Corporate Greenhouse Action Plan 2020/21 to 2029/30

CITY OF Armadale

Contents

Executive Summary

The City of Armadale's previous Corporate Greenhouse Action Plan was finalised in 2014 and covered 2014/15 to 2019/20. Consequently, a new Plan is due for Council consideration.

The Australian government has targets for carbon mitigation, known as 'Nationally Determined Contributions' (NDCs), as a result of the 2015 Paris Agreement. Australia has committed to reducing greenhouse gas emissions to 26–28 per cent below 2005 levels by 2030.

The aim of the Paris Agreement is to restrict global temperature rises this century to well below 2º Celsius above pre-industrial levels. Further efforts may be pursued to ensure that this is limited to 1.5º Celsius. Australia will submit its next NDC, with a post 2030 target, to the United Nations Framework Convention on Climate Change (UNFCCC) in 2025.

Given that National targets and milestones are scheduled to conclude in 2029/30, it is logical that this document covers the period 2020/21 to 2029/30.

A gap analysis has been performed, using a management tool developed by WALGA. This has spawned a series of improvement actions across Waste, Buildings, and Fleet. These range from the expansion of flaring infrastructure, to finalising a business case for the bulk changeover of LED streetlights.

An opportunity exists for the Flaring Project to be extended for a further five years to 2026/27. In conjunction with surplus credits from the existing contract, this has the potential to generate additional unbudgeted income of $979,000. These funds can be used to address the recommendations of this Plan ($145,000), leaving $834,000 for other initiatives.

Several emission reduction targets have been considered in the finalisation of this Plan. The recommended approach is a 2030 net zero carbon emissions target. This is the result of recent reports from the Intergovernmental Panel on Climate Change. An allocation of municipal funds of $89,000 per annum from 2022/23 to 2029/30 is required to achieve this action, and is heavily subsidised by the sale of credits generated by the Flaring project.

Finally, the Plan proposes the creation of a 'Carbon Reserve', enabling the accumulation of ring-fenced funds for the purchase of offsets and abatement initiatives.

Introduction

The first City of Armadale Corporate Greenhouse Action Plan (CGAP) covered the period 2008/09 to 2011/12. A subsequent report was produced for 2014/15 to 2019/20. This incorporated carbon reduction targets, on a per capita basis. Here, National reduction strategies, expressed in absolute terms, were converted to per capita basis that reflected high levels of growth in the City:

'19% per capita reduction in 2000 levels by 2020'

The target was achieved, primarily through carbon abatement activities and the purchase of offsets, allowable under the federally supported Climate Active scheme.

The expiry of the 2014/15 to 2019/20 Plan necessitates the production of a new CGAP. The focus of is the mitigation of City of Armadale (the City) corporate emissions. It covers;

- International, national and state level carbon mitigation policy
- Western Australian Local government initiatives
- The duration of the new CGAP
- Current and projected emissions profiles
- A synopsis of current abatement projects and opportunities for improvement
- The development of carbon reduction targets
- An Offsets Strategy, addressing any residual emissions to the target

The cost implications of future strategies will be presented, facilitating transparent decision-making.

Global and Domestic Context

International Initiatives

The central aim of the 2016 Paris Agreement (PA) is to facilitate a global response to the threat of climate change. It seeks to ensure that global temperature rises this century are limited to less than 2º Celsius above pre-industrial levels. Efforts will be made to further limit temperature increases, to 1.5 degrees.

The PA includes commitments from all major emitting countries to reduce carbon emissions, and to periodically review and strengthen targets over time. It requires that all make their 'best efforts' through Nationally Determined Contributions (NDC's) (carbon abatement targets).

The PA opened for signature 22nd April 2016 ('Earth Day'), and came into force 4th November 2016 (thirty days after 55 countries, accounting for at least 55% of total global greenhouse gas emissions, deposited instruments of ratification with the United Nations). The 4th November 2016 is the point at which the 'Double Threshold Test' was passed.

As of July 2021, 191 countries are a party to the PA. The carbon mitigation targets, or NDC's, for a cross section of parties are included as Appendix 1.

The UK will host the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow on 31 October – 12 November 2021. The run up to this conference will see countries updating their plans for reducing emissions. It is hoped that countries will be more aggressive in revising targets, to limit temperature rises to 1.5º Celsius.

Recent Developments

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations body for assessing the science related to climate change. It was created to provide policymakers with regular scientific assessments, its implications and future risk, as well as to put forward adaptation and mitigation options.

A sixth "Assessment Report" has recently been released. It examines a series of different possible scenarios, and in all of them, the 1.5 degree threshold is reached before 2035, and in the worst case scenario by 2028.

The Climate Council is an Australia climate change communications organisation. They provide advice to the public on climate change, energy solutions and international action, based on the science available. They include some of the country's leading climate scientists. As a result of the IPPC Report, they have announced that the following targets are appropriate:

- 75% on 2005 levels by 2030
- Net zero by 2035

These are more ambitions than most National targets (see below).

Australian National Policy

Carbon Mitigation

Australia has committed to a 26 to 28% reduction in carbon emissions by 2030, relative to 2005 levels.

As highlighted in Appendix 1, Australia's short term target is in line with that of the United States, Canada and New Zealand. Russia and the United Kingdom use 1990 as a baseline year, with 2030 reduction targets of 25 to 30% and 40% respectively. The target of the European Union is similar to that of the UK.

Alternative approaches have been adopted by other countries, examples as follows;

Table 1: Examples of Alternative Approaches to Emissions Target Setting

Country	Approach
India	33 to 35% in carbon emissions relative to Gross Domestic Product by 2030 (known as an 'emissions intensity' approach)
Brazil	Absolute target of 1.3GtCO_2-e by 2025
China	Peak CO2-e emissions by 2030 at the latest Non-fossil fuel sources: 20% in 2030 Forest stock – Increase of 4.5 bnm3 by 2030 relative to 2005 Emissions intensity (carbon relative to GDP) – 60 to 65% below 2005 levels by 2030

There are also longer-term targets in place. For example, the United Kingdom has committed to net zero emissions by 2050. Australia has yet to commit to a longer term objective.

Renewable Energy

A Renewable Energy Target (RET) was introduced by the Federal Government in 2001. This had the initial aim of acquiring two percent of national electricity from renewable sources. In 2009, this was increased to 20 percent of Australia's electricity supply (41,000 gigawatt hours – GWh).

In 2011, the RET was split into two parts; the Large-Scale Renewable Energy Target and the Small Scale Renewable Energy Scheme. Through this, high energy users are obligated to acquire a fixed proportion of their electricity from renewable sources. This is achieved by surrendering Large-Scale Generation Certificates (LGCs) or Small Scale Technology Certificates (STCs).

LGCs are typically generated by renewable energy power stations (e.g. wind and solar farms), STCs through small scale systems; rooftop solar; solar water heaters; and: heat pumps. The government issues LGCs to the electricity provider, in line with production. These are then be sold to high energy users, who surrender them in order to meet their target.

STCs are provided as up-front financial incentives to the installer, in the form of a discount.

In June 2015, the Australian Parliament passed the *Renewable Energy (Electricity) Amendment* Bill. This reduced the Large-scale Renewable Energy Target in 2020 from 41,000 to 33,000GWh in 2020, to reflect updated energy production forecasts.

The 20 percent power supply target was achieved in November 2019. Both LGC and STC schemes have been extended until 2030, with a continued annual target of 33,000GWh.

State Government Response

These have responded differently to National carbon abatement policy:

Table 2: State Governments Response to National Targets

State	Details
Australian Capital Territory	50 to 60% reduction on 1990 levels by 2025 65 to 75% on 1990 levels by 2030 90 to 95% on 1990 levels by 2040
New South Wales	35% reduction on 2005 levels by 2030 Net zero emissions by 2050
Northern Territory	Net zero emissions by 2050
Queensland	30% reduction on 2005 levels by 2030 50% Renewable Energy by 2030 Net zero emissions by 2050
South Australia	50% below 2005 levels by 2030 Net zero emissions by 2050
Tasmania	At least 60% below 1990 levels by 2050
Victoria	Targets for 2025 and 2030 to be set imminent Net zero emissions by 2050
Western Australia	Net zero emissions by 2050

New South Wales and Queensland are broadly in line with the 2030 national objective. South Australia and the ACT have more stringent targets, and Victoria has yet to announce an abatement pathway. As it stands, Tasmania, the Northern Territory and Western Australia do not have targets for 2030. Western Australia has a 'net zero emissions' target for 2050.

Western Australia

The Department of Water and Environmental Regulation (DWER) has carriage over the '*Western Australian Climate Policy*'. This includes a plan for a climate resilient community, and prosperous low-carbon future.

The vision '*…is to harness Western Australia's innovation and wealth of natural and mineral resources to achieve net zero emissions and ensure a prosperous, resilient future for all Western Australians.'*

The Policy includes a number of streams;

- Clean manufacturing and Future Industries; Actions include the provision of support through, for example, the *Renewable Hydrogen Strategy* and *Future Battery Industry Strategy*.
- Transforming Energy Generation and Use; The *Energy Transformation Strategy* and *Distributed Energy Resources (DER) Roadmap* will enable continued uptake and better integration of resources such as a rooftop solar, batteries and electric vehicles.
- .Storing Carbon and Caring for Our Landscapes; The Development of a *Western Australia Carbon Farming Strategy*, and the expansion of the conservation estate will assist in meeting 2050 targets.
- Lower-Carbon Transport; An *Electric Vehicle Strategy* has created a plan to support the uptake of battery electric vehicles, and hydrogen fuel cell electric vehicles.

There is also a work package dedicated to Climate Change Adaptation and includes, for example, the Waterwise Perth Action Plan.

Local Government

Carbon mitigation targets vary across WA Local Governments (LGs). Appendix 2 summarises the strategies of eleven LGs. These can be classed into a number of categories:

1. Those that do not account for carbon, or have carbon reduction strategies; or;
2. Those that do not have a landfill, but have carbon reduction targets (e.g. Melville); or:
3. Those that have a landfill, but may or may not account for carbon from municipal waste on the commissioning of the Waste to Energy Facility (WTEF) (Cockburn); or:
4. Those that have a landfill and have carbon reduction targets, but exclude waste emissions from the targets (e.g. Stirling); or:
5. Those that have a landfill, but do not account for carbon and have no emissions reduction targets (e.g. Rockingham).

The most ambitious targets are those of Cockburn (CoC) and Victoria Park (ToVP) (net zero emissions by 2030).

In 2022, CoC will be diverting waste to the new WTEF. The extent to which this waste will be accounted for by LGs is being reviewed by WALGA. Emissions from the Cockburn landfill site are approximately 50% of that of the City's.

ToVP's municipal waste is diverted to a regional facility, but they have made the decision to account for the carbon. The annual footprint of this waste is 20,000tCO_2-e, circa 50% of the Hopkinson Road Landfill and Recycling Facility (the 'Landfill Site').

There is an inconsistent approach across local governments in setting targets, and in accounting for landfill waste. Furthermore, the size of the City's landfill, and the commercial setting means that making a comparison with the CoC or ToVP on emission reduction targets is difficult.

Synopsis

There is no single consistent approach to carbon mitigation in the international arena. Although Australia has a national target, State governments do not have a unified strategy.

Western Australia has a 'net zero emissions' commitment for 2050, but does not have a carbon reduction commitment for 2030. WA local governments are equally inconsistent in their approach

Regulatory Framework

National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) governs the accounting and reporting of greenhouse gas emissions. This enables the periodic calculation of a National carbon 'inventory', and reporting against international carbon emission commitments.

If certain thresholds are exceeded, corporations must report emissions for individual facilities over which they have 'Operational Control'. This is deemed to apply if an organisation has the authority to introduce and implement policies in the following areas;

1. Operational
2. Health and Safety
3. Environmental

The range of emission types, and those that are reportable under NGER, are summarised below.

Table 3: Emission Classifications - NGER Act

Emissions Category	Definition	Reportable Under the NGER Act?
Scope 1	Also known as 'direct emissions', they are released to the atmosphere as a result of activities at a facility level, from owned or controlled sources. E.g. the City's Landfill Site	Yes
Scope 2	Indirect emissions from the generation of purchased energy. Scope 2 emissions from one facility are part of the Scope 1 emissions from another facility (e.g. Coal fired power stations). E.g. CoA buildings and fleet	Yes
Scope 3	These are indirect emissions (other than scope 2 emissions), generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business. E.g. CoA Councillor/employee flights to conferences	No

Officers are currently investigating the extent to which the City has reporting obligations under the NGER Act.

The City's emissions profile will be mapped against the different Scopes.

Climate Active

The Climate Active scheme (the 'Scheme') is an ongoing partnership between the Federal government and Australian business to drive voluntary climate action. The brand represents Australia's collective effort to measure, reduce, and offset carbon emissions.

The *Climate Active Carbon Neutral Standard for Organisations* (the 'Standard') is a guideline to manage greenhouse gas emissions and achieve carbon neutrality, overseen by the Scheme. It provides best-practice guidance on how to measure, reduce, offset, validate and report emissions that occur as a result of the operations of an organisation.

The Standard can be implemented in a number of ways. It can be used to better understand and manage carbon emissions, to credibly claim carbon neutrality and to seek carbon neutral certification. A set of broad principles underpin the approach.

The emphasis of the NGER Act is reporting, but the focus of the Standard is mitigation of organisational carbon footprints. This can lead to differences in the inclusion/exclusion of certain components.

For example, Scope 3 emission reporting is not required under NGER (see above). However, under the Standard, they must be considered, tested for relevance, and potentially mitigated, if carbon neutrality is sought.

Under the 'Additionality' principle, any emissions reduction achieved '*must represent abatement that has not been double counted*'. This has direct relevance to the City, in the previous and potential future treatment of carbon credits arising from the Flaring Project. This is discussed in more detail below.

At a very high level, the Standard suggests that organisations should adopt the following approach to carbon management; 1) Identification of Emissions; 2) Reduction of Emissions; 3) Offsetting of Emissions.

Safeguard Mechanism

The Safeguard Mechanism (the 'Mechanism') provides a framework for Australia's largest emitters to measure, report and manage their emissions. It does so by encouraging large facilities, whose net emissions exceed the safeguard threshold, to keep carbon footprints below baselines set by the Clean Energy Regulator.

The Mechanism applies to facilities with Scope 1 emissions exceeding 100,000 tonnes of carbon dioxide equivalent (tCO_2-e) per year. If the baseline is exceeded there are options to neutralise any surplus, all of which have negative financial impacts. These include, for example, the purchase of an equivalent number of Australian Carbon Credit Units (ACCUs) on the 'Voluntary Market' (VM). They must then be cancelled (surrendered) to the Federal government. This then brings corporate emissions back to baseline levels.

It is this demand from large corporations that may provide a market for future carbon credits generated by the City. The VM provides an opportunity for companies with Climate Solutions Fund (CSF) (see below) projects to sell their credits, and for those triggering the Safeguard Mechanism to buy them. Emitters wishing to voluntarily reduce their carbon footprint may also purchase credits through the VM.

Activities at the City's Landfill Site fall under the definition of Scope 1 emissions. However, in 2020 the carbon footprint of the site was 47,553tCO2-e, well below the 100,000tCO_2-e threshold.

Climate Solutions Fund

The CSF provides incentives to adopt carbon efficient practices or technologies to reduce emissions. It is enacted through the *Carbon Credits (Carbon Farming Initiative) Act 2011*, the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* and the *Carbon Credits (Carbon Farming Initiative) Rule 2015*.

Through the initiation of carbon abatement projects, the CSF provides an opportunity to earn revenue through; 1) A contract with the Federal government; or: 2) the 'Voluntary Market'. The City's Flaring Project is accredited under the CSF, and a contract in place with the Federal government. This is nearing completion.

Historical Application in the City

The City has not been in a position to set or achieve targets in relation to carbon neutrality/net zero emissions. Nevertheless, the principles of the Standard have been followed in relation to alternative targets;

1. Identification of emissions
2. Abatement activities through project delivery e.g. the Flaring Project, solar panel installation, geothermal bore
3. Process improvement e.g. diversion of green waste away from the landfill
4. The purchase of offsets through accredited schemes, to address residual carbon emissions

In the purchase of offsets, only those recommended by the Climate Active scheme have been purchased. This ensures that a robust accreditation process has taken place.

The Additionality principle of the *Climate Active Carbon Neutral Standard for Organisations* has been followed. As highlighted above, the Standard suggests that there should be no double counting of abatement. Only corporations that 'cancel' (surrender) credits are able to count the mitigation (cancelling or surrendering = 'donating' to the relevant regulatory agency). Specifically;

'Eligible offset units must be cancelled via an offsets registry. The cancellation should be clearly attributed to the carbon neutral claim and the organisation or responsible entity making the claim. The cancellation and attribution of eligible offset units is important to prevent resale or double counting of offset units.'

The City has previously sold credits from the Flaring Project, not cancelled them. For this reason, any credits sold to third parties have been replaced, and cancelled. This means that the City has still been able to count the abatement, albeit from a different source.

Given that neutrality has not been sought, the CoA has previously only included Scope 1 and Scope 2 emissions in carbon mitigation calculations. Scope 3 emissions have not been covered. This decision has been on the basis of materiality, and complexities associated with calculating the City's component (e.g. see example provide in Table 3 above – Councillor Flights).

A very high level calculation estimated that Scope 3 emissions were circa 500tCO_2-e in 2019/20 (1% of City emissions).

City of Armadale Emissions Profile

2019/20 Carbon Footprint

City emissions for 2019/20 are summarised below. These are consistent with previous reports to Council and the methodology of the NGER Act (only Scope 1 and 2 emissions):

Table 4: Analysis of City Emissions in 2019/20

Emissions Component	Tonnes of Carbon Dioxide Equivalent (tCO_2-e)	Emission Scope
Gross Waste Emissions	**52,887**[1]	**1**
Amounts Flared	**(9,833)**[1]	**1**
Net Waste Emissions	**43,055**[1]	**1**
Buildings	**4,366**[2]	**2**
Fleet	**132**[2]	**2**
Total	**47,553**	

[1] Calculated using the Federal government Solid Waste Calculator
[2] Provided by carbon accounting software (third party)

The Landfill Site accounts for 91% of the City's carbon footprint, from methane (CH_4) from the anaerobic decomposition of waste. According to the IPCC, CH_4 has an Emissions Factor that is twenty eight times the global warming potential of carbon dioxide (the IPCC regularly reviews the Emissions Factors of all greenhouse gases, based on scientific analysis). The operation of the flare, converting methane into CO_2, abates 20% of gross emissions at the Landfill Site.

The remainder of the profile consists of the City's building portfolio (9%), and a small fleet component.

If the City's population (94,348) is compared to the carbon footprint, emissions equate to circa 0.5tCO_2-e per capita in 2019/20. The baseline for Australia's national targets, and a number of State governments, is 2004/05. Appendix 3 highlights the City's emissions profile at this point. Per capita emissions were 35,782tCO_2-e/51,795 = 0.69tCO_2-e.

Emissions intensity has reduced over time in the City, due to efficient waste management practices (segregation of green waste) and the Flaring Project.

Non-Reportable Emissions

Streetlight emissions in 2019/20 were 4,118tCO_2-e. Prior to the previous CGAP, the Western Australian Local Government Association (WALGA) performed an assessment of whether streetlights are under the Operational Control of local governments (see 'Operational Scorecard' - Appendix 4).

The review concluded that Western Power has control. Streetlights have therefore not been considered part of the City's carbon footprint.

As per the approach discussed above (see 'Historical Application in the City'), the City has never reported on Scope 3 emissions.

Duration of Plan

Under the PA, National carbon emission targets are set to be achieved in 2030. This milestone is replicated by many countries, and several Australian states.

Consequently, it is proposed that the term of this Plan is 2020/21 to 2029/30. This enables a clear indication of how the City's activities contribute towards National and International carbon reduction targets.

Future Forecasts and Initiatives

WALGA recently released a comprehensive list of actions with the capacity to reduce greenhouse gas emissions (the WALGA Action Planning Tool – 'WALGA Tool'). This was developed in collaboration with Ernst and Young, and a Local Government Working Group.

The list of 49 actions has been considered, and a gap analysis performed by City staff. This took place in an internal workshop, with a multi-disciplinary team. It identified existing practices and opportunities for improvement. The results are documented in Appendix 5.

The City's emissions profile provides a framework for the discussion of these opportunities. Forecast emissions for each source (Waste, Buildings and Fleet) are provided for 2020/21 to 2029/30, giving context to the assessment of opportunities.

However, consideration will also be given to the potential for additional strategic documents, and carbon accounting aspects, to provide overarching guidance around carbon mitigation.

Climate Change/Mitigation Policies

Context

The City of Armadale Strategic Community Plan has an outcome (2.1) to ensure '*Conservation and restoration of the natural environment'* and a supporting action of '*Minimising corporate and community carbon footprints'*. This is replicated in the City's Strategic Environmental Commitment, approved by council in 2019.

Opportunities/Results of Gap Analysis

1. *Strategic Policy Positions*

The WALGA Tool was issued in conjunction with the following templates:

1. Climate Change Declaration: Provides a clear statement that Local Governments accept the science of climate change and commit to adopting climate change adaptation and mitigation strategies.
2. Climate Emergency Declaration: May be adopted by Local Governments committed to taking urgent climate action and allocating resources accordingly. This involves rapidly scaling up mitigation and adaptation actions.
3. Corporate Adaptation Plan Template: This specifically focuses on identifying actions for Local Governments to manage climate risks, and adapt to the operational impacts of climate change.
4. Corporate Mitigation Action Plan: This identifies actions that LGs can take to reduce greenhouse gas emissions and help avoid future impacts of climate change.

The City has not endorsed a Climate Emergency Declaration, but did sign a Climate Change Declaration in 2011 that was submitted to State Council (see Appendix 6). Given its age, the currency of this document needs to be reviewed, as does the potential for developing an Emergency Declaration.

Recommendation 1	**Responsibility and Timescale**
Provide a report to Council, proposing an approach to the development of a Climate Change Declaration and Climate Emergency Declaration	Manager Environmental Services 2022/23
Budget Required	$Nil

The potential impacts of climate change are evaluated through the City's Risk Management Framework. Risks and mitigating controls are periodically evaluated by the Executive Leadership Team (ELT).

Nevertheless, it would be beneficial to conduct a review of the Climate Change Adaptation WALGA template, and assess any potential implementation benefits.

Recommendation 2	**Responsibility and Timescale**
Report to Council, proposing an approach to the production of a Climate Change Adaptation Management Plan and/or Strategy	Manager Environmental Services 2022/23
Budget Required	$Nil

Recommendations 1 and 2 may be addressed through a 2020/21 $35,000 budget allocation, (for supporting consultant activities associated with the Corporate Greenhouse Action Plan). This has been identified as a Strategic Operational Carry Forward.

Hopkinson Road and Landfill Recycling Facility

Context

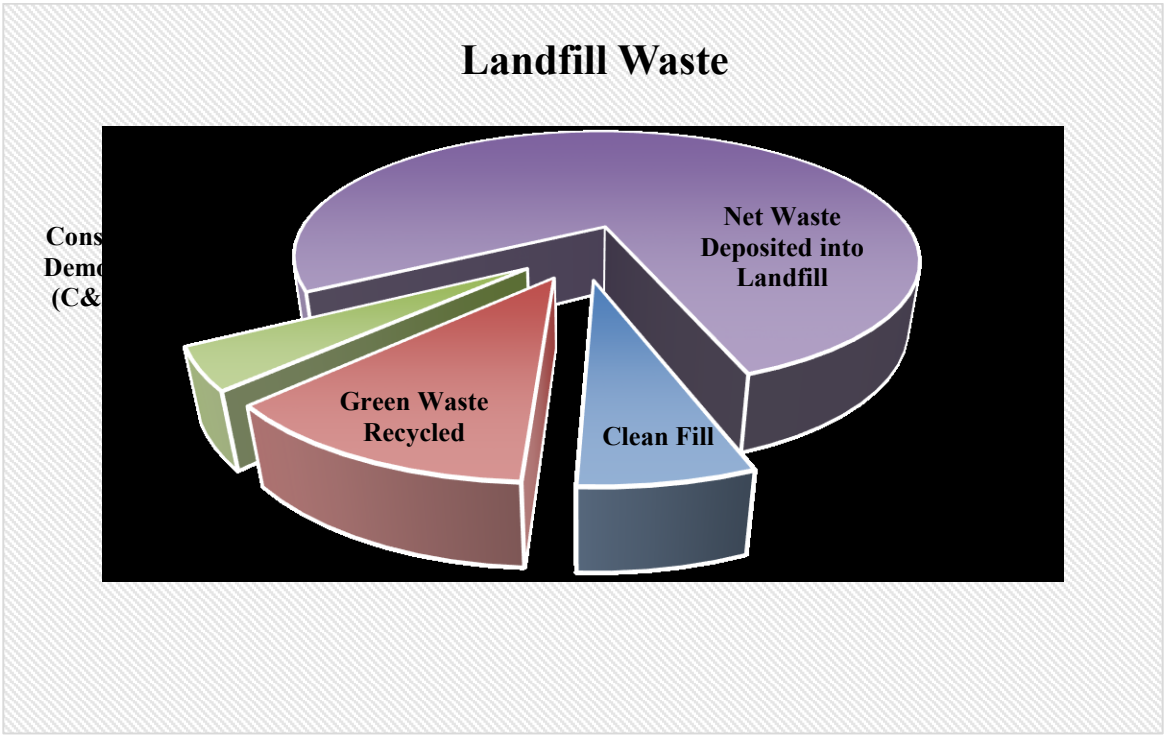
The site opened for business in 1974. For context, a reconciliation of waste receipts to landfill deposition is highlighted below:

Table 5: Landfill Waste in 2019/20

Component	Tonnes	Notes
Gross Receipts	**57,662**	
Clean Fill	(3,625)	Used as final cover Inert material.
Green Waste Recycled	(6,882)	Mulched by a third party
Construction and Demolition Waste (C&D) Recycled	(2,517)	Stockpiled and used on site
Net Waste Deposited	**44,638**	
Analysed as Follows:		
Municipal Solid Waste (MSW)[1]	30,412	73% of waste deposited
Commercial and Industrial Waste (C&I)	3,353	8% of waste deposited
C&D Waste[1]	7,772	19% of waste deposited

[1] Trailer waste of 10,292t is allocated to MSW (31.3%) and C&D Waste (68.7%), as per audit findings.

Figure 1: Landfill Statistics for 2019/20



Using the Federal government's Solid Waste Calculator, landfill deposition resulted in a gross (pre abatement) figure of 52,887tCO_2-e in 2019/20.

The City has entered into a contract with Avertas Energy, operators of the new Waste to Energy Facility (WTEF). On commissioning, expected in March 2022, all MSW generated by residents will be processed in Kwinana.

Carbon Accounting Matters

WALGA has recently established a 'Carbon Accounting Group, consisting of LG members. The City has been added as a participant. The Terms of Reference include an objective to '*Establish an agreed guide as to what corporate carbon emission sources should be tracked by Local Governments*'.

The Group intends to formulate an accounting position on household waste diverted to the WTEF. This will guide the extent to which LGs incorporate carbon emissions into their profile (as a Scope 3 emission).

Avertas will receive the waste, in consideration for Local Government financial contributions. It is also possible that they will seek to register the combustion process as an abatement project (as it avoids CH_4 emissions). This may result in an additional income stream for the WTEF.

Avertas therefore receives a financial benefit for the service provided, at a cost to the LGs, including the City. From this perspective, it would be inequitable for the CoA to account for the carbon, and any potential related costs (e.g. mitigation through the purchase of offsets, or staff time in the preparation of carbon statements).

From this perspective, the 'carbon burden' should be matched with the revenue, and not borne by the City.

Recommendation 3	**Responsibility and Timescale**
Irrespective of the results of the WALGA review, the City of Armadale does not account for carbon emissions associated with household waste diverted to the Waste to Energy Facility	N/A
Budget Required	$Nil

Forecast

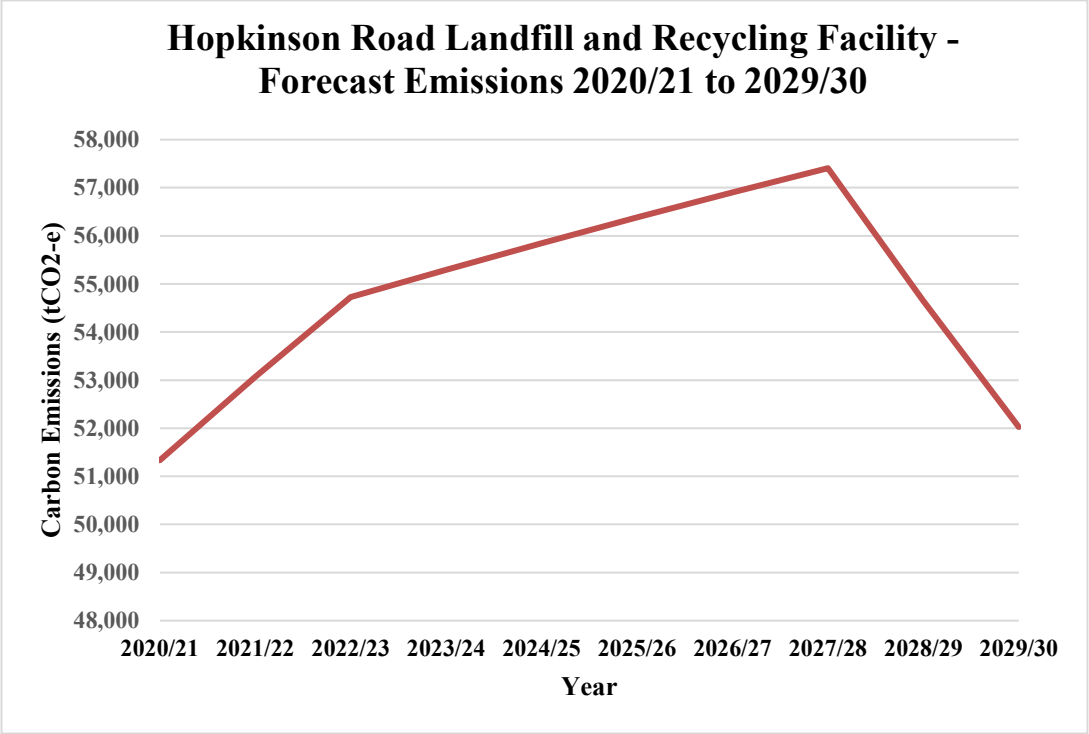
Adopting the above recommendation means that, from 2022, waste from residents will no longer drive emissions. The recent 'Air Space Tender' sought proposals to accelerate deposition rates at the site. This will advance the closure date and generate income for the City, supplementing reserve funding levels. The intent is for this to address landfill closure and rehabilitation costs.

It is anticipated that from 2022/23, the deposition profile will approximate to 12% MSW and 88% C&I. This will arise from new commercial contracts, and the continued receipt of waste from small LGs.

The Landfill Site is scheduled to reach full capacity by the end of 2026/27. However, this is dependent on the number of commercial contracts in place, and the volumes received.

Assumptions underpinning the forecast are highlighted in Appendix 7. Detailed supporting waste volume calculations are within Appendix 8. These form an input into the 'Solid Waste Calculator', a Federal Government tool that automatically calculates landfill emissions (see below):

Figure 2: Hopkinson Road Landfill and Recycling Facility Forecast Emissions 2020/21 to 2029/30



All emissions calculated in accordance with the Federal Government Solid Waste Calculator

Figure 2 highlights that gross emissions are projected to gradually increase, and then tail off, over the term of the Plan. During this period, the City has elected to receive commercial waste and municipal waste from adjacent Local Governments, after the diversion of household waste to the WTEF.

Legacy waste will continue to decay and produce methane for a number of years after deposition. While waste from future contracts will produce less methane than current levels of municipal waste, this is more than offset by the volumes projected. In addition, during this period, legacy waste will continue to contribute to the emissions profile.

Net annual emissions at the Landfill site will be 9,800tCo_2-e less than displayed above, due to the Flaring Project (conservative estimate based on 2019/20 performance). Nevertheless, it is more appropriate to highlight Gross emissions, as the City may sell, rather than cancel the Flaring Project abatement. Hence, the above Figure shows the actual contribution to the City's footprint.

The approach to waste emissions is consistent with the City's historical methodology, used in the preparation of Flaring Project Offset Reports. These were submitted to the Clean Energy Regulator, and subject to pre-submission audits. These concluded that the process, and interpretation of relevant legislation were sound. Consequently, Council can have confidence over the forecasting methodology.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

Site processes ensure that waste deposition to the tip, and carbon emissions, are minimised;

1. Green Waste: Material from two verge collections is transferred offsite for mulching. A small component is returned and available free of charge to the community.
2. Construction and Demolition waste: After compaction, used on-site as road base material.
3. Drop and Shop: Goods having the potential of a 'second life' are sold to the public.
4. E-Shed: Electrical components are dismantled and sold to a contractor.
5. Transfer Station: Waste sorting results in the segregation and re-use of wood, metal, glass and polystyrene.
6. Tyres, white goods, cardboard and PVC polypipe are recycled and/or stockpiled for re-use or resale when market conditions are optimal.

The flare has operated at the site since 2014, converting methane to carbon dioxide. This abated 91,050tCO_2-e during the last CGAP period (2014/15 to 2019/20), equating to circa 32% of gross emissions.

Climate Solutions Fund

The Flaring Project is CSF accredited. The conversion of methane to carbon dioxide generates an asset to the City, Australian Carbon Credit Units. Since 2014, ACCU's have been sold, generating income under a seven year contract with the Federal government.

The City elected to replace these credits, with alternatives accredited under the Climate Active scheme. The price difference between income received and offsets purchased has been allocated to the Wungong River Project, an environmental rehabilitation initiative. The intent was for these funds to be invested into a local project, benefitting the local community.

Opportunities/Results of Gap Analysis

Documented in Appendix 5, these are summarised below.

1. *Expansion of Flaring Infrastructure*

The flare generated 9,833tCO_2-e of abatement in 2019/20, mitigating 20% of site emissions.

The continued extension of the pipework and well heads will ensure ongoing methane abatement. This provides the most effective mechanism available to the City to minimise carbon emissions:

Recommendation 4	**Responsibility and Timescale**
Implement the continued expansion of infrastructure associated with the Flaring project, enabling continued carbon abatement at the site	Manager Waste Services Ongoing
Budget Required	Already Funded in Waste Services budget

No additional budget allocation is required.

2. *Lifespan - Flaring Project*

Finalisation of Contract

The City is party to a seven year contract with the Federal government. This is for the provision of 68,000 tonnes of carbon abatement.

As previously reported, enough surplus credits have accrued to complete the contract. The City's Australian National Registration of Offset Units account (ANREU) displays a holding of 16,810tCO_2-e ACCU's. However, only 9,716tCO2-e are required to satisfy the contract, leaving a residual 7,094tCO_2-e.

The City may request that the Clean Energy Regulator draw the arrangement to a conclusion, triggering the transfer of 9,716 units from the City's ANREU account. The Manager Environmental Services and Executive Director Technical Services are the respective 'Initiator' and 'Approver' of transactions on the ANREU system (as approved by the previous CEO).

Recommendation 5	**Responsibility and Timescale**
The Climate Solutions Fund contract with the Federal Government is to be completed early, through the provision of the total amount of contracted carbon credits	Manager Environmental Services/ Executive Director Technical Services 2021/22
Budget Required	Implications Already Included in the Long Term Financial Plan

There are no further budgetary implications.

Additional Reporting and Income

Despite contractual obligations being fulfilled early, there is a requirement to produce a final Offset Report for 20 June 2020 to 13 December 2021 (the scheduled end date of the project).

This is likely to record that abatement of approximately 12,000 to 13,500 units has been generated over the final project period (eighteen months). This is above and beyond the requirements of the contract.

These units may be combined with residual holdings of 7,094tCO_2-e, resulting in a total of 19,000 to 20,500tCO_2-e.

An option is to sell these on the Voluntary Market as a 'one-off' sale. The current spot price of carbon is $18.50. Following the application of a 15% contingency, to cover broker commission and market fluctuations, a price of $15.7 per unit is likely. Hence, they have an approximate value of $310,000.

Recommendation 6	**Responsibility and Timescale**
Council authorise the sale to the Voluntary Market of surplus carbon credits (7,094tCO_2-e), and those generated in the period 20 June 2020 to 13 December 2021	Manager Environmental Services 2021/22
Budget Required	See Table 6 below

This will result in an additional unbudgeted income stream:

Table 6: Income Stream from Surplus Credits

Income or Cost	**Origin**	**2021/22 Additional Income Generated or Budget Required $**
Additional Income Streams[1]	Surplus Credits 7,094tCO_2-e x $15.7	111,376
	Final Offset Period 20 June 2020 to 13 December 2021 12,750 x $15.70	$200,175
	Total	**$311,551**

A budget allocation for the preparation of the supporting Offset Report is already in place for 2021/22.

3. Future Flaring Project Options

The regulator recently announced that all CSF Flaring projects may be extended by five years. For the City, this means a potential total life span of twelve and a half years.

There are three possible approaches to the treatment of the project, summarised below and evaluated in Appendix 9. The merits of the Voluntary Market are discussed below:

Table 7: Financial Summary of Options for the Flaring Project

Option	Explanation	Net Financial Impact $
1.	Extend the project – Sell City generated Australian Carbon Credit Units (ACCU's) on the Voluntary Market	666,890
2.	Extend the project – Do not sell City generated ACCU's and surrender credits to the Federal government	(105,000)[1]
3.	Do not extend the project – Account for flare abatement in-house	0

[1] The result of compliance costs

Option 1 creates a position of financial surplus. This places the City in a position to potentially fund the recommendations of this Plan.

Projected income and cost streams, associated with the project extension, are summarised below:

Table 8: Forecast Income and Cost Schedule for the Project Extension Phase

Year	2023/24 $	2024/25 $	2025/26 $	2026/27 $	2027/28 $	2028/29 $	Total $
Income[1]	-	308,756		308,756		154,378	**771,890**
Compliance Costs[1]	(45,000)		(45,000)		(15,000)		**(105,000)**
Total	**(45,000)**	**308,756**	**(45,000)**	**308,756**	**(15,000)**	**154,378**	**666,890**

[1] Assumes Offsets Report and Audit are due after the completion of year two and four in December 2023 and 2025, with income collected the following financial year (audit process can take 3 months, and the regulator has a three month determination period).

The spot price of carbon is considered a conservative estimate. As 2030 approaches, the demand for ACCU's is likely to increase, as State and Local Government commitments are delivered. This will quite probably lead to an increase in price.

Income and cost allocations have been made in the Long Term Financial Plan. However, these need to be amended to reflect the above projections. This will be performed as part of the four year budget process.

The Voluntary Market is the most appropriate sales avenue for carbon credits. This enables the City to sell as many or as few credits as it likes, at a time that suits. Buyers will be those with voluntary targets, or corporations seeking to meet obligations under the Safeguard Mechanism.

The alternative is entering into a new contract with the Federal government. In this scenario, Council will be obliged to provide fixed amounts at a specific point in time. This could prove to be a risky strategy, given the Landfill Site is in a period of transition. For this reason, the Voluntary Market is recommended as the preferred approach.

The spot price of carbon is consistently higher than weighted average values in Federal Government contracts. Hence, there is the potential to maximize revenue.

Recommendation 7	Responsibility and Timescale
Council authorise an application to the Federal government, seeking an extension to the life of the Flaring Project by a further five years	Manager Environmental Services 2021/22
Budget Required	$Nil

Recommendation 8	Responsibility and Timescale
Council endorse the principle of selling carbon credits for the extension period on the Voluntary Market	N/A
Budget Required	See Table 8 above

Council approval will be sought prior to the sale of carbon credits in the extension period, facilitating an analysis of project performance against forecast.

Buildings

Context

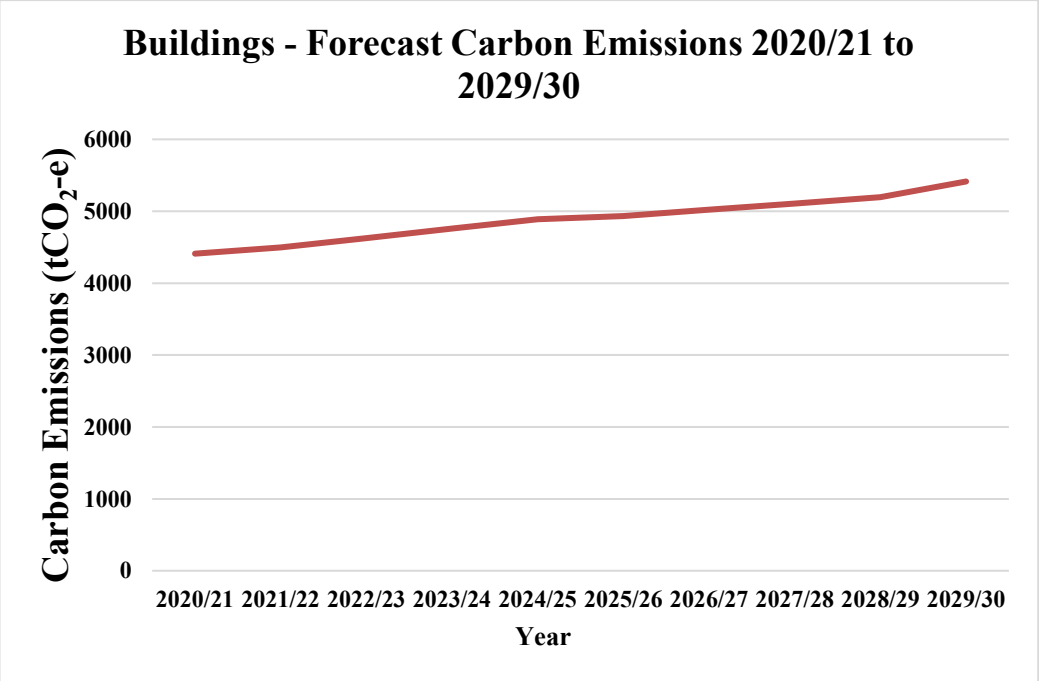
The City manages a portfolio of 135 community buildings. This includes sporting clubs, two recreation centres, three libraries and seven operational facilities. Electricity associated with 116 metered irrigation bores is included within buildings emissions.

In 2019/20 the carbon footprint equated to 4,366tCO_2-e (9% of the City's total).

Forecast

Anticipated emissions are presented below:

Figure 3: Building Facility Forecast Emissions 2020/21 to 2029/30



Calculated using carbon accounting software from a third party

Population growth is used as a proxy for emissions.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

These are summarised as follows:

1. Finalisation of energy audits, and subsequent implementation of actions for AFAC (2016), Armadale Arena (2016), the Depot (2016), Piara Waters Pavilion (2016) and the Champion Centre (2014)
2. Solar panel installation at Armadale Arena, Armadale Fitness and Aquatic Centre (AFAC), Main Administration Building and the Depot
3. Geothermal bore at AFAC for water heating

An energy audit of the Landfill Site is currently in progress, facilitated by Switch Your Thinking.

The City is installing new solar systems at the Champion Centre (30kW) and Orchard House (160kW). The existing solar panels at AFAC are now under-sized, given facility upgrades. Consequently, a 500kW system is being installed. All systems will be commissioned by 31 December 2021, and funded by government stimulus packages. Collectively, these will produce an annual energy saving of 1,000MWh (circa $300,000), and reduce the carbon footprint by 700tCO_2-e.

City facilities are either 'Contestable' or 'Non-Contestable' electricity users. The former utilise in excess of 50 megawatt hours per annum, and a competitive quotation process is undertaken. The City has eleven contestable sites, accounting for 70% of electricity consumption, and 65% of total cost.

Non-Contestable sites are supplied by Synergy, with no option for a competitive process. In this case, prices paid are mandated by the economic regulator.

At the time of writing, the carbon footprint of the City's Contestable sites is nil, as Council elected to procure 100% renewable power for the current contract.

Energy efficiency projects will therefore not reduce the City's carbon footprint for Contestable sites, but will result in electricity cost savings. For Non-Contestable sites, they also reduce the carbon footprint.

Opportunities/Results of Gap Analysis

The WALGA Tool (Appendix 5) highlights potential opportunities for the City.

1. *Building Policy*

The City does not have a policy position on standards associated with new or refurbished buildings. This would be of benefit, providing consistency across all facilities, and the deployment of energy efficient technology.

Recommendation 9	**Responsibility and Timescale**
Develop a Policy for Green Buildings	Property Services Manager 2021/22
Budget Required	$Nil

2. *Energy Efficiency*

Solar installation at City facilities has been opportunistic, with efforts focused on sites demonstrating the most likely attractive payback periods. Installations have also been in response to specific grant opportunities.

The City would benefit from a formal feasibility study, covering the top 20 energy using sites. Installation may then be prioritised, with 'grant ready' projects available.

Recommendation 10	**Responsibility and Timescale**
Complete a solar feasibility study for the City's top 20 electricity using facilities	Property Services Manager/ Manager Environmental Services 2022/23
Budget Required	$50,000

Energy audits at City facilities have also been opportunistic. A formal programme may be introduced, focusing on high consumption sites.

Recommendation 11	Responsibility and Timescale
Complete energy audits for two City facilities per annum, focusing on the top 20 electricity consuming sites	Property Services Manager/ Manager Environmental Services 2022/23
Budget Required	$10,000 per annum

3. Monitoring

The City deploys a carbon, energy and water monitoring system. Consumption reports are reviewed quarterly by a multi-disciplinary City team. This enables the identification of unusual trends and/or efficiency opportunities.

Whilst the carbon component of the system is effective, and used for Council reporting purposes, there is an opportunity to upgrade electricity and water consumption components.

'Real-time' monitoring, rather than retrospective review, enables a swift response to emerging issues (e.g. water leaks, energy spikes). It also enables a unified approach to the monitoring of solar PV production (currently measured through a number of disparate systems). The existing consultant contract expires in September 2021, at which point the City can consider alternatives.

Recommendation 12	Responsibility and Timescale
Progressively implement a real-time energy and water monitoring system, initially targeting high demand (top 20) facilities.	Property Services Manager/ Manager Parks/ Manager Environmental Services 2021/22
Budget Required	Already Funded in Environmental Services budget

No additional budget allocation is required.

4. *Energy Sharing*

Traditionally, electricity has been supplied through a linear chain, incorporating generation, transmission, distribution and retail.

This system is evident in the energy produced from solar panels. When power is generated, surplus to the requirements of the facility, it exported to the grid. The facility owner derives no financial benefit.

The South West Interconnected System has recently undergone a change, due to the enormous uptake of solar systems. The grid has transitioned from a linear model, to a network of generation and storage assets, including solar PV, battery storage, electric vehicles and metering devices.

The governance and regulatory framework to support this advancement is in development. However, the potential exists for Local governments to share renewable energy between facilities, through 'Micro-Grids' or 'Virtual Power Plants'. This could, in theory, reduce operating costs and provide cheaper electricity.

This matter is discussed in detail in Appendix 10 (Switch Your Thinking discussion paper presented to the South East Regional Energy Group).

Recommendation 13	**Responsibility and Timescale**
Switch Your Thinking remain abreast of regulatory developments, and through Council reporting, recommend implementation projects in the City of Armadale	Switch Your Thinking Ongoing
Budget Required	$Nil

5. *Electricity Procurement*

As discussed, the City's Contestable sites are currently supplied by renewable power. This comes at a premium, at approximately 15% more expensive than traditional energy sources.

WALGA are investigating the possibility of a bulk purchase of Renewable energy. This will take the form of a Power Purchase Arrangement, scheduled to commence April 2022. It is hoped that this will introduce economies of scale.

The City has provided energy use profiles to WALGA, to assist in setting procurement volumes. Suppliers may then use this to determine pricing.

A Memorandum of Understanding has also been signed by the City's Chief Executive Officer, enabling participation in the quotation process. A chosen supplier will be selected by WALGA in October 2021. It is not compulsory for the CoA to accept the preferred supplier or pricing on offer.

At this point, a report will be produced for Council to consider the commercial and environmental benefits of contracting with the preferred supplier.

Recommendation 14	**Responsibility and Timescale**
Produce a report to Council, providing a cost benefit analysis of the City entering into a contract with the WALGA preferred supplier	Manager Environmental Services 2021/22
Budget Required	$Nil

Fleet

Context

The City owns and maintains the following assets:

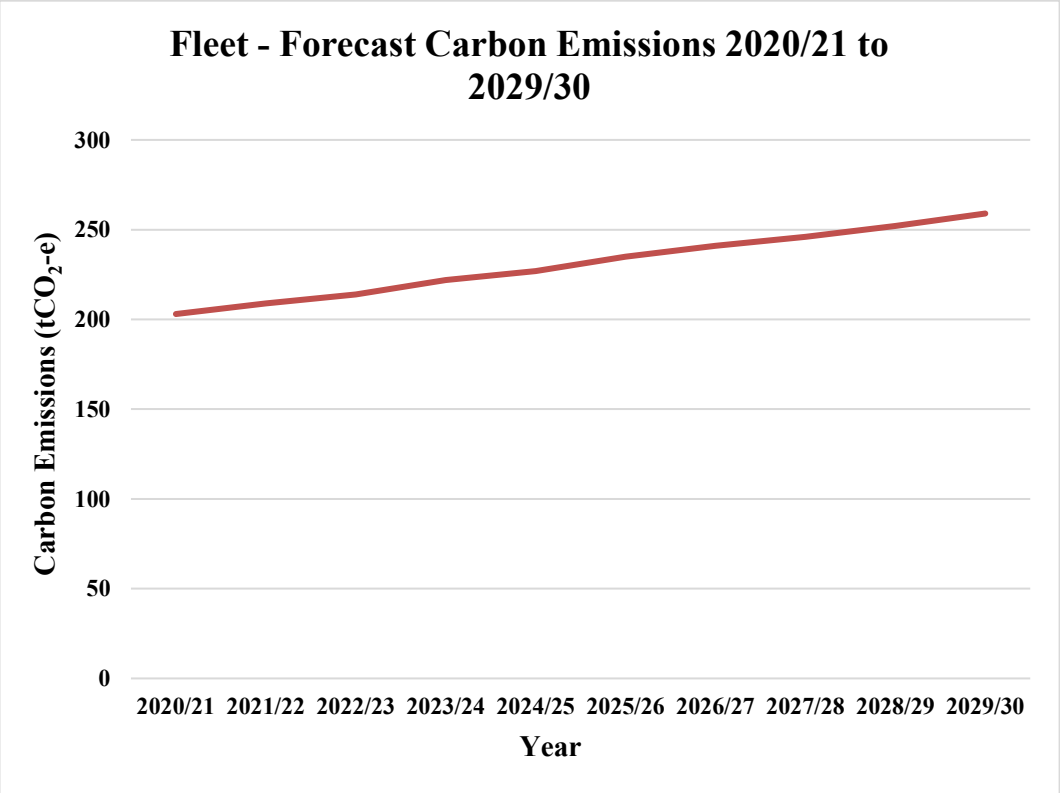
Table 9: City of Armadale Fleet

Type	Number
Light Fleet (e.g. cars)	131
Light Plant (e.g. cement mixer)	85
Heavy Fleet (e.g. waste truck)	40
Heavy Plant (e.g. tractor)	13
Other	1
Total	**270**

Forecast

This is summarised as follows:

Figure 4: Fleet Emissions 2020/21 to 2029/30



Calculated using carbon accounting software from a third party

Population growth forecasts are used as a proxy to estimate emissions.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

A report is currently in production, with the objective of recommending strategies to optimise operational fleet numbers.

The Australian Renewable Energy Agency (ARENA) Future Fuels Fund addresses barriers to the implementation of new vehicle technologies. Funding of $16.5m is available to finance Battery Electric Vehicle (BEV) fast charging stations in capital cities and regional centres.

Recently, Switch Your Thinking were approached by Synergy, CRC Future Battery Industries and the Gemtek Group, to identify potential suitable locations for installation in in the City. The Administration Building is ideally situated, close to both the Albany and South West Highways.

An application for $120,000 was submitted to the Future Fuels Fund for a charger at the City's Administration Building. Unfortunately, this was unsuccessful. The Switch Your Thinking team, however, will continue to monitor potential funding opportunities to deliver the project.

Opportunities/Results of Gap Analysis

1. *Deployment of Electrical Vehicles*

Aside from one vehicle, the City's fleet is fuelled by traditional sources. There is an opportunity for an ongoing evaluation of alternative technologies and the benefits they may introduce. These include, for example, electric or hydrogen powered vehicles.

Recommendation 15	**Responsibility and Timescale**
Develop options for improving the sustainability of the City's fleet such as transitioning to electric or non-hydrocarbon vehicles	Manager Assets 2022/23
Budget Required	$Nil

Other Initiatives

The benchmarking exercise has yielded a number of additional actions.

1. *Streetlights*

Most street lights in Australia are owned and operated by Distribution Network Service Providers. In Western Australia, this is Western Power.

There are 11,000 streetlights in the City, attracting a flat daily tariff. There is limited transparency over the components of this charge, particularly for electricity and maintenance costs. The City's lighting stock consists of inefficient, antiquated technology and there are environmental issues associated with disposal (e.g. mercury vapour lights).

The annual street lighting bill to the City is $2.2m, with no opportunity for contestability. Although not included in the City's carbon footprint, street lights in Armadale generate emissions of 4,118tCO_2-e.

In 2020, a Street Lighting Working Group was formed by the Cities of Albany, Armadale, Canning, Cockburn and Melville. The purpose is to implement, in partnership with Western Power, bulk changeover projects to replace old lights with LED smart ready lighting.

An indicative business case, provided by a third party consultant, was presented to Council in August 2020. This highlighted that a changeover project will cost in the region of $6.4m. This will reduce the cost of street lighting by $1.1m per annum, with a payback period of less than six years. The carbon footprint associated with street lights will be halved.

The working group continues to liaise with Western Power to advance the project, and derive certainty over costs.

Recommendation 16	**Responsibility and Timescale**
When there is certainty over implementation costs and ongoing tariffs, provide a business case report to Council on a bulk changeover to LED street lights	Manager Environmental Services Timescale Dependent on Western Power
Budget Required	Implications will be discussed in the report to Council

A policy is currently in draft form, covering lighting standards in new development areas, and an approach to replacement lighting in older suburbs. This provides an additional opportunity to implement energy efficient lighting.

Recommendation 17	**Responsibility and Timescale**
Finalise, and present to Council, a Streetlighting Policy around the deployment of energy efficient lighting in the City	Manager Engineering Design 2021/22
Budget Required	$Nil

The City owns and manages approximately 500 decorative lights. There is an opportunity to change these over to LED models.

Recommendation 18	Responsibility and Timescale
Prepare a business case for the potential changeover of decorative lights to more energy efficient models	Manager Engineering Design 2021/22
Budget Required	$15,000

2. Revolving Energy Fund

Council considered the possibility of a Revolving Energy Fund (REF) in 2002, and during the finalisation of the *2009 to 2012 Corporate Greenhouse Action Plan*.

Through 2009/10 budget deliberations, $100,000 was allocated as seed funding. The reserve was set up to fund energy audits and the implementation of energy efficiency measures. Initial capital project costs were to be funded by the REF, and the account replenished by utility savings. This then provides funds for further re-investment.

The REF is still in operation, used several years ago to fund solar panels for the Administration Centre, Armadale Arena, Depot and AFAC. The balance on the fund is now $235,000.

There is an opportunity to clarify the rules around the mechanism of the Fund. Thus far, replenishment of the REF ends when the capital cost is fully recovered. This increases the utility budget, but does not encourage additional continuous improvement. Consequently, it is proposed allocate annual cost savings to the REF in perpetuity. The use of the REF should be captured in a formal policy.

Recommendation 19	Responsibility and Timescale
Develop a policy around the use of the Revolving Energy Fund	Manager Environmental Services 2023/24
Budget Required	$Nil

3. Divestment

In 2015, Council considered a report on the City's investment practices, focusing on projects funded by investing institutions. The merits of 'Divestment' were considered as part of this review. Divestment is the process of steering funds away from institutions supporting projects that involve the exploitation of fossil fuels.

The report resulted in an amendment to Council policy FIN4 '*Investments*', and the accompanying Management Practice. The changes ensure that the City prioritises investments in institutions with a portfolio of 'green' investments. Qualifying criteria accompanied the changes, ensuring that ratepayer funds are also invested in a financially responsible manner, and only with appropriately rated institutions.

The policy was last reviewed in 2018, and the relevant extracts were unchanged. There is a Monthly Financial Report to Council, highlighting the proportion of the City's investments in 'green' and 'non green' institutions. Hence, appropriate oversight is in place.

4. Sustainable Procurement Policy

Appendix 5 highlights an opportunity to reduce Scope 3 carbon emissions, through the implementation of responsible purchasing practices. For example, when purchasing paper, the City may elect to procure only recycled material. Larger City purchases could be the focus of any guidelines or policy. Alternatively, it may be focused on large scale project implementation, to implement sustainable practices.

The *Switch Your Thinking Business Plan 2020/21 to 2024/25* includes an action to develop a Sustainable Purchasing Policy template for all partner Councils. This will provide guidance on the principles to be applied in the procurement process.

Recommendation 20	**Responsibility and Timescale**
In partnership with the Switch your Thinking team, investigate the feasibility of implementing a Sustainable Purchasing Policy, and develop appropriate City supporting documentation	Switch Your Thinking 2022/23
Budget Required	$Nil

5. Staff Incentives

It is becoming increasingly common for organisations to offer employee incentives to adopt more sustainable procurement practices. These include subsidies for staff to use public transport. It is possible that an incentive scheme could work effectively in the City, and in relation to a broad range of areas.

Recommendation 21	**Responsibility and Timescale**
Complete an investigation into possible incentives for employees to adopt sustainable practices. The study should cover options for behaviours that could be incentivised, in conjunction with the potential rewards offered	Switch Your Thinking 2022/23
Budget Required	$Nil

City of Armadale Targets

The International community, Australian government and many State governments have 2030 targets for carbon abatement. It is appropriate that the City follow suit, enabling a transparent link between efforts on the micro and macro scale. A cost benefit analysis is required to determine which target the City should apply.

Options

Six potential targets have been considered, and the rationale documented. The results are summarised in Table 10.

In five of the six options, a progressive or tapered approach is taken towards target achievement. Annual emissions are compared against an emissions reduction trajectory. To avoid double counting, the City's actual emissions are not reflective of any flare abatement.

The sixth option involves the City considering only emissions from Buildings and fleet, in accordance many WA Local Governments.

A worst case scenario is applied when calculating the 'emissions gap', where it is assumed that no abatement activity is achieved in the City, and that Green power is not purchased (nil carbon footprint). This is considered prudent.

In all scenarios, abatement activities are highly unlikely to meet the target. As a result, offsets will need to be purchased.

The table highlights two options for the purchase of offsets; 1) Those allowable under the Climate Active scheme (probably sourced from overseas); or 2) Australian Carbon Credit Units. The former come at a much lower price (estimated at $4 per tCO_2-e compared to $18.50).

For reference, income from the sale of surplus credits, credits generated over the last eighteen months of the project, and credits from the five-year extension are displayed at the top of the table. Costs associated with the Plan are also displayed.

This enables all financial aspects to be considered holistically. In this sense, income may be used to fund the recommendations of this Plan ($145,000), and the purchase of offsets. The table therefore also displays residual income or net costs after the purchase of offsets.

Table 10: Target Options and the Price of Offsets

Income/Cost Source			**$**
Surplus Credits and the Final Project Period (18 months)			**312,000**
Flaring Project Extension			**667,000**
Actions in CGAP			**(145,000)**
Residual Income			**834,000**
Target	**Rationale**	**Income, Cost of Offsets and Residual Amounts/(Cost) $**	
		CA Scheme $	**ACCU's $**
1. Emissions at 2005 Levels by 2030	2005 is commonly used as a baseline year	**834,000** **(752,000)** **82,000**	**834,000** **(3,478,000)** **(2,644,000)**
2. 28% Reduction on 2005 Levels by 2030	Aligned to Australian National target	**834,000** **(972,000)** **(138,000)**	**834,000** **(4,497,000)** **(3,663,000)**
3. 45% Reduction on 2005 Levels by 2030	Based on IPCC publication *'Special Report 'Special Report - Global Warming of 1.5 Degrees C'* states that '(to limit)…*global warming to 1.5 degrees....Global net human-caused emissions of carbon dioxide would need to fall by about 45% from 2010 levels by 2030, reaching 'net zero' by 2050*	**834,000** **(1,106,000)** **(272,000)**	**834,000** **(5,116,000)** **(4,282,000)**
4. 75% Reduction on 2005 Levels by 2030	Based on recommended Climate Council target	**834,000** **(1,342,000)** **(508,000)**	**834,000** **(6,208,000)** **(5,374,000)**
5. Zero emissions by 2030	Elimination of the City's carbon footprint	**834,000** **(1,539,000)** **(705,000)**	**834,000** **(7,119,000)** **(6,285,000)**
6. Offset Buildings and Fleet Only for 2020/21 to 2029/30	Many LGs with or without Landfill Sites only have targets in relation to Buildings and Fleet	**834,000** **(205,000)** **629,000**	**834,000** **(947,000)** **(113,000)**

In all cases, it is clear that the costs of ACCU's are price prohibitive. Hence, it is advantageous to the City to purchase offsets allowable under the Climate Active scheme.

As highlighted above, a prudent approach has been taken. If Green power is purchased, this will mean a reduction in the carbon footprint over the 2020/21 to 2029/30 period of 45,000tCO_2-e. This will reduce offset costs by $180,000 (Climate Active) or $710,000 (ACCU's).

Limitations

It should be noted that the financial analysis presented above is predicated on several assumptions. These have been 'de-risked' wherever possible, ensuring a conservative approach is taken;

Table 11: Uncertainties Associated With Plan

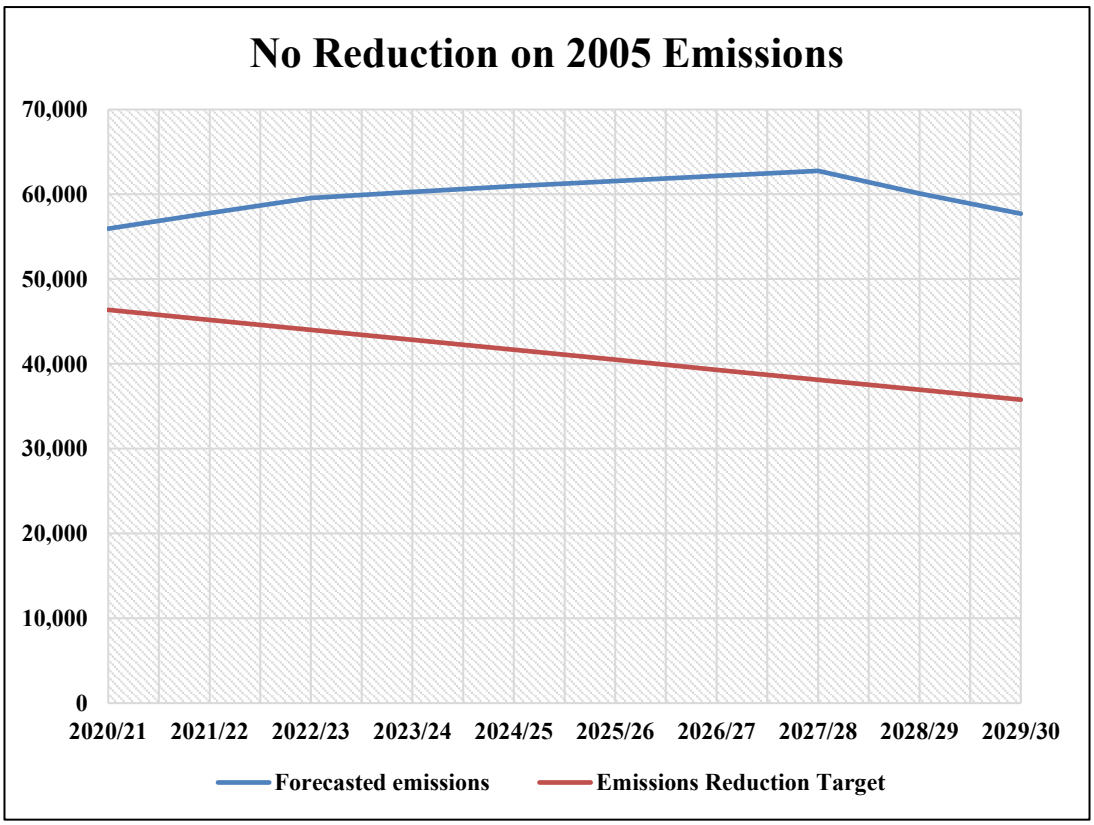
Broad Level Assumption	Influence	Explanation/Mitigation Strategy
1. Future Waste Streams include 50,000t of Commercial Waste and 7,000t of MSW per annum, with tip full by 2026/27	Impact on Waste Emissions if volumes change Emissions 'tail off' will change if the Landfill Site takes longer to fill	Biennial review of waste streams and calculation of impact on carbon footprint/future offset liabilities
2. Performance of Flare	Impacts on Carbon Credit Income (through volumes)	Lowest annual flaring volume to date used as a conservative estimate. Likely to be an 'upside' on volumes and, subject to impact of 1 above, the results of the proposed expansion of flaring infrastructure
3. Spot Price of Carbon on the Voluntary Market	Impacts on Carbon Credit Income (through price)	Conservative estimate of $15.70 per tonne applied, although market rate is $18.50. Possibility of an 'upside', as prices likely to increase closer to 2030
3. Price of Offsets	Impacts on Cost of Plan	Current market rate for Climate Active offsets is between $2.50 and $4 per tonne. Applied $4 per tonne in calculations Residual risk is that this continues to rise (will be addressed through biennial forecasts – see 1 above)
4. Global Warming Potential (GWP) of Methane	Adjustments influence calculated waste emissions and flaring quantities	In 2020, the Clean Energy Regulator adjusted the GWP of methane from 25 to 28, as a result of studies concluded by the IPCC. Updates are periodically incorporated into the Solid Waste Calculator and the Methodology for Flaring projects. This impacts on the Waste carbon footprint and amounts flared Mitigation Strategy - Biennial review of waste streams and calculation of impact on carbon footprint

Calculations have been based on the best information to hand, and provide a mechanism for the evaluation of the options.

Evaluation of Options

Option 1

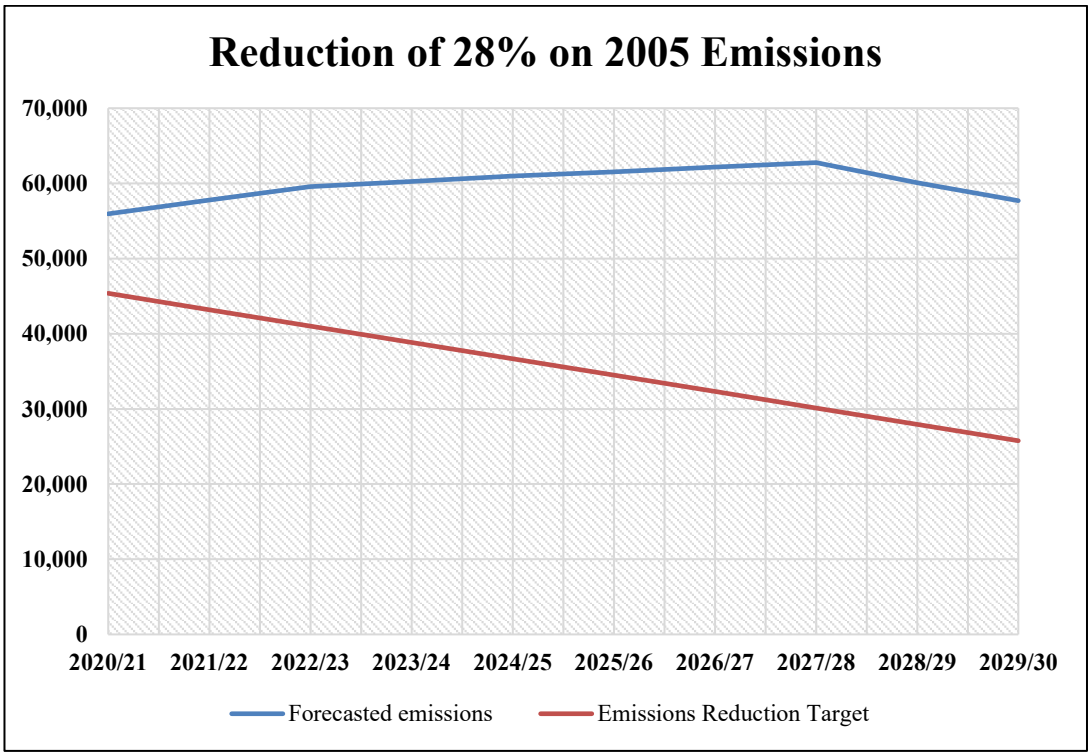
Figure 5: Graph Highlighting 2005 Abatement Target



This could be self-funded. The cost of offsets is $752,000 and $834,000 of income is available.

Option 2

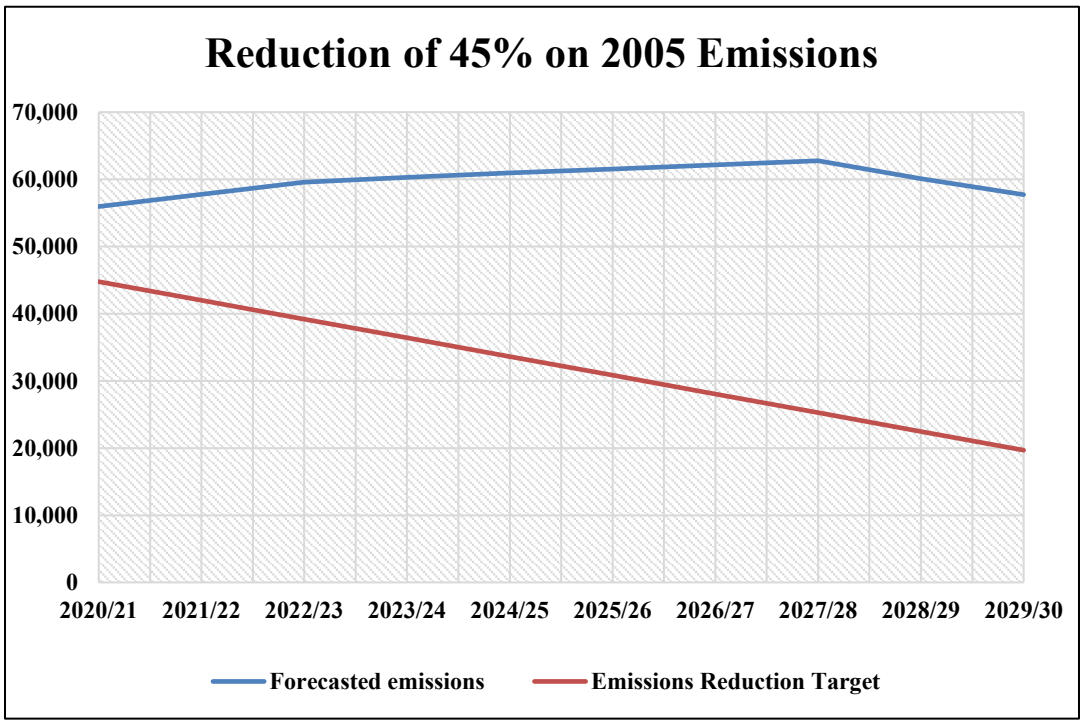
Figure 6: Graph Highlighting 28% Abatement Target



This matches National efforts, and is not quite self-funded (offset cost is $972,000 against income of $834,000). Adopting this approach would require an injection of municipal funds ($138,000).

Option 3

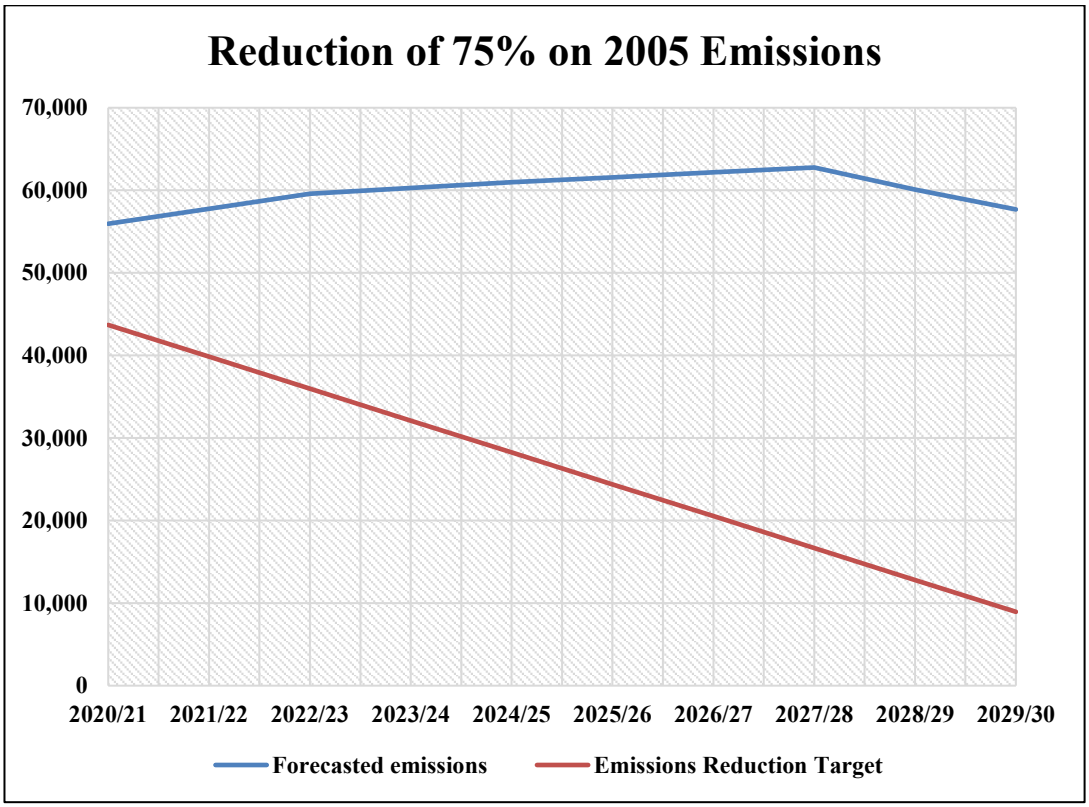
Figure 7: Graph Highlighting 45% Abatement Target



Setting a 45% reduction target, in reference to 2005, will cost $1,106,000 in offsets. When compared to income, this results in a deficit of $272,000.

Option 4

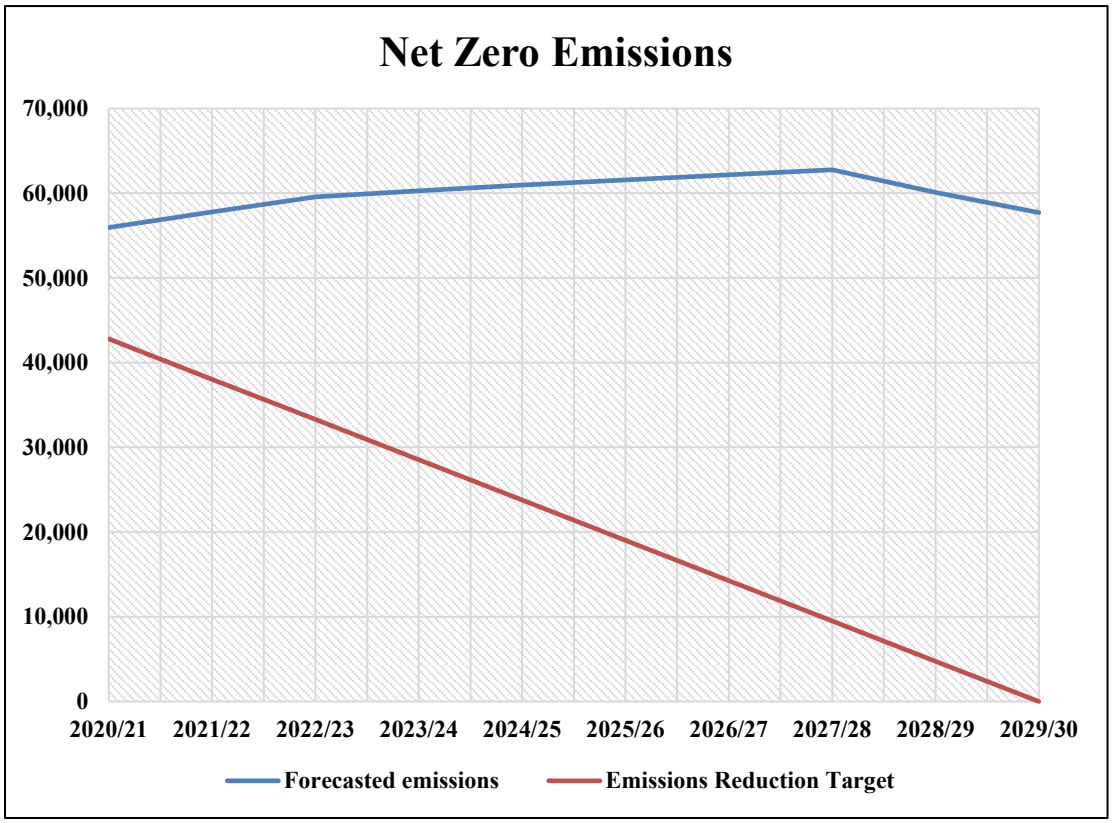
Figure 8: Graph Highlighting 75% Abatement Target



This matches the recommendations of the Climate Council. Offset cost is $1,342,000 against income of $834,000). Adopting this approach would require an injection of municipal funds.

Option 5

Figure 9: Graph Highlighting Net Zero Emissions



This would require an allocation of $705,000 from municipal funds ($89,000 per annum over the remaining 8 years of the Plan). The cost of offsets is $1,539,000, against income of $835,000.

Option 5

Emissions from Buildings and Fleet are highlighted above in Figures 3 and 4. These equate to 51,175tCO_2-e in the period 2020/21 to 2029/30. For these to be 100% offset, will cost $205,000 for Climate Active offsets and $947,000 for ACCU's.

Analysis

It would be advantageous for income from the Flaring Project to fund the recommendations of the Plan ($145,000). Residual income of $834,000 may be used to pursue an offsets strategy.

Australian generated offsets are very expensive, and not a viable option. The focus must therefore be on units allowable under the Climate Active Scheme.

For Options 2 (28% reduction on 2005 emissions), 3 (45% reduction), 4 (75% reduction) and 5 (net zero emissions), income of $834,000 does not cover the cost of offsets. A supplemental injection of municipal funds is required to purchase the requisite number of offsets. This injection ranges from $138,000 to $705,000. In this case, the total spend on offsets ranges from $972,000 to $1,539,000.

Option 1 (emissions at 2005 levels by 2030) is achievable, with $82,000 left over (total spend on offsets = $752,000). This is also the case for Option 6 (100% offset of buildings and fleet), $629,000 remaining (total spend on offsets = $205,000).

Conclusion

As highlighted by the IPCC, the range of predicted global warming scenarios do not paint a positive picture. This presents the City with an opportunity to take a leadership role.

The above forecasts suggest that a 2030 net zero carbon emissions target (Scope 1 and 2) could be achieved. Australian Carbon Credit Units are expensive, but an $89,000 per annum allocation from 2022/23 to 2029/30 enables the purchase of accredited Climate Active Offsets. This figure is suppressed, due to the sale of credits generated by the Flaring project.

Finally, in order to be consistent with State government, the City should also adopt a target of net zero emissions by 2050. By this time, the Landfill Site is anticipated to be long closed. Buildings and Fleet will dominate emissions.

Recommendation 22	**Responsibility and Timescale**
Council adopt the following approach to carbon abatement: - A target of net zero emissions by 2029/30 - Fund the recommendations of this Plan from Flaring Project income - Allocate an additional $89,000 per annum towards offsets in the period 2022/23 to 2029/30 - A target of net zero emissions by 2050	N/A
Budget Required	$89,000 per annum

It is imperative that variables in the financial analysis are continuously monitored, and periodically updated financial forecasts prepared. This will give assurance on the achievement of the objectives of this Plan (see ‘Limitations’ section above). Updates can be provided through the Environmental Services biennial report to Council.

Recommendation 23	Responsibility and Timescale
Provide an analysis to Council as part of the biennial Environmental Services report on the financial impact of achieving the carbon abatement target. This should cover: - The results of updated modelling from the Solid Waste Calculator, which is influenced by the type and quantities of waste received and forecast for the Landfill Site - Flare performance - The spot price of Australian Carbon Credit Units, facilitating forecast income calculations - Purchase price of offsets under the Climate Active scheme	Manager Environmental Services
Budget Required	$Nil

Carbon Neutrality

As the recommended target only covers Scope 1 and 2 emissions, this means that the City does not have the option of becoming 'Carbon Neutral' under the Climate Active Scheme. This the calculation of Scope 3 emissions.

However, this may be something that is considered at some point in the future. Key features of this scheme include:

- Base year is set for carbon emissions, enabling a comparison over time
- Requirement to demonstrate emissions reduction in priority over offsetting
- The consideration of Scope 3, as well as Scope 1 and 2 emissions
- Application for a Federal Government license every two years (Certification cost of $15,000). Supporting consultant costs are estimated at $20,000 to complete the application, and $30,000 for it to be audited (total cost every two years = $50,000
- Report publicly on emission status and reduction activities

Hence, these costs will need to be considered at the appropriate time.

Budget Allocation Process

The City requires a mechanism to accumulate funds for the purchase of offsets and energy efficiency projects. An effective way to achieve this is through the creation of a Carbon Reserve. Appendix 12 highlights the cash flows associated with this Plan.

In most years, there will be a net transfer of funds into the reserve. In others, transfers out are required, to fund the recommendations of the Plan. However, the reserve will always be cash positive, due to the initial influx of income in 2021/22, followed by regular deposits.

Rather than waiting till the end of the CGAP, it may advantageous to purchase offsets in increments, depending on their price. In this scenario, Council approval will be required to access the reserve.

Recommendation 24	**Responsibility and Timescale**
Council approve the creation of a Carbon Reserve, for the purpose of ring-fencing carbon credit income, purchasing carbon offsets and funding the recommendations of the Corporate Greenhouse Action Plan 2020/21 to 2029/30	Executive Manager Corporate Services 2021/22
Budget Required	$Nil

Summary of Recommendations

Recommendation	Responsibility/Timescale/ Budget Implications
1. Provide a report to Council, proposing an approach to the development of a Climate Change Declaration and Climate Emergency Declaration	Manager Environmental Services 2022/23 - $Nil
2. Report to Council, proposing an approach to the production of a Climate Change Adaptation Management Plan and/or Strategy	Manager Environmental Services 2022/23 -$Nil
3. Irrespective of the results of the WALGA review, Council endorse the approach of not accounting for carbon emissions associated with household waste diverted to the Waste to Energy Facility	N/A
4. Implement the continued expansion of infrastructure associated with the Flaring Project, enabling continued carbon abatement at the site	Manager Waste Services Ongoing - Already Funded in Waste Services Budget
5. The Climate Solutions Fund contract with the Federal Government is to be completed early, through the provision of the total amount of contracted carbon credits	Manager Environmental Services/ Executive Director Technical Services 2021/22 - $Nil
6. Council authorise the sale to the Voluntary Market of surplus carbon credits (7,094tCO_2-e), and those generated in the period 20 June 2020 to 13 December 2021	Manager Environmental Services 2021/22 - $ - See Table 6
7. Council authorise an application to the Federal government, seeking an extension to the life of the Flaring Project by a further five years	Manager Environmental Services 2021/22 - $Nil
8. Council endorse the principle of selling carbon credits for the extension period on the Voluntary Market	N/A $ - See Table 8
9. Develop a Policy for Green Buildings	Property Services Manager 2021/22 - $Nil
10. Complete a solar feasibility study for the City's top 20 electricity using facilities	Property Services Manager/ Manager Environmental Services 2022/23 - $50,000
11. Complete energy audits for two City facilities per annum, focusing on the top 20 electricity consuming sites	Property Services Manager/ Manager Environmental Services 2022/23 - $10,000 per annum
12. Progressively implement a real-time energy and water monitoring system, initially targeting high demand (top 20) facilities	Property Services Manager/ Manager Parks/ Manager Environmental Services 2021/22 - Already Funded in Environmental Services Budget
13. Switch Your Thinking remain abreast of regulatory developments, and through Council reporting, recommend implementation projects in the City of Armadale	Switch Your Thinking Ongoing - $Nil
14. Produce a report to Council, providing a cost benefit analysis of the City entering into a contract with the WALGA preferred supplier	Manager Environmental Services 2021/22 - $Nil

Recommendation	Responsibility/Timescale/ Budget Implications
15. Develop options for improving the sustainability of the City's fleet such as transitioning to electric or non-hydrocarbon vehicles	Manager Assets 2022/23 - $Nil
16. When there is certainty over implementation costs and ongoing tariffs, provide a business case report to Council on a bulk changeover to LED street lights	Manager Environmental Services Timescale Dependent on Western Power
17. Finalise, and present to Council, a Streetlighting Policy around the deployment of energy efficient lighting in the City	Manager Engineering Design 2021/22 - $Nil
18. Prepare a business case for the potential changeover of decorative lights to more energy efficient models	Manager Engineering Design 2021/22 - $15,000
19. Develop a policy around the use of the Revolving Energy Fund	Manager Environmental Services 2023/24 - $Nil
20. In partnership with the Switch your Thinking team, investigate the feasibility of implementing a Sustainable Purchasing Policy, and develop appropriate City supporting documentation	Switch Your Thinking 2022/23 - $Nil
21. Complete an investigation into possible incentives for employees to adopt sustainable practices. The study should cover options for behaviours that could be incentivised, in conjunction with the potential rewards offered	Switch Your Thinking 2022/23 - $Nil
22. Council adopt the following approach to carbon abatement: - A target of net zero emissions by 2029/30 - Fund the recommendations of this Plan from Flaring Project income - Allocate an additional $89,000 per annum towards offsets in the period 2022/23 to 2029/30 - A target of net zero emissions by 2050	N/A Additional $89,000 per annum
23. Provide an analysis to Council as part of the biennial Environmental Services report on the financial impact of achieving the carbon abatement target. This should cover: - The results of updated modelling from the Solid Waste Calculator, which is influenced by the type and quantities of waste received and forecast for the Landfill Site - Flare performance - The spot price of Australian Carbon Credit Units, facilitating forecast income calculations - Purchase price of offsets under the Climate Active scheme	N/A
24. Council approve the creation of a Carbon Reserve, for the purpose of ring-fencing carbon credit income, purchasing carbon offsets and funding the recommendations of the Corporate Greenhouse Action Plan 2020/21 to 2029/30	Executive Manager Corporate Services 2021/22

Conclusion

This Plan is proposed to be implemented until 2029/30, in alignment with Australian targets under the Paris Agreement.

The approach is broadly consistent with that of the previous CGAP. There are recommended abatement activities within the City's waste, building and fleet portfolios. An overall objective has been set to achieve net zero (Scope 1 and 2) emissions by 2030. A Net Zero Emissions target is recommended for the year 2050.

In order to meet the 2029/30 target, abatement activities will need to be supplemented by the purchase of offsets. The City is in a fortuitous position, the Flaring Project able to be extended by a further five years. This is forecast to provide $834,000 of additional income, after compliance costs. This is able to fund the actions of this Plan ($145,000), and partially subsidise the purchase of offsets. An additional injection of Municipal Funds is required of $89,000 per annum to meet the 2030 target.

Finally, the Plan recommends strategic document production, including policy positions around Climate Change Adaptation and standards associated with new and upgraded buildings.

Appendix 1: International Government Targets

Country	Approach
India	**2030 Unconditional Target:** 33 to 35% below 2005 in carbon emissions relative to Gross Domestic Product by 2030 ('emissions intensity' approach) **2030 Conditional Target:** Non -fossil share cumulative power generation capacity by 40% by 2030 **Long Term Goal:** Per capita emissions never to exceed those of developed countries
Australia	**2030 Unconditional Target:** 26-28% below 2005 by 2030 **Long Term Goal**: None
European Union	**2030 Unconditional Target:** At least 40% below 1990 levels by 2030 **Long Term Goal:** 91 to 94% below 1990 levels by 2050 (excluding LULUCF, but including carbon removal)
United Kingdom	**2030 Unconditional Target:** 40% below 1990 by 2030, incl. LULUCF **Long Term Goal**: Net zero GHG emissions by 2050
Canada	**2030 Unconditional Target:** 30% below 2005 by 2030, excl. LULUCF **Long Term Goal:** 80% below 2005 levels by 2050 (65% below 2005 levels excl. LULUCF)
New Zealand	**2030 Unconditional Targets:** 30% below 2005 by 2030 **Long Term Goal:** Net zero emissions on all GHG emissions, excluding methane emissions from agriculture and waste sectors. 24 to 47% below 2017 by 2050 for methane emissions from agriculture and waste sectors
Brazil	**2030 Unconditional Targets:** 1.3 GtCO2e (GWP100; IPCC SAR) by 2025 incl. LULUCF. Absolute target of 1.3GtCO_2-e by 2025 **Long term Goal:** Strive for a transition towards energy systems based on renewable sources and decarbonisation of the global economy, by the end of the century
Norway	**2030 Unconditional Target:** At least 50% and towards 55 below 1990 by 2030 **Long Term Goals:** Low carbon society 2050 Reduction in GHG emissions by 80%-95% from 1990 reference
China	**2030 Unconditional Target:** Peak CO2-e emissions by 2030 at the latest Non-fossil fuel share: 20% in 2030 Forest stock – Increase of 4.5 bnm3 by 2030 relative to 2005 Emissions intensity (carbon relative to GDP) – 60 to 65% below 2005 levels by 2030 **Long Term Goal:** Carbon Neutrality by 2060l
United States	**2030 Unconditional Target:** 26 to 28% below 2005 by 2025, incl. LULUCF **Long Term Goal:** 80% below 2005 levels by 2050 incl. LULUCF
Russian Federation	**2030 Unconditional Targets:** 25to 30% below 1990 by 2030, incl. LULUCF **Long Term Goal:** None
Ukraine	**2030 Unconditional Targets** At least 40% below 1990 level incl. LULICF by 2030 **Long Term Goals:** 50% below 1990 by 2050

Appendix 2: WA Local Government Initiatives

Local Government	Landfill Operated by Council?	Corporate Greenhouse Strategy?	Measure and Track emissions?	Emissions Targe	Key measures
City of Cockburn	Yes - diverting waste to WTEF by 2022	Yes - Climate Change Strategy 2020-2030	Yes	Net zero emissions by 2030	Transfer of waste to WTEF; Transition to renewable energy providers; fleet to transfer to EV's; LED Streetlighting
City of Rockingham	Yes	Sustainability Strategy - 2020	No	None	Methane capture at landfill; Solar PV on buildings; offset vehicle (fleet) emissions; LED Streetlighting
City of Canning	Yes	No - Climate Action Plan currently in development	No	None	LED Streetlighting; geothermal energy; solar PV panels on key assets
City of Mandurah	Yes - diverting waste to WTEF by 2022	No	No	None	Transfer of waste to WTEF; Solar PV on buildings; LED bulb replacement on buildings
City of Gosnells	No	No	Yes	None	Unable to find information
City of Stirling	No (transfer and recycling centre)	Draft Sustainable Energy Action Plan	No	Reduce corporate carbon emissions by 70% by 2030 (not inclusive of landfill/waste emissions)	LED lighting in City assets; Solar PV installations; power purchase agreement to source 100% renewable energy by 2030

Local Government	Landfill Operated by Council?	Corporate Greenhouse Strategy?	Measure and Track emissions?	Emissions Targe	Key measures
Town of Kwinana	No	Climate Change Mitigation and Adaptation plan 2015-2020	Yes	Yes - reduce carbon dioxide equivalent emissions by 10% below 2009/10 levels by 2020	Solar PV installation on key assets, energy efficient lighting upgrades, adopt energy efficiency measures, community awareness raising
City of Kalamunda	Yes - Walliston Transfer Station	No	No	None	Community awareness
City of Melville	No	No	Yes	48% emission reduction on 2005-2006 levels from its own facilities and operations by 2025	Solar PV installation, LED light replacement, staff education
City of Swan	No	No	No	None	Energy efficient alternatives, energy audits, fleet upgrades for more fuel efficient alternatives
Town of Victoria Park	No - but landfill emissions are included in their carbon accounting	No - developing a Climate Emergency Plan	Yes	Zero Carbon emissions by 2030	Achieve at least 40% emissions reduction through direct action (i.e.not through carbon offsets) Support the community and businesses in working towards their own zero-carbon target

Appendix 3: City Emissions in 2004/05

Emissions Component	Tonnes of Carbon Dioxide Equivalent (tCO_2-e)
Gross Waste Emissions	**34,345**[1]
Amounts Flared	0
Net Waste Emissions	**34,345**
Buildings	**1,332**[2]
Fleet	**105**[2]
Total	**35,782**

[1] Calculated using the Federal government Solid Waste Calculator
[2] Extrapolated from Average fleet emissions (between 2014 to 2021) and scaled down to reflect difference in population in 2005 (no records for 2005)

Appendix 4: Operational Control Scorecard for Streetlights

	Policy	Policy Score (0-30)	LGA	Western Power
Operating Policies	Responsibility for provision of lighting services (ERA governed)	20	20	0
	Authority to commission lighting	30	0	30
	Specification of road type (and therefore lighting requirements)	20	20	0
	Design of lighting	30	30	0
	Approval of lighting design	30	30	0
	Establishment of lighting options	20	20	0
	Lamp selection	30	20	10
	Luminaire selection	30	20	10
	Pole selection	10	20	10
	Installation of lighting	30	15	15
	Establishment of operating hours	30	NA	NA
	Meeting operation hours	30	NA	NA
	Responsibility for paying electricity bills	30	30	0
	Establishment of maintenance schedule	30	0	30
	Maintenance of luminaires	30	0	30
	Replacement of lamps	30	0	30
	TOTAL	430	225	165
Environment Policies	Efficiency of lighting	20	20	0
	GreenPower purchase	10	20	0
	Environment management system (e.g. ISO14001)	30	15	15
	TOTAL	60	55	15
OH&S Policies	Provision of safety equipment	20	0	20
	Establishment of personnel safety requirements during installation	20	10	10
	Implementation of personnel safety requirements during installation	20	10	10
	Establishment of personnel safety requirements during maintenance	20	0	20
	Implementation of personnel safety requirements during maintenance	20	0	20
	Road traffic safety	30	15	15
	Safe globe disposal	30	0	30
	OHS Systems & Processes	30	0	30
	TOTAL	190	35	155
	OPERATIONAL CONTROL TOTAL	680	315	**335**

Appendix 5: WALGA Tool - Gap Analysis/Opportunities

Appendix 6: City of Armadale Climate Change Declaration

CITY OF Armadale

WESTERN AUSTRALIAN LOCAL GOVERNMENT ASSOCIATION

The Western Australian Local Government Declaration on Climate Change

The City of Armadale acknowledges that:

- Evidence shows that climate change is occurring.
- Climate change will continue to have significant effects on the Western Australian environment, society, and economy and the Local Government sector.
- Human behaviours, pollution and consumption patterns have both immediate and future impacts on the climate and environment.

The City of Armadale supports the:

- Environmental, social and economic benefits of addressing climate change immediately.
- Opportunity for Local Government to demonstrate leadership in climate change management at a community level.
- Development of equitable and implemental State and Commonwealth strategies for climate change management.

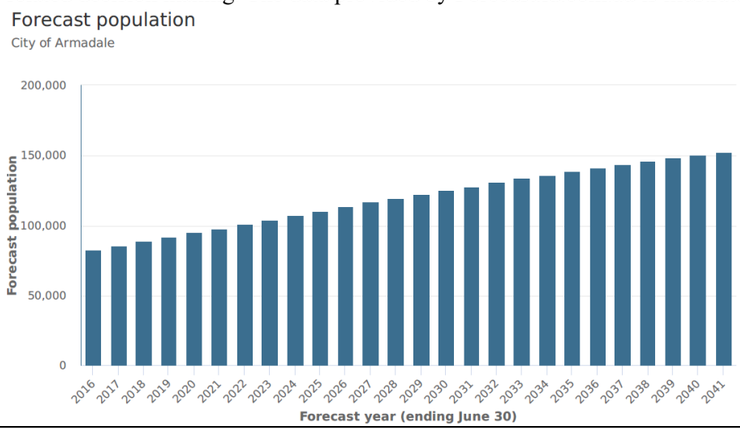
The City of Armadale commits to:

- Monitoring existing Local Government emissions reduction targets, and work towards their achievement.
- Work with the support of State and Federal Government to ensure achievement of greenhouse gas emissions reduction targets, as set out in key national and international agreements.
- Work with the support of State and Federal Government to implement key actions and activities for climate change management at a local level.
- Implement the City of Armadale Corporate Greenhouse Action Plan across all Local Government functions, to be reviewed every five years.
- Ensure that, at appropriate review intervals, the strategic plan and policies for the Local Government are reviewed and amended to reflect climate change management priorities.
- Encourage and empower the local community and local businesses to adapt to the impacts of climate change and to reduce their greenhouse gas emissions
- Monitoring the progress of climate change initiatives and ensure full communication of achievements for Council and Community.

Cr Linton Reynolds AM JP, Mayor

R S Tame, Chief Executive Officer

Appendix 7: Assumptions Underpinning Forecasts

Data Set	Description	Assumptions
City Building and Fleet Emissions	In order to determine the likely emissions footprint of the City's buildings and fleet historical emissions are considered against trends in population growth. The assumption being that as the City's population increases, so will the need for additional community buildings/facilities and increased use of these assets Plus increased workforce and resources required to support this growing population and asset base Population growth forecasts are taken from Forecast.id.com.au which is used by the City and other Local Governments to help understand population changes to inform infrastructure spend and other community related decision making. The data provided by Forecast.id.com.au is illustrated below: 	1. Forecast emissions from buildings and fleet have been calculated to increase at the same rate as population growth 2. Population growth data has been taken from 'Forecast.id.com.au' which is considered the most accurate predictor of population growth related to Local Government areas
Waste Inputs (Waste Volume - Appendix 7)	One of the important changes that will affect waste going into the City's landfill is the fact the City entered into a contract to send municipal waste to a commercial Waste to Energy Facility (WTEF) offsite. Given the landfill still has capacity to accept waste, it was decided that for the interim the City would generate an income by accepting commercial waste. Therefore while it will be the responsibility of the commercial operators of the WTEF to account for any emissions generated at that facility (including the City's municipal waste), the City will still be accepting waste into our landfill and will therefore account for any emissions generated. The estimated tonnages which were provided by the City's waste team for post 2022 were input into a 'Lead Schedule' which analyses all the raw waste data provided by the landfill and sorts this into specific waste categories (refer to Appendix 7). The total waste input and volumes associated with the different categories are then input into the Federal Government's Solid Waste Calculator, which uses complex calculations to determine the emissions generated based on the volume of waste and the waste types, including legacy emissions (emissions generated in previous years). Therefore, assuming the estimated waste tonnages that the landfill will accept from 2020 to 2030 is accurate then the forecasted emissions profile should be correct. However despite best efforts to predict future inputs into the landfill, there are a number of influencing variables.	<u>Forecasted waste inputs for each year based on the following assumptions:</u> 2020/21: 1. Accepting waste as per normal operations (transfer of waste to WTEF not scheduled until mid- 2022) 2. Total waste collected = average of total waste collected for last 11 years (since 2009/10) 3. Commercial and industrial (C&I) = average of C&I for last 11 years (since 2009/10) plus 6,000 tonnes to reflect commencement of C&I contract on Jan 2021 (12,000 tonnes per FY contracted) 4. Trailer waste = Average of trailer waste volumes across last 11 years (since 2009/10) 5. Municipal Solid Waste (MSW) = Average of MSW volumes across last 11 years (since 2009/10) 6. C&D = Average of C&D volumes across last 11 years (since 2009/10) 2021/22: 1. Currently contracted to move waste to WTEF in Jan 2022, but estimates assume this will commence 1st July 2022 in case of delays) 2. Total waste collected = average of total waste collected for 11 years prior to 2020/21 (since 2009/10) 3. C&I = average of C&I for last 11 years (since 2009/10) plus 15,000 tonnes to reflect C&I contract (15,000 tonnes is an estimate provided by waste team)

Data Set	Description	Assumptions
		4. Trailer waste = Average of trailer waste volumes across 11 years prior to 2020/21 (since 2009/10) 5. MSW = Average of MSW volumes across 11 years prior to 2020/21 (since 2009/10) 6. C&D = Average of C&D volumes across 11 years prior to 2020/21 (since 2009/10) 2022/23,to 2029/30: 1. All MSW and trailer waste now diverted to WTEF 2. C&I now at 50,000 tonnes per annum up to end of 2027 on advice from waste team 3. Landfill facility to close from 2028 onwards (no waste inputs) 4. No other waste deposited in City landfill apart from recycling and green waste(non-emission sources)

Appendix 8: Waste Volume Forecast and Solid Waste Calculator Output

Year	Reference	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
WASTE											
Total waste collected		79,426	79,426	57,000	57,000	57,000	57,000	57,000	0	0	0
Total g/waste recycled	G										
Clean fill for capping	CAP										
C&D waste stored for recycling	CD Recycled										
NGERS - Total Deposited											
Trailer Waste											
Trailer Waste	T	10,143	10,143	-	-	-	-	-	-	-	-
Municipal Solid Waste											
MSW	MSW										
plus 30% trailer waste	-										
Revised MSW	-	30,015	30,015	7,000	7,000	7,000	7,000	7,000	0	0	0
Commercial and Industrial											
Commercial and Industrial	CI	8,914	17,914	50,000	50,000	50,000	50,000	50,000	0	0	0
Construction and Demolition											
Construction and Demolition	CD										
plus 70% of trailer waste	-										
Revised Commercial and Industrial Waste	-	11,272	11,272	-							
TOTAL Deposited	-	50,201	59,201	57,000	57,000	57,000	57,000	57,000	0	0	0

Notes

Year	Reference	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
1. Total amount of waste accepted at the weighbridge											
2. Green waste entering the facility as per the weighbridge											
3. Inert Material for capping of the landfill, as per weighbridge.											
4. Construction and demolition waste separated and stored on site in readiness for selling amount stored reaches a certain level and when market prices are favourable). Again, this is as per the weighbridge and is the amount received at site.											

% composition

MSW		60%	51%	12%	12%	12%	12%	12%	-	-	-
C&I		18%	30%	88%	88%	88%	88%	88%	-	-	-
C&D		22%	19%	0%	0%	0%	0%	0%	-	-	-

Year	Gross Waste Input (from Lead schedule above)	Flare Inputs (not applicable)			Emission Output
2021	79,426	0	0	0	51,335
2022	79,426	0	0	0	53,068
2023	57,000	0	0	0	54,726
2024	57,000	0	0	0	55,294
2025	57,000	0	0	0	55,846
2026	57,000	0	0	0	56,382
2027	57,000	0	0	0	56,902
2028	0	0	0	0	57,406
2029	0	0	0	0	54,645
2030	0	0	0	0	52,023

Appendix 9: Flaring Project Approach

The City has the option of extending the term of project accreditation, under the Climate Solutions Fund, beyond December 2021 for a further five years. This will result in a total life span of twelve and a half years.

There are three possible approaches in the treatment of the project:

1. Extend the project, and sell City generated ACCU's on the voluntary market
2. Extend the project, but do not sell City generated ACCU's and surrender these to the Federal government
3. Do not extend the project, and account for flare abatement in-house

The benefits of selling credits on the voluntary market, as opposed to entering into a new Federal contract, are discussed in the main body of the report. In summary, selling on the voluntary market, ensures that the City avoids any risk in relation to contract delivery.

Compliance activities follow the extension the project, irrespective of whether the City sells credits. These include audit inspections, providing assurance to the Clean Energy Regulator that carbon abatement is appropriately calculated.

The implications of each option are considered below.

1. Extend the Project – Sell ACCU's on the Voluntary Market

A summary of implications is provided below.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
Sale of ACCU's: 5 years x 9,833tCO_2-e x $15.7[1] = **$771,890**	Compliance Costs[2] (Three Offsets Reports, Two Audits): (3 x $15,000[3]) + (2 x $30,000[3]) = **$105,000**	**$666,890**	Staff time for compliance activities (Offsets Reports and Audits Potential for broker's fees in the sale of ACCU's Funds generated are available for other City initiatives, including the purchase of offsets under the Climate Active Program to cover the wider City of Armadale carbon footprint. Therefore, any carbon mitigation targets may be achieved

[1] 15% contingency deducted off the current spot rate ($18.50) of carbon. Spot rate may vary over time.
[2] Offset Reports and Audits are mandatory if the project is extended.
[3] Based on amounts paid over the last six years.

As highlighted above, in pure financial terms, there is a benefit to the City in adopting this approach.

2. **<u>Extend the project – Do not sell City generated ACCU's and surrender these to the Federal government</u>**

In this instance, there is no revenue from the sale of carbon credits.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
Sale of ACCU's: **$Nil**	Compliance Costs (Three Offsets Reports, Two Audits): (3 x $15,000) + (2 x $30,000) = **$105,000**	**($105,000)**	Staff time for compliance activities (Offsets Reports and Audits) Opportunity for positive 'PR' Funds for carbon offsetting for the achievement of targets will need to be 100% funded from municipal funds

This produces a negative swing of $771,890, in comparison to Option 1.

3. Do not extend the project – Account for flare abatement in house

For this option, there are no external revenues or costs.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
$Nil	**$Nil**	**$Nil**	Staff time for internal calculations and reporting Funds for carbon offsetting for the achievement of targets will need to be 100% funded from municipal funds

This approach is financially neutral, and is preferable to Option 2.

Conclusion

If a fiscally responsible approach, in conjunction with meeting carbon targets, are the primary drivers of the approach, the options may be listed in the following order of preference:

- **Option 1**: Extend the project, selling City generated ACCU's on the voluntary market
- **Option 3**: Do not extend the project and account for the abatement in-house (neutral cash flow and low impact on staff resources)
- **Option 2**: Extend the project, cancelling/surrendering ACCU's to the Federal government (negative cash flow of $105,000 and significant impact on staff resources – although potential reputational benefits)

Option 1 also provides the opportunity for financial benefits to be deployed elsewhere in the City to the benefit of the community, and also partially offset the wider carbon footprint of the City.

Appendix 10: Switch Your Thinking Energy Sharing Report

Introduction

Traditionally, electricity has been supplied to consumers through a linear supply chain of generation, transmission, distribution and retail of electricity with a regulatory system that is designed to facilitate this.

The South West Interconnected System (SWIS) has undergone an unprecedented transition in the way electricity is supplied and used with an enormous up take in rooftop solar photovoltaic systems. Large-scale renewable generators are also supplying an increasing amount of our electricity needs. The grid has moved from a linear chain of supply to a network of connected generation and storage assets, or Distributed Energy Resources. Distributed Energy Resources include solar PV, battery storage, electric vehicles, appliances and metering devices. These coordinated Distributed Energy Resources can ultimately supply power in a cheaper, cleaner and more reliable way[1]

An essential part of this transition is the ability to share renewable energy between facilities so unused power from one facility can be used by another. This can be done in a variety of ways including microgrids, virtual power plants, power purchase agreements and energy trading. There are many different permutations of these approaches depending on the physical location, proponent and regulatory environment. Some examples allow for small scale generators (such as a building with solar panels) to sell their electricity.

There is the potential for Local Government to participate in this new energy distribution framework either within their own facilities, in partnership with the community or participating in State Government coordinated projects. Such projects could, in theory, reduce the local government's operating costs or provide cheaper electricity for their ratepayers. This document outlines the current situation with regards to energy sharing projects in WA and opportunities for Switch your thinking or the SEREG member councils.

Types of energy sharing

Electrically-connected microgrid
A microgrid is a subset of the broader electricity network with all the necessary components to operate independently. A microgrid can operate while connected to the grid however, importantly it can break off and operate on its own using local energy generation. It can be powered by renewable or non-renewable forms of energy or a combination of both.

[1] https://www.brighterenergyfuture.wa.gov.au/

A microgrid has a monitoring and control platform used to coordinate the supply and demand of the customers connected to the microgrid. A renewable microgrid uses this platform to aggregate and optimise the Distributed Energy Resources delivering power where it is needed and storing excess power in batteries to be used later.

A microgrid can range in size from one building to whole sections of a town (sometimes the terms 'nanogrids' and 'macrogrids' will be used to refer to smaller- and larger-scale microgrids). "Mini-grids", which are not connected to a larger grid at all, have been in operation for a long time outside of the SWIS (Horizon Power operates 37). These mostly use diesel fuel for generation, with increasing numbers of solar PV and diesel hybrid generation systems.

Microgrids are now beginning to become established within the SWIS as well particularly in fringe of grid areas. Western Power operates WA's largest microgrid in Kalbarri which is powered by a wind farm and rooftop solar PV. Energy is stored in a 4.5MWh battery. Development WA have also recently established a consortium which will operate a grid-connected microgrid at Peel Business Park, an industrial and agri-business precinct.

Microgrids don't rely on long transmission lines so they can reduce transmission losses and improve reliability when power lines are affected by weather events and bushfire. They can also improve grid power supply issues related to the increased use of solar power.

Grid parallel mode microgrid

In partnership with Murdoch University, the City of Melville ran a two-year project (Oct 2018 to Oct 2020), that aimed to provide a reliable monitoring system to improve energy and water efficiency[2]. It is also the first step in having the data required to successfully share electricity between their own facilities.

Using this data, the City of Melville attempted to work with their existing energy retailer to allow net generation and consumption of solar across 14 buildings. These buildings are not electrically connected but net generation and consumption billing would mean that the excess electricity generated by (for example) a community facility on the weekend would in effect be powering their aquatic centre which requires the additional energy on the weekends rather than being exported to the grid for free. To date they have not been able to establish this arrangement with their retailer.

In this case this arrangement has been called a "grid parallel mode" microgrid as the facilities are not directly electrically connected rather energy would be traded across one organisation's multiple facilities.

The City of Melville intends to run a public seminar on the results of this project in the coming months.

[2] https://arnowa.com/melville-smart-grid-project/

Virtual power plant

A Virtual Power Plant (VPP) is a 'power plant' made up of distributed energy resources e.g. batteries, appliances, solar PV and smart meters, working together and communicating with each other via a cloud based software aggregator. The aggregator can act on the member's behalf trading energy in the wholesale market which individuals could not gain access to.

The distributed energy resources participating in the VPP are not directly electrically connected, but virtually connected via the cloud and could be owned by different organisations who participate via a third party aggregator organisation. The Distributed Energy Resources participating in the VPP need to be grid-connected.

In comparison to microgrids, VPPs can cover a wider area and are flexible enough to expand or contract the area in which they operate, depending on market conditions.

Powerbanks

The Western Power community energy project, the PowerBank Trial, includes utility-scale batteries, owned and maintained by Western Power, integrated into an already-established major metropolitan electricity network. Western Power has installed infrastructure at multiple locations across Perth metro area, including Southern River. Phase 3 of the community battery trial was announced on the 10th of February with the only additional batteries in the SEREG region being located in Southern River[3].

The Powerbanks operate as a VPP. Customers export excess solar energy during the day to the Powerbank and can draw it back out later in that 24 hour period. It does not allow peer to peer trading between dwellings in the trial.

Peer to Peer trading

Western Power and Curtin University are trialling a shared energy model through a solar-powered microgrid, battery storage system and peer to peer trading through Power Ledger[4]. Power Ledger is a blockchain enabled software platform for trading renewable energy and environmental commodities.

Unlike a centralised record keeping system, blockchain-enabled ledgers are decentralised. This means market transactions are recorded across multiple locations at the same time, creating multiple copies and offering protection from targeted cyber-attacks.

The project is located in White Gum Valley development, Fremantle and includes 80 co-located dwellings. Residents are able to trade between the co-located dwellings only.

[3] https://www.westernpower.com.au/our-energy-evolution/projects-and-trials/powerbank-community-battery-storage/

[4] https://westernpower.com.au/community/news-opinion/sharing-energy-in-white-gum-valley/

A second, very similar project, was undertaken by the same partnership at ReNeW Nexus, also in Fremantle. The main difference between the White Gum Valley project and ReNeW Nexus is that Nexus residents in the trial are able to set their own rates for the electricity they want to buy or sell. [5]

Current requirements to become an energy retailer

An aggregator is a party which facilitates the grouping of Distributed Energy Resources to act as a single entity when engaging in power system markets (both wholesale and retail) or selling services to the system operator.

Currently it is possible to offer these services by applying for a licence or exemption under the Electricity Industry Act 2004 (the Act). This is a costly and involved process.

A review is underway to identify a regulatory framework that facilitates businesses providing innovative behind-the-meter electricity services, including microgrids and VPPs, while ensuring that adequate consumer protections are available for consumers of those services. The Act is currently being amended to accommodate alternative electricity service provision to small use customers. The proposed timeframe for the Act appearing before WA Parliament is January 2022.

New businesses entering the market will only be able to supply small-scale consumers and not industry. There are costs incurred including a set-up fee of $5000 - $7000 (estimated), an annual licence ($2400 - $3400), a standing charge to the ERA to support the Energy and Water Ombudsman scheme, an energy safety levy, and auditing.

The Act is also concerned with providing rigorous consumer protections, thus all new suppliers will be required to provide:

- Tariffs at rates which are regulated by the ERA
- Concession rates
- Hardship payment plans
- Do not disconnect plans
- Adherence to all rules of the Australian Energy Supplier Code of Conduct

Regulatory environment

In addition to the energy retailer requirements, there are currently regulatory and structural barriers to energy sharing and small scale energy generators and aggregators entering the market in WA.

A major example is that existing network access arrangements are precluding a number of proposed renewable energy generation projects from connecting to the grid.

The Energy Transformation Strategy states "*Under existing network access arrangements, there is not sufficient spare capacity available in the areas of the network they want to*

[5] https://www.synergy.net.au/Our-energy/For-tomorrow/RENeW-Nexus-Trial

connect to. In most cases this network constraint is contractual rather than physical, with a number of large, long-established generators having a contractual right to the network capacity, even if they do not use it all. This means that new parties cannot access the network unless they pay for expensive and often unnecessary upgrades.

The State Government is changing the network access arrangements to a 'constrained access' model, which provides a more level playing field for all generators seeking access to network capacity. All generators will be required to share network capacity and bid for the right to supply power through the network.

Introducing this constrained access model will enhance utilisation of existing network capacity, meaning cleaner and potentially cheaper generation sources can connect – without the need to spend billions of dollars on new poles and wires to increase network capacity that is not actually needed. [6].

Changes to facilitate the reforms will be progressed largely through amendments to the Wholesale Electricity Market Rules and the Electricity Networks Access Code 2004. The new Wholesale Electricity Market Rules were gazetted in December 2020.

The Distribution Storage Plan

Within the Distributed Energy Resources plan, Western Power has prepared the Distribution Storage Plan. In this document Western Power has used modelling to determine constrained parts of the network. Once this is confirmed a competitive procurement process will be released to provide those storage services including behind the meter residential and commercial batteries as well as flexible loads and other innovative demand reduction services[7].

Western Power will be preparing an Alternative Options Strategy and the Network Opportunity Map (NOM). This map will provide greater transparency and opportunity for 'alternative options' service providers to provide a contracted service with their equipment to address network capacity constraints. The first iteration of the NOM is expected to be released 1st October 2021.

There is an Indicative Distribution Storage Opportunities Map within the paper which identifies Byford and Southern River Distribution Networks as having large scale distribution storage needs. The Indicative Storage Opportunities Map also identifies further community batteries (approx.10-15 per year at various locations across the SWIS)[8].

What form these alternative solutions providers might take and whether local government could participate is not yet clear, however it can be surmised that suburbs within the SEREG council's local government areas are priorities for energy sharing initiatives.

[6] https://www.wa.gov.au/organisation/energy-policy-wa/energy-transformation-strategy

[7] https://www.westernpower.com.au/community/news-opinion/50mw-of-extra-battery-storage-planned-for-the-swis/

[8] https://www.westernpower.com.au/about/reports-publications/distribution-storage-plan/

Current Opportunities

DER Orchestration Trial - Project Symphony

A State Government led virtual power plant entitled "Project Symphony" was announced on the 3rd of February 2021.

500 households and businesses are expected to participate in $35 million Project Symphony pilot in Southern River, City of Gosnells – set to be WA's largest VPP. Southern River has a particularly high uptake of rooftop solar (50% of households)[9].

Energy Policy WA has in the past indicated that local government facilities may be eligible to participate in this project. The project is still being developed and Expressions of Interest have not yet been invited.

Switch your thinking have been in contact with Energy Policy WA and Synergy who are aware of our interest in this project and we will be kept informed of developments as the project progresses.

Local government facility microgrids

SEREG could initially look to establish microgrids within Council owned facilities to reduce energy costs prior to looking to the community as an aggregator. There are a number of things that local governments can do now to prepare for energy sharing schemes.

The first step in this process is installing solar PV systems and storage batteries on as many council owned buildings as possible. Solar PV in particular offers excellent financial returns as a stand-alone project which will only be enhanced if connected to a microgrid or VPP at a later stage. Switch your thinking has been working with the SEREG councils on opportunities to do this.

The second step would involve improving data collection systems, similar to the approach taken by the City of Melville. This has the additional benefit of allowing improved energy efficiency as unusual patterns of energy use can be identified and acted on. The Switch your thinking Business Plan also includes actions to assist with installing data monitors on meters.

9 https://www.mediastatements.wa.gov.au/Pages/McGowan/2021/02/Virtual-Power-Plants-to-become-a-reality-in-WA-first.aspx

Solar PV and batteries in new developments

SEREG councils could work with developers in constrained areas to encourage the installation of solar panels and batteries in new housing with a view to establishing a microgrid or VPP.

Conclusion

Until legislative reforms are undertaken the opportunity for a local government to act as an aggregator would be limited.

In the meantime there are a number of opportunities that Switch your thinking can pursue which will allow us to increase our understanding and capacity in this field in the lead up to these legislative changes taking place.

This is a rapidly evolving field and other opportunities may present themselves in the coming months and years. Switch your thinking will continue to monitor these developments and present opportunities to SEREG in that time.

Appendix 11: Cash Flow Forecast

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Opening Account Balance	**0**	**311,551**	**324,746**	**357,941**	**744,892**	**778,087**	**1,165,038**	**1,228,233**	**1,460,806**	**1,539,000**	
Flaring Project - Initial Phase											
Income	311,551										**311,551**
Flaring Project - Extension Period											
Income				308,756		308,756		154,378			**771,890**
Compliance Costs			-45,000		-45,000		-15,000				**-105,000**
Initiatives											
Building Policy											
Solar Feasibility		-50,000									**-50,000**
Energy Audits		-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000		**-80,000**
Decorative Lighting Study		-15,000									**-15,000**
Injection of Municipal Funds		88,195	88,195	88,195	88,195	88,195	88,195	88,195	88,194		**705,559**
Offsets Purchase										-1,539,000	**1,539,000**
Net Annual Impact	**311,551**	**13,195**	**33,195**	**386,951**	**33,195**	**386,951**	**63,195**	**232,573**	**78,194**	**-1,539,000**	
Closing Amount	**311,551**	**324,746**	**357,941**	**744,892**	**778,087**	**1,165,038**	**1,228,233**	**1,460,806**	**1,539,000**	**0**	