reduce gas consumption by up to 70 percent (108 tonnes of CO₂-e), with a cost saving of \$84,000 per annum. Unfortunately, this project was unsuccessful due to the high iron content in the bore water which led to system failure. Whilst unsuccessful, the project demonstrates that attempting to reduce gas use at this facility will reduce emissions and save money over time. If the electric heat pump option, once investigated, is not deemed viable then a ground source heat pump could be revisited to assess the impact of a closed vs open loop system.

A detailed investigation into the energy efficiency of the Aquarena is outside the scope of this report, however four options to replace the gas boiler were assessed. The option presented in this report is the installation of electric heat pumps supported by an additional 200kW system which would result in a total system of 350kW.

The air heat pumps take heat from the ambient atmosphere and use it to heat the water directly. This would reduce the amount of gas usage however does increase the electricity consumption. The Coefficient of Performance (CoP) for air source heat pumps is now over 5 which makes them one of the most successful forms



» 18% of electricity used is currently generated by the City's solar photovoltaic systems. It is proposed that the City continue to maximise renewables with the potential to increase this to 82% by 2030.«

of energy efficiency for pool heating systems. Dependent on the cost differential between gas and electricity this may increase electricity costs although this is potentially/ partially offset with the gas savings and a renewable energy power purchase agreement would also influence this balance. Solar resolves this issue and is a recommended solution with any heat pump.

To calculate the emission savings from this electric heat pump solar option the assumption was applied that it would be installed by FY2024 and increase the daily electricity load by 50% during daylight hours. A high-level assumption of 50 percent improvement in gas consumption efficiency was also applied, this is a broad assumption and further investigation into the actual gas savings would need to be applied.

Based on this, the estimated emission savings are 166 tCO₂-e per year in electricity savings plus an additional 189 tCO₂-e saving in emissions from reduced gas consumption. The cost savings from reduced electricity usage equates to approximately \$40,400 per annum. The cost of purchasing gas is expected to increase in the future, with the price by 2028 -2030 being estimated at \$8.50-\$9.00 per GJ. With the reduced gas consumption this would result in a cost saving of approximately \$31,600. The total cost saving each year would be estimated at \$72,000 and the total emission savings would be approximately 355 tCO₂-e. The capital cost of purchase and installation of the heat pumps was not included in this assessment and high-level assumptions were applied to get an indication on whether this option was viable. The action going forward is to further investigate the feasibility of this option with more specific data. A feasibility assessment should also include structural integrity to ensure the Aquarena facility roof can withstand additional solar installed.

5.5.3 Alternative Fuels

As a long-term action (at the end of the life of the current gas boiler), it may also be viable to consider hydrogen as an alternative fuel source to gas. We know that the hydrogen industry in Western Australia is currently experiencing rapid growth and hydrogen plants are planned within the Mid-West. This would provide an accessible supply of hydrogen that the City can potentially utilise.

This option should continue to be investigated as the hydrogen industry continues to grow and technological advances that could be utilised by the City in their operations are made.

5.5.4 Green Energy Power Purchase Agreements (PPA)

A potential further abatement opportunity to assist in the achievement of net zero emissions from electricity is by entering into a PPA. A PPA is an agreement that a business or organisation will buy electricity from a generator (and can be specifically targeted at renewables such as solar or wind farm) at an agreed price over a fixed term, usually 10 years. Entering into a corporate PPA with a renewable-energy generator, through an electricity retailer, can increase price certainty for a business making it an excellent investment. It also reduces the business's emissions and improves its environmental reputation (City of Sydney, 2020). This approach has been taken by several local governments in the National Electricity Market in the eastern state and underpins most goals to achieve net zero emissions.

WALGA is assisting local governments to assess the feasibility of developing renewable energy PPA. The City should seek to incorporate renewables into its electricity contracts to assist in the achievement of net-zero emissions by 2030. Obtaining an agreement for all corporate grid-electricity is likely to give the City the most bargaining power with electricity retailers.

5.6 Zero Emissions Fleet

Prior to using carbon offsets, the City aims to improve efficiency and explore electric and hydrogen alternatives to achieve a zero emissions fleet by 2030.

5.6.1 Zero Emissions Fleet Action Plan

Table 12 Zero Emissions Fleet Action Plan

| Objective | Action | Timing |
|--|--|-------------------|
|  <p>Zero Emissions Fleet</p> | Gradual replacement of unleaded vehicles with hybrids | Short/Medium-term |
| | Investigate feasibility/location of installing EV charging stations aligned with renewable energy (e.g. Airport solar & battery) | Ongoing |
| | Develop/implement low emission fleet requirements/improvements | Short-term |
| | Investigate potential replacement of current fleet vehicles/plant with electric/hydrogen alternative | Ongoing |
| | Ensure a zero emissions fleet by purchasing carbon offsets for residual transport emissions | Long-term |

Note: Short term: FY22 – 2024, Medium-term: FY25 – 2027, Long-term: FY28 – 2030

For further detail on all key actions refer to Appendix A and Sections 5.6.2 to 5.6.4 below.

5.6.2 Electric Vehicles and Alternative Fuels

5.6.2.1 Unleaded Petrol (ULP) Vehicles

Although ULP vehicles contribute an insignificant amount to overall emissions (only 1 percent of total fuel emissions), there is opportunity to reduce these emissions through natural attrition of the councils unleaded vehicles. The gradual replacement, like for like, with the hybrid option of the small cars used (Toyota Yaris/Corolla) with all replacements made by FY2026 would result in an approximate reduction of ULP emissions of approximately 38% each year which equates to approximately 3.66tCO₂-e each year.

The cost of purchasing the hybrid model (based on 2021 Yaris SX 1.5L hybrid and Corolla sedan hybrid 1.8L SX) is approximately \$2000 more than the non-hybrid version. All calculations used a conservative L/100 kilometre usage and were applied to the fuel usage of the councils seven ULP cars.

Innovations in the vehicle industry and declining battery costs will soon put Electric Vehicles (EVs) on par with conventional fuel powered vehicles. Other factors will also increase EV uptake, such as:

- Increased availability of low and medium-priced as more companies release EV options
- The phase out of combustion engines by many car companies
- Establishment of a second-hand market

Over the next five years, it is expected that most of the barriers to adoption will be addressed due to industry and government initiatives such as the Electric Vehicle Action Plan (Government of Western Australia, Energy Policy WA, 2021). This will drop the price of EVs below their conventional counterparts over the next 10 years.

Corporate and government fleets have the potential to drive this electric revolution as collectively this group makes up 52 percent of annual new vehicle sales across Australia. Commitments to fleet electrification are important as they can demonstrate vehicle demand to carmakers, are an important source of supply to the second-hand market and provide impetus for the roll out of charging infrastructure. (Electric Vehicle Council, 2021).

EVs can also form part of the City's power system as they use, generate and store electricity.

Technological advances in hydrogen fuel cell vehicles and generators may also present opportunities, particularly with waste vehicles and standby generators.

Replacing the fleet and plant energy source from fuel to electricity and hydrogen, can help reduce the risks of fuel price volatility. Integrating battery storage and renewables into the energy mix will help to enhance energy security as the City can generate and store its own fuel source onsite.

As uptake of hydrogen fuel cell vehicles and generators is currently unknown, we have not included this in the 2030 emissions projection. Currently it is assumed that diesel will continue to be used as the primary fuel for this emissions source. The status of this should be reviewed biennially.

5.6.3 Ensuring an Efficient Fleet

It is important that the Council maintain a fleet to ensure operational tasks can be met. This includes attendance at meetings, site visits, compliance, ranger activities as well as those activities requiring larger vehicles. A booking system and annual audits enables assessment of the fleet to ensure efficiency and an appropriate sized fleet, with only those vehicles that are required should be maintained.

A booking system is currently used to monitor corporate passenger vehicle use. This system is used to determine the number of fleet vehicles required to support Council officer requirements. There is the potential to expand use of this system to track corporate use of fleet 4WD options to ensure the correct vehicles are maintained within the fleet to support actual use requirements

By developing and implementing low emission requirements through formalised processes such as a Fleet Policy which considers minimum emission standards of vehicles as well as continuing to rationalise the number/type of Council vehicles required. Supplementing this is Investigating a review/upgrade of the fleet booking system to monitor for efficiencies.

5.6.4 Offsetting Fuel Emissions

To achieve net zero by 2030, it is recommended that all residual fuel emissions are offset through purchasing verified and recognised offsets, until further mitigation measures can be applied. It is estimated that the cost to purchase offsets for fuel emissions without any mitigation measures being applied would be approximately \$76,600 based on the projected emissions and the costs of offsets in 2030 (estimated to be \$50 per tonne).

Fuel usage is projected to account for an estimated 1,542 tCO₂-e each year, of that 99 percent is diesel usage, the majority of which is from emissions associated with transport including from large plant and truck. The top 15 consumers of diesel are large plant/trucks and account for approximately 42 percent of all diesel usage in FY2019, it includes equipment such as graders, wheel loaders, prime movers. When looking at options to replace these, they should be of highest priority.

If the top 15 vehicles and plant that consume the most fuel were to be replaced with full hydrogen or electric equivalents, then the reduction in diesel related emissions would be almost half of total diesel emissions. If only hybrid equivalents can replace these with a reduction in 50 percent of their emissions, it would decrease total diesel related emissions by approximately 21 percent. It is recommended that feasibility of hydrogen/electric options be revisited in 2025 with a final decision on implementation to be made with sufficient time to allow implementation before 2030 to allow the emissions saving target of net zero to be achieved. If the emissions from the top 15 can be reduced by half by FY2027 that would avoid approximately \$17,404 in purchased offset costs, at full replacement with renewable fuel alternatives it would avoid a minimum \$34,800 each year in purchased offsets.

Diesel is the most difficult source of emissions to mitigate, therefore long-term purchasing of offsets is required by all who commit to net zero as technologies develop. The top 15 manufacturers are Caterpillar, Komatsu, and Isuzu/Hino. This equipment is similar to that used within the mining industry. There are benefits to this in that industry collaboration and developments in technologies are happening. With the manufactures such as caterpillar and Komatsu joining forces with major mining companies and industry to solve and develop zero emissions mining equipment. Monitoring these developments will be useful in understanding the progress in the journey of zero emissions large equipment.

5.7 Reduce Emissions from Waste

The aim is to avoid and reduce emissions from landfill while maximising benefits associated with emissions from landfill.

5.7.1 Reduce Emissions from Waste Action Plan

Table 13 Reduce Emissions from Waste Action Plan

| Objective | Action | Timing |
|---|---|------------|
|  Reduce Emissions from Waste | Meet targets to avoid and recover (CGG Waste Plan) | Ongoing |
| | FOGO implementation and rollout | Short-term |
| | Landfill emissions Flaring/Biogas Capture and additional mitigation/benefit opportunities | Short-term |
| | Investigate opportunities further reduce/maximise benefits of landfill emissions | Long-term |

Note: Short term: FY22 – 24, Medium-term: FY25 – 27, Long-term: FY28 – 30

For further detail on all key actions refer to Appendix A and Sections 5.7.2 to 5.7.5 below.

5.7.2 Avoid and Recover

The City’s waste includes waste collected from kerbside, verge side, drop-off facilities, public place bins, litter and sanitation services and management of waste created by local government service provision. Meru Landfill Facility also accepts waste inputs from surrounding local government areas.

The City’s Strategic Waste Management and Recycling Action Plan 2020-2030 provides a framework for effective, efficient and sustainable management of waste within the City. The Waste Plan aligns the City’s objectives and activities with the State Waste Avoidance and Resource Recovery Strategy 2030.

The Avoid and Recover mitigation opportunity is based on the implementation of measures to meet targets to avoid and recover as detailed in the City’s Strategic Waste Management and Recycling Plan 2020-2030 (Target 55% by 2025, 60% by 2030)(Figure 21). The projected waste to landfill and recovery figures were determined using a 3 percent population growth assumption. Figures used for 2022 and beyond were in alignment with figures provided in the City’s Strategic Waste Management Plan. Actuals were used for data up to 2012 and applied through NGER Solid Waste Calculator to calculate the greenhouse gas emissions from waste disposed in landfill.

The total projected waste emissions for 2030 is estimated to be 34,043 tCO₂-e. If the Avoid and Recover targets of 55% by 2025, 60% by 2030 are met as intended then the overall emissions savings is approximately 6,619 tCO₂-e. Detailed breakdown of waste and recycling data is required and must be recorded and calculated accurately. The process of this data collection needs to be assessed to ensure data recording is to the standard required. This will ensure that progress towards meeting the Avoid and Recover targets is monitored and that any projected emission reduction abatement projects can be assessed accurately for feasibility.



Figure 21 Resource Recovery Projections, Strategic Waste Management and Recycling Plan 2020-2030 (Ask Waste Management Consultancy Service, 2020)

5.7.2.1 Waste Transfer Station Upgrade at Meru Waste Disposal Facility

A critical action to meet the Avoid and Recover targets is the upgrade to the Meru Waste Disposal Facility. The City has budgeted funds for an upgraded Transfer Station at the Meru Waste Disposal Facility. The key objective of the upgrade is to maximise waste diversion with a modern best practice facility and be part of a proposed Regional Resource Recovery Facility that will include:

- Community Recovery Facility
- Multi-tier municipal waste transfer station with a drop off facility to accommodate 20 vehicles
- Upgrade of Household Hazardous Waste Collection point and shed with bunker
- New hardstand areas for the various waste streams currently collected for reprocessing and recycling
- Processing shed for recyclable materials.

(Ask Waste Management Consultancy Service, 2020)

5.7.3 FOGO Implementation

A Food and Garden Organics (FOGO) trial of 530 dwellings across the City was rolled out in 2020. The average bin presentation is 60 percent with an average bin weight of 11.3 kilograms. If successful, the program will be expanded to all residents (City of Greater Geraldton, 2021).

This initiative supports the national target to halve the amount of organic waste sent to landfill by 2030 (Department of Agriculture, Water and the Environment, 2017). The WA State Government is focused on FOGO as a priority and commits to providing all local governments in the Perth and Peel regions with a consistent three bin kerbside collection system, which includes FOGO and kerbside collection by 2025 (Government of Western Australia, Waste Authority, 2012).

To determine the potential FOGO related emissions saving a high-level assessment was conducted and was based on trial data from the 2020 FOGO trial. A conservative assumption of 70% presentation with a gradual increase of 1,000 tonnes per year to a total estimated 20,000 tonnes each year with the projected full roll out to be implemented by FY2023. By 2030 this will be a yearly emission reduction of 3,094 tCO₂-e in comparison with the 'Do Nothing' approach.



Figure 22 Three Bin System Example, Strategic Waste Management and Recycling Plan 2020-2030 (Ask Waste Management Consultancy Service, 2020)

5.7.4 Landfill Gas Flaring/Biogas Capture

To determine the impact a landfill flaring or biogas capture of methane emissions opportunity would have, it was assumed that the capture efficiency was 66.6 percent. It was also calculated based on if those emissions were 'transferred' to a third party or removed from the City's emission profile. With the assumption that implementation of this project would be by FY2025 the estimated emissions savings is approximately 17,795 tCO₂-e per year by 2030. Further investigation is needed to determine the best approach to implementation of this type of mitigation opportunity. Considerations which need a detailed assessment include, third-party implementation or City managed and owned implementation, specifically the advantages/disadvantages that it has for emission reduction, potential ACCU generation, future potential income and other additional benefits (e.g. renewable energy). Contractual agreements as to the withholding of a certain percentage of ACCU's generated could be an option, approximately 30 percent of the estimated 17,795 tCO₂-e would need to be retained to offset the residual City corporate annual emissions.

5.7.5 Other Opportunities

With waste emissions being the largest source of emissions, it also provides the largest opportunity in regard to maximising full benefits to potentially mitigate and/or use those emissions for a renewable energy supply. It is recommended to further investigate options such as anaerobic digestion as a supplementary stage to initial biogas capture. The potential emission savings from this would be minimal however this is dependent on the management and implementation of other waste abatement opportunities e.g. FOGO.

5.8 Offsets

Carbon offsets are certificates created by projects that reduce or avoid emissions that would otherwise have occurred, or actively sequester carbon from the atmosphere into permanent 'sinks' such as forests and soils. One carbon offset unit is equal to one tonne of emissions avoided or removed from the atmosphere. The cost of one carbon offset is dependent on the project that generated it and the market supply and demand of offsets at the time of purchasing. It is estimated to be \$50 per tonne by 2030 (Mazengarb, 2021)), this has been the assumption applied to all offset cost calculations. However, based on other global carbon trading frameworks it is likely that the amount could reach much higher. All estimations of accredited offset costs are conservative and based on the current data and trends available.

It is well known that trees take up and store carbon. The City's nursery grows 30,000 native seedlings each year which are planted in the City's bushland areas (including coastal dunes) and recreational parkland. In addition to this a number of non-native species are planted within streetscapes. The City is also more than halfway towards its goal of planting 1 million trees across the municipality. These plantings cannot currently be included as official offsets under the National Offset Standard and therefore do not contribute towards the City's emissions reduction calculations. Official tree plantings could be investigated subject to the official criteria being met and the availability of suitable land of sufficient size.



6. References

- 100 Percent Renewables. (2017). *Setting up a Revolving Energy Fund*. Retrieved from 100 Percent Renewables: <https://100percentrenewables.com.au/setting-revolving-energy-fund/>
- Ask Waste Management Consultancy Service. (2020). *Strategic Waste Management & Recycling Action Plan 2020-2030*.
- Australian Government, Clean Energy Regulator. (2016). *Opportunities for Industry*. Retrieved from Clean Energy Regulator: <http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-industry>
- Australian Government, Clean Energy Regulator. (2020). *Australian carbon credit units*. Retrieved from Clean Energy Regulator: <http://cleanenergyregulator.gov.au/OSR/ANREU/types-of-emissions-units/australian-carbon-credit-units>
- Australian Government, Clean Energy Regulator. (2021). Retrieved from Clean Energy Regulator: <http://cleanenergyregulator.gov.au/nger/about-the-national-greenhouse-and-energy-reporting-scheme/greenhouse-gases-and-energy>
- Australian Government, Department of Industry, Science, Energy and Resources. (2021). *Australian electricity generation - fuel mix 2019*. Retrieved from www.energy.gov.au: <https://www.energy.gov.au/australian-electricity-generation-fuel-mix-2020>
- Beyond Zero Emissions, Ironbark Sustainability, ICLEI. (2018). *Australian Local Government Climate Action Review*.
- City of Greater Geraldton. (2021). Personal communication.
- City of Sydney. (2020, April 30). *PPA: A beginner's guide to power purchase agreements*. Retrieved from City of Sydney: <https://renewableenergy.cityofsydney.nsw.gov.au/article/165-basics-power-purchase-agreements>
- Climate Council of Australia. (2020). *Primed for action: A resilient recovery for Australia*.
- Commonwealth of Australia, Australia State of the Environment . (2016). *Key Findings Atmosphere*. Retrieved from Australia State of the Environment: <https://soe.environment.gov.au/theme/atmosphere/key-findings?year=96#key-finding-117276>
- Department of Agriculture, Water and the Environment. (2017). *National Food Waste Strategy*. Retrieved from Department of Agriculture, Water and the Environment: <https://www.environment.gov.au/protection/waste/publications/national-food-waste-strategy>
- Electric Vehicle Council. (2021). *Fleet*. Retrieved from Electric Vehicle Council: <https://electricvehiclecouncil.com.au/fleets/?web=1&wdLOR=c368F3F0D-7938-4831-B890-8B4B244B2A53>
- Government of Western Australia, Energy Policy WA. (2021). *Electric Vehicle Action Plan*.
- Government of Western Australia, Waste Authority. (2012). *Waste Avoidance and Resource Recovery Strategy 2030*.
- Green Building Council of Australia. (2021). *What is Green Star*. Retrieved from Green Buildings Council of Australia: <https://new.gbca.org.au/green-star/green-star/>
- Green Star Building of Australia. (2021). *Why Use Green Star*. Retrieved from Green Star Building of Australia: <https://new.gbca.org.au/green-star/why-use-green-star/>
- Mazengarb, M. (2021, July 8). *Australia's de-facto carbon price at record high, may reach \$50 per tonne*. Retrieved from Renew Economy: <https://reneweconomy.com.au/australias-de-facto-carbon-price-at-record-high-may-reach-50-per-tonne/>
- Western Australia Local Government Association. (2021). *Regional Climate Alliance Program*. Retrieved from WALGA: <https://walga.asn.au/Policy-Advice-and-Advocacy/Environment/Climate-Change/Regional-Climate-Alliance-Program>
- Western Australian Local Government Association. (n.d.). *WALGA*. Retrieved from Climate Change Tools and Templates: <https://walga.asn.au/Policy-Advice-and-Advocacy/Environment/Climate-Change/Templates-and-Tools.aspx>



Appendix A

Detailed Mitigation Actions

| Objective | Action | Action Detail | Timing | Timeframe | Responsibility |
|---|---|---|---|-----------|--------------------------------|
|  <p>Strong Climate Leadership</p> | Develop a Climate/Sustainability Strategy incorporating Corporate/Community Mitigation/Adaptation Plans | Develop an overarching Climate/Sustainability Strategy which includes Corporate and Community Mitigation and Adaptation Actions Plans | Short-term | 2022-2023 | Environment and Sustainability |
| | Emissions inventory recording and reporting requirements | Undertake an annual greenhouse gas emission corporate inventory and report on progress towards net zero. And investigate NGER requirements | Ongoing/ Immediate | 2022 | Environment and Sustainability |
| | Resource the delivery of the Climate Change Mitigation Plan (corporate and community) | Include delivery of the Climate Mitigation Plan (corporate and community) into a specified Council officer role and resource appropriately | Immediate | 2022 | Environment and Sustainability |
| | Develop Climate Change Communication and Engagement Plan for Climate Mitigation/Adaptation Plans | Develop a Climate Change Communication and Engagement Plan to promote City initiatives and actions of the Climate Mitigation/Adaptation Plans | Short-term | 2022-2023 | Communications |
| | Establish an Internal Climate Change Working Group | Establish an Internal Climate Change Working Group | Immediate | 2022 | Environment and Sustainability |
| | Establish a Green Office program | Establish a Green Office program | Short-term | 2022-2024 | Climate Change Working Group |
| | Undertake a Council Policy review for climate change mitigation considerations | Undertake a Council Policy review to ensure appropriate climate change mitigation considerations/determine how well they are applied and recommend any improvements (Policies - Economic Development and Investment, Local Planning Policy: Towards | Short-term (align with existing policy review timeframes) | 2022-2024 | Environment and Sustainability |

| | | | | | |
|--|--|------------|--|-----------------------|--|
| | Sustainable Residential Development, Procurement of Goods and Services, Climate Change, Asset Management) | | | | |
| Explore climate change program membership/accreditation opportunities | Explore climate change program membership/accreditation opportunities e.g. Cities Power Partnership, Zero Carbon Communities, Climate Active Accreditation | Immediate | | 2022 | Environment and Sustainability |
| Review Climate Mitigation Plan (corporate and community) | Review the Climate Mitigation Plan every two years to incorporate up-to-date emissions calculations and update the action plan | Biennially | | 2023, 2025, 2027,2029 | Environment and Sustainability |
| Establish a Revolving Energy Fund | Establish a Revolving Energy Fund which uses financial savings from energy reduction and renewable energy projects to implement further climate mitigation actions | Immediate | | 2022 | Environment and Sustainability/ Finance |
| Investigate potential for CGG renewable projects to generate ACCU (carbon credits) | Investigate, compare and prioritise the potential of new renewable energy, efficiency and waste projects for ACCU generation, register with the Regulator and implement. | Immediate | | 2022 | Environment and Sustainability / Waste / Asset Management |
| Investigate grant opportunities | Continue to investigate grant opportunities for implementation of identified projects | Ongoing | | 2022-2023 | Environment and Sustainability / Finance / other departments as relevant |
| Purchase of ethical, accredited carbon offsets for residual emissions 2030 | Purchase of ethical, accredited carbon offsets for residual emissions that can't be reduced by 2030. | Long-term | | 2028-2030 | Environment and Sustainability |



| | | | | | |
|--|---|--|-------------|--|--------------------------------|
| | | Including develop a Carbon offsets strategy/policy that commits to investing in accredited carbon offsets and sets expectations of Australian/local offsets. | | | |
| | Improved metering | Undertake a metering improvement audit and implement outcomes such as the installation/replacement of meters | Short-term | 2022-2023 | Sports/Leisure & Parks |
| | | Install/improve solar metering to improve accuracy of data collected and incorporate into annual reporting | Short-term | 2022-2023 | ICT Services |
| | Energy efficiency - Streetlight LED replacement CGG owned & advocate to Western Power | Replace all City owned streetlighting with LED by 2030 (85 per year) | Ongoing | Aim for 50% changed by 2026. An increase from currently 50 replace per year to 85. | Parks Services |
| | | In collaboration with WALGA advocate to Western Power to upgrade Western Power streetlights to LED, smart street lighting and contestability of street lighting | Medium-term | 2025-2027 | Environment and Sustainability |
| | Energy efficiency - Progressive LED lighting upgrade at parks/council buildings based on high/low priority. | Progressively upgrade high priority lighting in identified parks and recreation areas and Council buildings to LED efficient lighting (by priority recommendation) | Short-term | 2024-2026 (high priority by FY26) | Parks Services |
| | | Progressively upgrade low priority lighting in identified parks and recreation areas and Council buildings to LED efficient lighting (by priority recommendation) | Medium-term | 2026 - 2028 (low priority by FY28) | Parks Services |

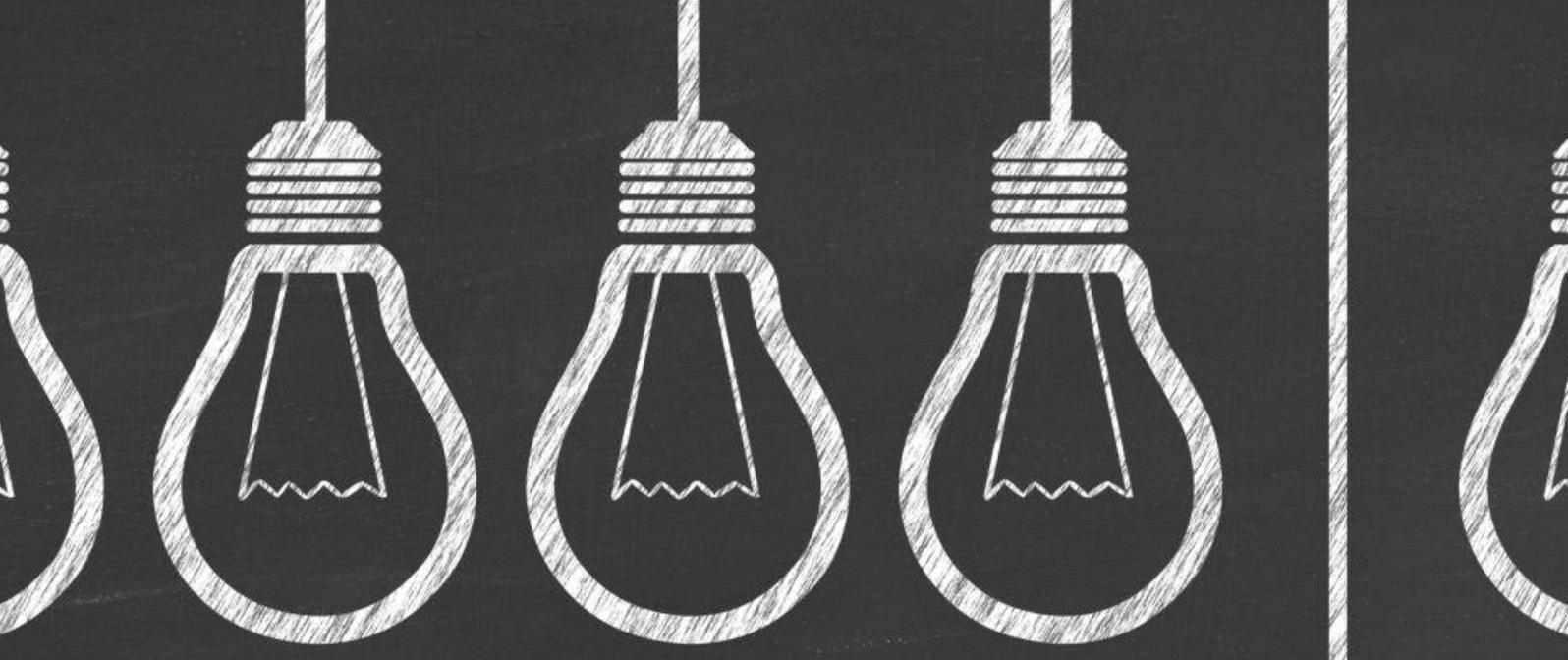
| | | | | | |
|--|--|---|-------------------|-------------------------------------|---|
| | Energy efficiency - Energy improvement audits (20% improvement) | Undertake energy efficiency audits & implement improvements at identified priority facilities. Incorporate energy efficiency audits into maintenance processes. Assumption of 20% improvement if all actions implemented. | Ongoing | | Building Maintenance / Environment and Sustainability |
| | Investigate green building design criteria/minimum standards for new Council buildings | Investigate and implement green building design criteria/minimum standards for new Council owned buildings and infrastructure and formalise in Council policy. | Short-term | 2022-2024 | Building Services |
|  <p>Transition to Renewables</p> | Install proposed solar based on priority (high/low) | Install solar photovoltaic systems on identified Council buildings as recommended as high priority. | Short-term | 2022 - 2024 (installed by mid 2025) | Environment and Sustainability |
| | Install proposed solar based on priority (high/low) Proposed Geraldton Airport solar PV & battery | Install solar photovoltaic systems on identified Council buildings as recommended as low priority. | Medium term | 2025 - 2027 (installed by mid 2027) | Environment and Sustainability |
| | | Implementation of large scale off-grid renewable energy at Airport with battery storage and further investigate other off grid energy options/opportunities including storage. | Short/Medium-term | 2022 - 2024 (installed by mid 2025) | Environment and Sustainability |
| | Investigate proposed Aquarena additional solar / electric pool heat pump | Further investigate the proposed implementation of electric heat pumps using additional solar to reduce gas consumption (pool heating). | Short/Medium-term | 2022-2024 | Sports and Leisure |
| | Investigate hydrogen/electric | Replace diesel/gas from stationary sources (plant) and gas heating with electric or | Long-term | 2028-2030 | Environment and Sustainability |

| | | | | | |
|--|--|--|-------------------|---------------------------|--|
| | replacement for gas/diesel sources (non fleet) | renewable alternative such as hydrogen. | | | |
| | Investigate power purchase agreements for green power | Investigate power purchase agreements to secure green power for remaining electricity usage, with priority focus on maximising renewables benefit e.g. Aquarena/Airport. | Medium/Long-term | 2025-2027 | Finance/ Environment and Sustainability |
| | Gradual replacement of unleaded vehicles with hybrids | Gradual replacement of unleaded vehicles with like for like electric hybrid vehicles via natural attrition. Aiming 40% of unleaded fleet in short-term (end of FY24) and 100% by end FY26. | Short/Medium-term | 2022 - 2023 and 2025-2026 | Fleet Management |
|  <p>Zero Emissions Fleet</p> | Investigate feasibility/location installation of EV charging stations aligned with renewable energy (e.g. Airport solar & battery) | Further investigate feasibility and location installation of electric vehicle charging stations and align with renewable energy sources e.g. Airport solar battery. | Ongoing | 2022 - 2024 | Fleet Management |
| | Develop/implement low emission fleet requirements/improvements | Develop and implement low emission requirements. Including continuing to rationalise the number/type of Council vehicles required. Investigate a review/upgrade of the fleet booking system to monitor for efficiencies. | Short-term | 2022 - 2024 | Fleet Management |
| | Investigate potential replacement of current fleet vehicles/plant with electric/hydrogen alternative | Continue to investigate feasibility for the potential of electric/hydrogen powered vehicles to replace key diesel vehicles within the Council fleet, at end of life replacement. | Ongoing | 2023-2027 | Environment and Sustainability/ Fleet Management |
| | Ensure a zero emissions fleet by purchasing carbon offsets for residual transport emissions | Ensure a zero emissions fleet by purchasing accredited carbon offsets for residual transport emissions (fleet/truck/plant) until complete transition to 100% renewable energy fleet. | Long-term | 2028-2030 | Environment and Sustainability/ Fleet Management |



Reduce Emissions from Waste

| | | | | |
|---|---|-------------|-----------|----------------|
| Meet targets to avoid and recover (CGG Waste Plan) | Implementation of measures to meet targets to avoid and recover as detailed in the CGG Strategic Waste Management and Recycling Plan 2020-2030 (Target 55% by 2025, 60% by 2030). | Ongoing | 2022-2030 | Waste Services |
| FOGO implementation and rollout | Implementation and roll out of FOGO, investigate potential improvement options for further maximising benefit/reducing emissions of FOGO. | Short-term | 2022-2024 | Waste Services |
| Landfill emissions Flaring/Biogas Capture and additional mitigation/benefit opportunities | Investigate implementation of landfill Flaring/Biogas Capture to reduce Landfill emissions including assessing potential options for further opportunities to mitigate emissions/maximise additional benefits (e.g. renewable energy) | Short-term | 2022-2024 | Waste Services |
| Investigate opportunities further reduce/maximise benefits of landfill emissions | Investigate other opportunities to further reduce emissions from landfill and maximise benefits for Council e.g. Anaerobic Digestion Facility | Medium-term | 2025-2027 | Waste Services |



Appendix B

Opportunity/Action Identification,
Evaluation and Prioritisation Matrix



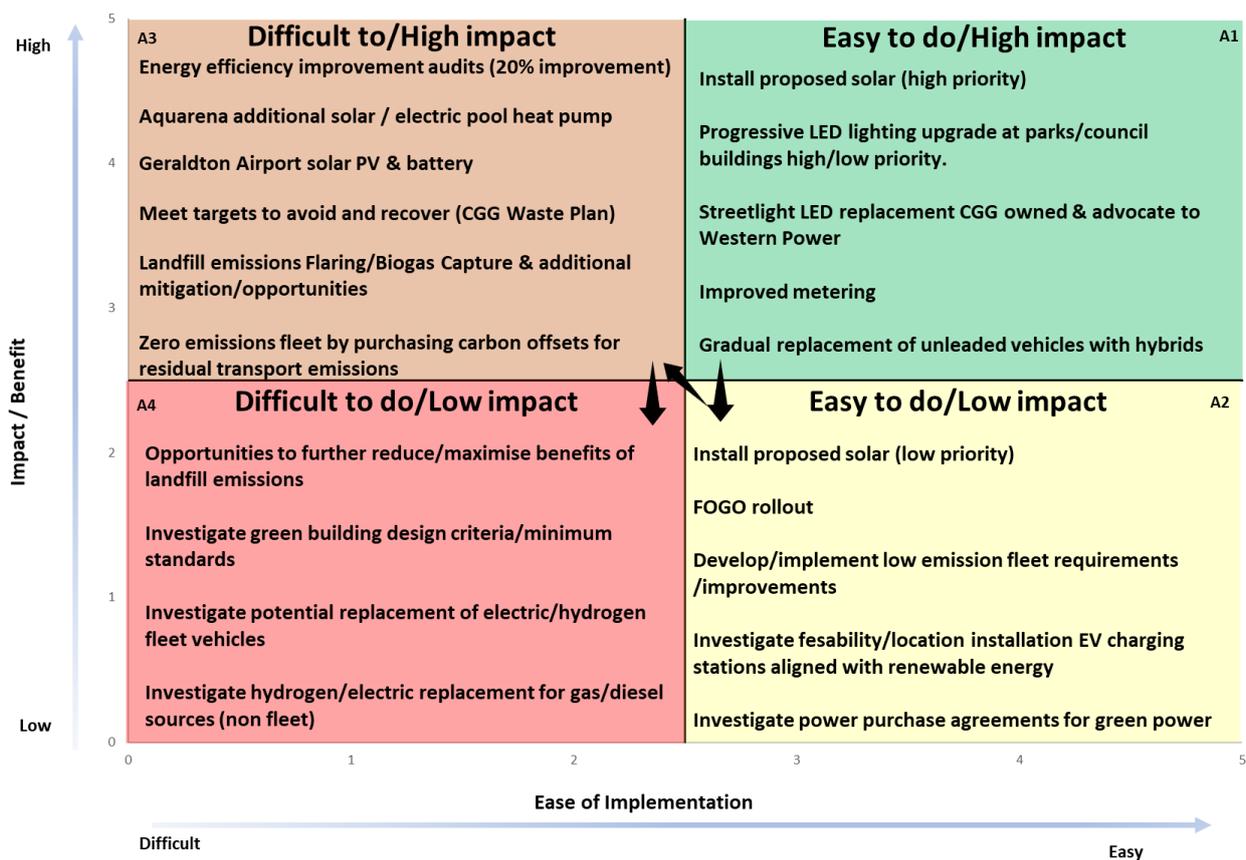


Figure 23 Opportunity/Action Prioritisation Matrix

Impact / Benefit considers: carbon emission abatement, cost savings, reputational or other benefit.

Ease of implementation considers: commitment, time, expense, complexity, effort, or resources.

A1: Easy to do/High impact: Prioritise these activities as the first to do. Getting these projects done helps with encouragement and support for more difficult projects as well as motivation for creating an impact.

A2: Easy to do/Low impact: These activities are to be done if they are a precursor to an activity which has a greater impact on the goal.

A3: Difficult to/High impact: These activities require time spent on planning as they have a higher likelihood of resulting in a poor outcome. Poor outcomes from executing some activities can result in the overall strategy being unsuccessful or limited. This can affect support of the overall strategy by senior management.

A4: Difficult to do/Low impact: These activities should only be attempted if they are either a precursor to activities with a higher impact on the goal. Activities which are precursor to others can be broken up in to small an easier to do activities. Difficult to do activities can be viewed as consuming resources and taking time are at risk of being the first to be rejected or with the least support by senior management.

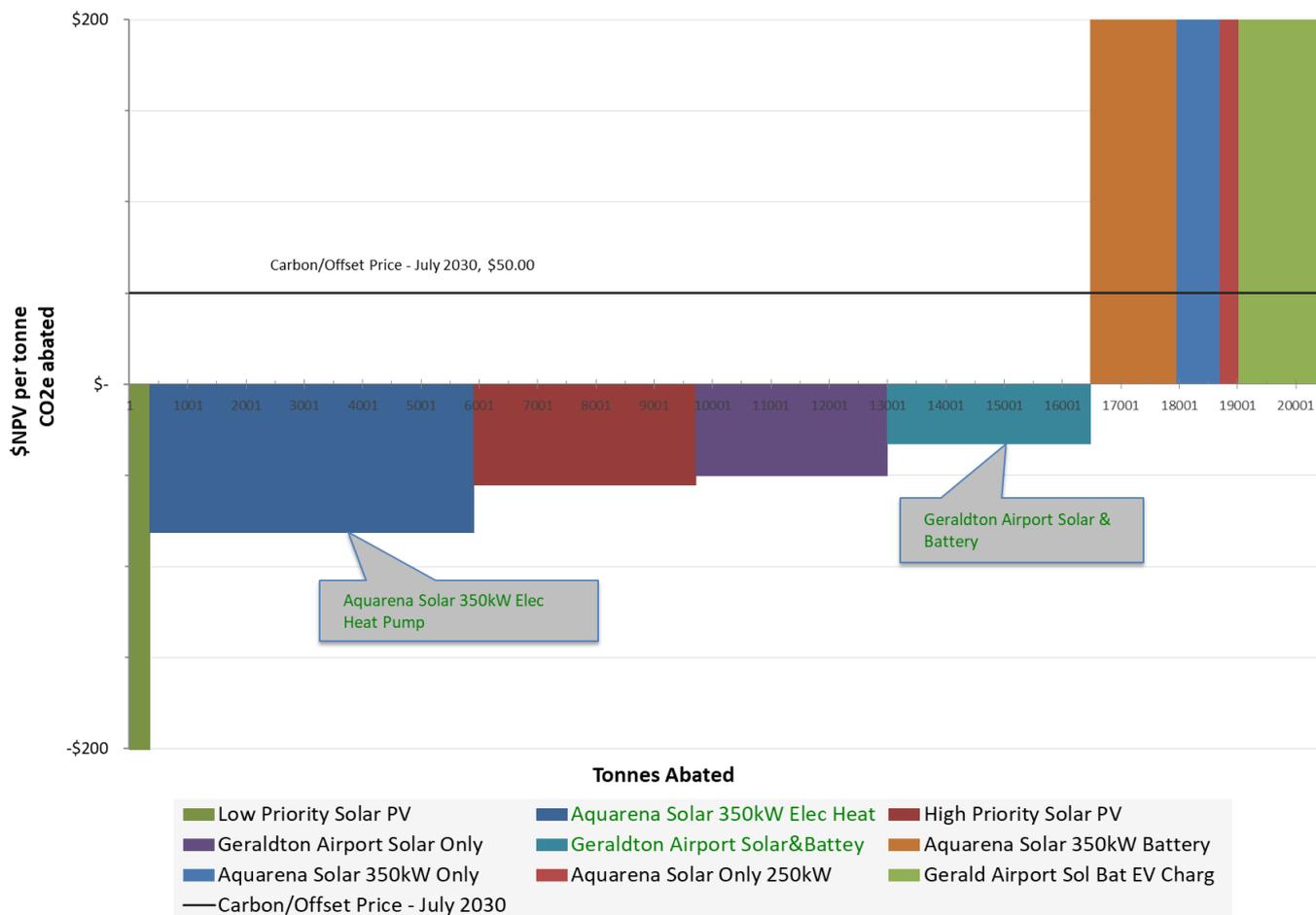


Figure 24 Marginal Abatement Cost Curve (MACC) – Proposed Renewables

Note that the Marginal Abatement Cost Curve displayed is based on the WALGA MACC Tool.

Refer to the MACC Tool Assessment Excel for further details.

Marginal Abatement Cost (MAC) is the cost per unit of GHG emissions abated throughout the lifetime of the project. The Marginal Abatement Cost is commonly referred to in terms of \$/tonne of CO₂e abated.

Net Present Value (NPV) is the total value of a project given in 'present day' dollar values. It is the total cost of the project over its lifetime less all anticipated savings, with a discount factor applied to allow for the diminishing value of money over time. This value can be positive (a net cost) or negative (a net saving).



ghd.com

→ **The Power of Commitment**