Appendix 07

Compact of Mayors Reporting 2017-18

Ironbark Sustainability

Hobsons Bay City Council

Community Emissions Profile Report

Prepared for
Hobsons Bay City Council

Version	Author	Date	Description of changes
V0a	Hannah Snape	11/04/2018	First Draft
V0b	James Tait	12/04/2018	Review
V1b	Alexi Lynch	13/04/2018	Final report for Council
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About Ironbark Sustainability
Ironbark Sustainability is a specialist consultancy that works with government and business around Australia by assisting them to reduce energy and water usage through sustainable asset and data management and on-the-ground implementation.

Ironbark has been operating since 2005 and brings together a wealth of technical and financial analysis, maintenance and implementation experience in the areas of building energy and water efficiency, public lighting and data management. We pride ourselves on supporting our clients to achieve real action regarding the sustainable management of their operations.

Our Mission
The Ironbark mission is to achieve real action on sustainability for councils and their communities.

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Abbreviations and Definitions

Term	Definition
ABS	Australian Bureau of Statistics
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences (previously Australian Bureau of Agricultural and Resource Economics or ABARE)
Activity Data	Activity data is a quantitative measure of a level of activity that results in GHG emissions taking place during a given period of time (e.g., volume of gas used, kilometres driven, tonnes of solid waste sent to landfill, etc.)
AEC	Australian Energy Council
AFOLU	Agriculture, Forestry, and Other Land Use
C40	C40 Cities Climate Leadership Group
CCA	Climate Change Authority
CCP	Cities for Climate Protection
cCR	Carbon*n* Climate Register
CH_4	Methane
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalent. The universal unit of measurement to indicate the global warming potential (GWP) of each GHG, expressed in terms of the GWP of one unit of carbon dioxide. It is used to evaluate the climate impact of releasing (or avoiding releasing) different GHGs on a common basis.
Global Covenant of Mayors	Global Covenant of Mayors for Climate & Energy is a coalition of city leaders addressing climate change by pledging to reduce their greenhouse gas emissions, tracking their progress and preparing for the impacts of climate change. It was formed through a merger of the Compact of Mayors and the Covenant of Mayors.
DNSP	Distribution Network Service Provider (Electricity Network)
Emissions Factor	An emissions factor is a measure of the mass of GHG emissions relative to a unit of activity.
ERF	Emissions Reduction Fund
ENA	Electricity Networks Australia
GHG	Greenhouse Gas
GHG Protocol	The Greenhouse Gas Protocol, developed by World Resources Institute and World Business Council on Sustainable Development, sets the global standard for how to measure, manage, and report GHG emissions.
GPC	Global Protocol for Community-Scale Greenhouse Gas Emission Inventories
GRP	Gross Regional Product
GSP	Gross State Product
Gt	Gigatonne
GWP	Global Warming Potential. The Global Warming Potential was developed to allow comparisons of the global warming impacts of different gases. Specifically, it is a measure of how much energy the emissions of one tonne of a gas will absorb

	over a given period of time, relative to the emissions of one tonne of carbon dioxide
ICLEI	International Council for Local Government Initiatives
IPCC	Intergovernmental Panel on Climate Change
IPPU	Industrial Processes and Product Use
kt	Kilotonne
Mt	Megatonne
MCF	Methane Correction Factor
SBT	Science-Based Targets
SEIFA	Socio-Economic Indexes for Areas
WRI	World Resources Institute

1. Executive Summary

This report provides an overview of the community greenhouse gas (GHG) profile for Hobsons Bay for the 2016/17 financial year. As a signatory to the Global Covenant of Mayors for Climate & Energy (herein referred to as the Global Covenant of Mayors), Council is required to develop an emissions profile compliant with the Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC). The development of this profile is the first step in the preparation of a full process for mitigating climate change.

In line with GPC requirements, this profile includes an emissions total, as well as exploring emissions through a number of filters: sector, gas type, and scope.

The total emissions summary is provided below (Table 1). Council's total annual community emissions have been calculated as 1,568kt CO_2-e. The largest source of community emissions by sector in Hobsons Bay is stationary energy, which mainly comprises electricity consumed by buildings and facilities and accounts for 77% (1,200kt) of total emissions. Meanwhile, on-road transportation is responsible for 21% of emissions, emissions from solid waste accounts for 2% and wastewater 1%.

Table 1: Total emissions summary for Hobsons Bay

Category	Emissions (t CO_2e)	Percentage (%)
Stationary Energy	1,199,771	77%
Transportation	323,233	21%
Waste	33,620	2%
Wastewater	11,011	1%
Total	1,567,635	100%

The majority of Hobsons Bay's community emissions can be classified as scope 2, which refers to emissions released as a result of grid-supplied energy, generally from outside of the municipal boundary to heat, steam and/or cool within the city boundary. Scope 1 emissions were the second highest type of emissions released by the municipality.

It is important to note that while this profile is compliant with the international standard (GPC), and covers emissions from the entire community, Council only has a limited amount of control and influence over many of the emissions sources. While Council can continue to advocate and assist the broader community to implement energy efficiency and renewable energy projects, a cross-sectoral approach – with residents, business and other levels of government – is required for substantial emissions reductions throughout the municipality.

Rather than use this profile as a baseline upon which to develop targets and measure the impact of climate change mitigation actions by Council, targeted monitoring should instead be used to measure and report the impact of these items. As data sources and emissions calculation methods improve into the future, these items will be able to be linked to Council's profile as a monitoring tool.

Recommended next steps from here are:

- Work with other councils, greenhouse alliances, State Government and stakeholders, such as ICLEI Oceania, WAGA (Western Alliance for Greenhouse Action) and Ironbark, to source improved and updated data that can feed into future profiles and improve accuracy.
- Continue to seek broader Global Covenant of Mayors compliance by developing community-wide emissions reduction targets. To be best-practice this should be a "science-based" target in-line with maintaining global average temperatures below a 2-degree increase.
- Continue to undertake climate mitigation and adaptation actions through the implementation of Council's various plans and strategies and measure and report the impact of these actions through targeted monitoring.

2. Introduction

2.1 Background

Sourcing and analysis of community GHG emissions data has long been a cause of frustration for Australian councils. A decade ago, hundreds of councils had access to "top-down" community data provided by ICLEI Oceania based on ABS (Australian Bureau of Statistics) and ABARES (Australian Bureau of Agricultural and Resource Economics and Sciences) data. However, the development of this data ceased in 2009 with the closure of the Cities for Climate Protection funding.

Over the last 12 months, a range of council stakeholders have been working on collating data from these traditional sources (ABS and ABARES) as well as directly from utilities, CSIRO and other state data (for example on waste and transport) to develop GPC-compliant community inventories.

This has included the development and submission of GPC-compliant community inventories for the purpose of complying with the Global Covenant of Mayors.

The development of the Hobsons Bay community emissions profile has been undertaken by a team from Ironbark Sustainability who have extensive experience working at and with councils. What's more, members of the team have recently been certified through the World Bank's City Climate Planner Certificate Program, a training and professional certificate program that aims to increase the global talent base of climate planning professionals.

2.2 Council Community Profile

Hobsons Bay is a metropolitan council located approximately 13 km south west of central Melbourne on the shores of Port Phillip Bay. For the purpose of this profile, the population of Hobsons Bay has been estimated at 94,022 people for the 2016/17 financial year.

The municipality includes 24 kilometres of beaches and foreshore areas, including the historic settlement of Williamstown. It supports a wide variety of ecosystems and habitats, including significant coastal wetlands, creek systems and native grasslands. The municipality also includes a large amount of industrial activity. Key industries include petroleum refinery, chemical manufacturing, transport and automobile parts manufacturing.

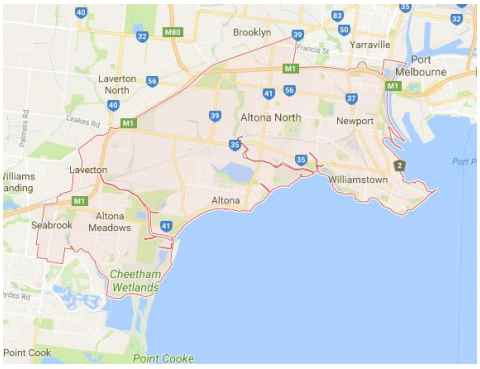

Figure 1: Hobsons Bay council area

Hobsons Bay have been very proactive in acknowledging and responding to climate change. The Hobsons Bay City Council Climate Change Policy (2013) commits to Council achieving net zero greenhouse gas emissions by 2020 and supporting the community to do so by 2030. A number of strategies to reduce greenhouse

gas emissions from both corporate and community activities are outlined in the following documents:

- Hobsons Bay Climate Adaptation Plan 2013-2018
- Hobsons Bay Community Greenhouse Strategy 2013-2030
- Hobsons Bay Corporate Greenhouse Strategy 2013-2022
- Hobsons Bay City Council Target 2265, A four-year emissions reduction plan

Sustainability projects undertaken recently include retrofitting council buildings such as the Civic Centre and Altona Library with LED lights, improved HVAC systems and solar systems; participating in the Greening the West program with City West Water; and changing over all of their residential street lights to energy efficient LEDs.

2.3 Use of this Profile

It is very important that this profile is read and used appropriately. It should be stressed that while this profile contains a snapshot of the GHGs allocated to activity within the Hobsons Bay municipality, it is not currently suitable as a monitoring tool for measuring the success of targets or actions.

A GPC-compliant profile is required in order to comply with the requirements of the Global Covenant of Mayors, to which Council has committed. The GPC values completeness over accuracy, which ensures that when profiles are compiled across municipalities, emissions are not double-counted nor unaccounted for. This means that it is sometimes preferable to use state or national level data scaled down to a municipal level, over more detailed data that may not be complete or correctly aligned to municipal boundaries.

This profile contains a mixture of modelled and detailed data. As new data sources become available and methods for calculating emissions become more sophisticated, the calculated profile for Hobsons Bay will change, regardless of actual changes to emissions.

3. Methodology and GPC Compliance

The GPC requires cities to measure and disclose a profile of GHG emissions and to total these emissions using two distinct but complementary approaches. One captures emissions from both production and consumption activities taking place within the city boundary, including some emissions released outside the city boundary. The other categorises all emissions into "scopes," depending on where they physically occur. Separate accounting of emissions physically released within the city boundary should be used for aggregation of multiple city inventories in order to avoid double counting.

The GPC enables a city's emissions to be broken down into the five sectors (where relevant data is available), summarised in Table 2.

Table 2: Sector descriptions used for GPC profiles

Sector	Description
Stationary Energy	Stationary energy sources are one of the largest contributors to a city's GHG emissions. These emissions come from the combustion of fuel in residential, commercial and institutional buildings and facilities, and manufacturing industries and construction, as well as power plants to generate grid-supplied energy. This sector also includes fugitive emissions, which typically occur during extraction, transformation, and transportation of primary fossil fuels.
Transportation	Transportation covers all journeys by road, rail, water and air, including inter-city and international travel. GHG emissions are produced directly by the combustion of fuel or indirectly by the use of grid-supplied electricity. Collecting accurate data for transportation activities, calculating emissions and allocating these emissions to cities can be a particularly challenging process. To accommodate variations in data availability, existing transportation models, and profile purposes, the GPC offers additional flexibility in calculating emissions from transportation.
Waste (solid waste and wastewater)	Waste disposal and treatment produces GHG emissions through aerobic or anaerobic decomposition, or incineration. GHG emissions from solid waste are calculated by disposal route, namely landfill, biological treatment and incineration and open burning. If methane is recovered from solid waste or wastewater treatment facilities as an energy source, it is reported under Stationary Energy. Similarly, emissions from incineration with energy recovery are reported under Stationary Energy.
Industrial Processes and Product Use (IPPU)	GHG emissions are produced from a wide variety of non-energy related industrial activities. The main emission sources are releases from industrial processes that chemically or physically transform materials (e.g., the blast furnace in the iron and steel industry, and ammonia and other chemical products manufactured from fossil fuels and used as chemical feedstock). During these processes, many different GHGs can be produced. In addition, certain products used by industry and end-consumers, such as refrigerants, foams or aerosol cans, also contain GHGs which can be released during use and disposal.

Agriculture, Forestry and Other Land Use (AFO LU)	Emissions from the Agriculture, Forestry and Other Land Use (AFOLU) sector are produced through a variety of pathways, including livestock (enteric fermentation and manure management), land use and land use change (e.g., forested land being cleared for cropland or settlements), and aggregate sources and non-CO_2 emission sources on land (e.g., fertilizer application and rice cultivation). Given the highly variable nature of land-use and agricultural activity across geographies, GHG emissions from AFOLU are amongst the most complex categories for GHG accounting.

The GPC provides overarching and sector-specific reporting guidance for sourcing data and calculating emissions. Councils should select the most appropriate methodologies based on the purpose of their profile, availability of data, and consistency with their country's national profile and/or other measurement and reporting programs in which they participate. The GPC does not require specific methodologies to be used to produce emissions data; rather it specifies the principles and rules for compiling a city-wide GHG emissions profile. Where relevant, the GPC recommends using methodologies aligned with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories.

Ironbark, in partnership with HuxConnect, has developed a GHG activity data tool that has been approved by ICLEI Oceania as being GPC compliant.

In compliance with the GPC's BASIC levels of GHG emissions accounting, Council's emissions profile includes scope 1, 2 and 3 emissions as required under the GPC for each sector (stationary energy, transportation and waste). Specifically, for GPC BASIC compliance, the inclusion of emissions for the following sources and scopes are required:

- All scope 1 emissions from stationary energy sources (excluding energy production supplied to the grid, which shall be reported in the scope 1 total)
- All scope 1 emissions from transportation sources
- All scope 1 emissions from waste sources (excluding emissions from imported waste, which shall be reported in the scope 1 total)
- All scope 2 emissions from stationary energy sources and transportation
- Scope 3 emissions from treatment of exported waste

Emissions are further defined by gas type as either carbon dioxide (CO_2), methane (CH_4) or nitrous oxide (N_2O) and then converted into carbon dioxide equivalent (CO_2-e) for comparison and to measure total impact.

3.1 Industrial Energy Consumption

In the first iteration of Hobsons Bay's community emissions profile, industrial energy was identified as an area of concern, as Ironbark's modelling at that time did not accurately represent the high industrial activity in the municipality.

Ironbark have been working on the collection and analysis of datasets for councils in conjunction with the state government, distributors, and other organisations for several years now, in order to build and verify our suite of tools and knowledge base. Throughout this time, we have found that data supplied by Distribution Network Service Providers (DNSPs) has significant inaccuracies and gaps, particularly in relation to industrial consumption. Gaps in reporting are common and there is little transparency about how they have been compiled.

In light of these inaccuracies and gaps, Ironbark have been liaising with the State Government Department of Environment, Land, Water and Planning (DELWP) and Sustainability Victoria (SV) to try to address some of these issues. At the time of preparing this report, they remain as significant hurdles for both the timeliness of availability and overall reliability from data directly supplied by DNSPs.

To give a better example of where Hobsons Bay Fits within our model, the follow graphs outline the relationships that we have developed from existing datasets of municipalities with actual consumption figures available, and compared them against relevant, publicly available data.

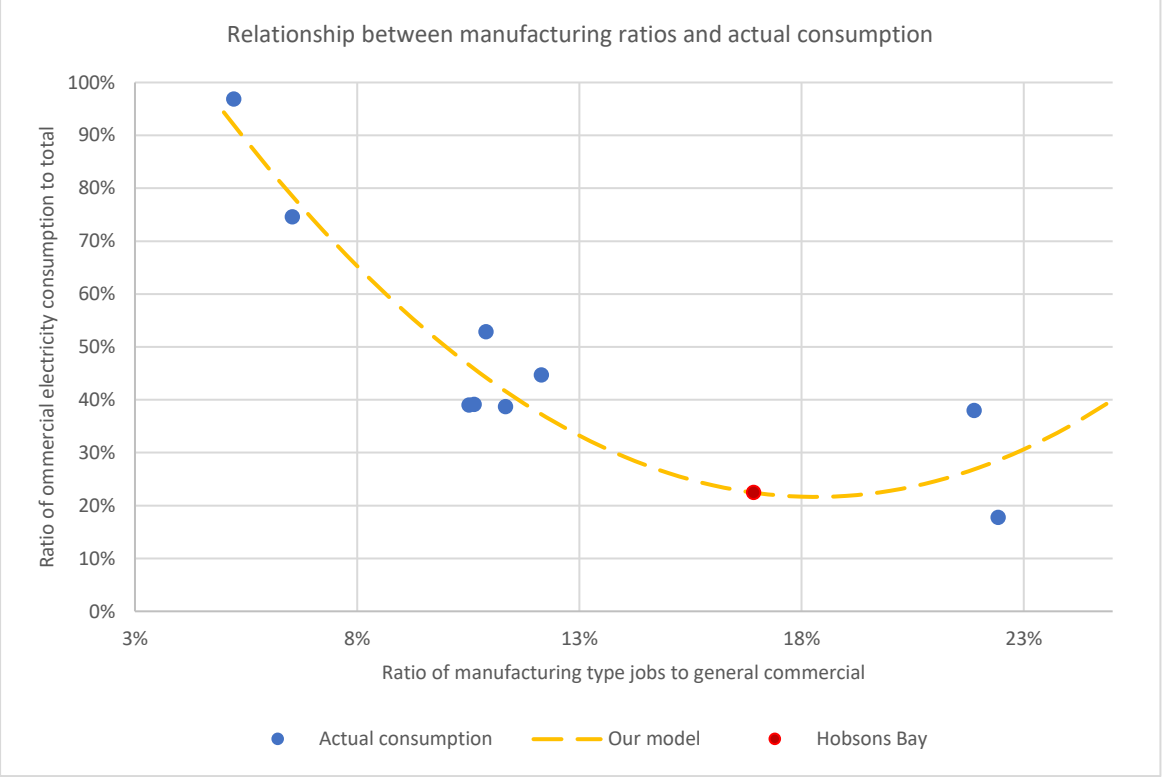

Figure 2: Relationship between manufacturing ratios and actual consumption

Additionally, when looking at how total consumption in the commercial/industrial sectors compare between simple scaling on economic metrics (which we are referring to as preliminary modelling) and then taking into account manufacturing job ratios, what we see is that there is a significant increase in total consumption as the ratio of manufacturing jobs increase.

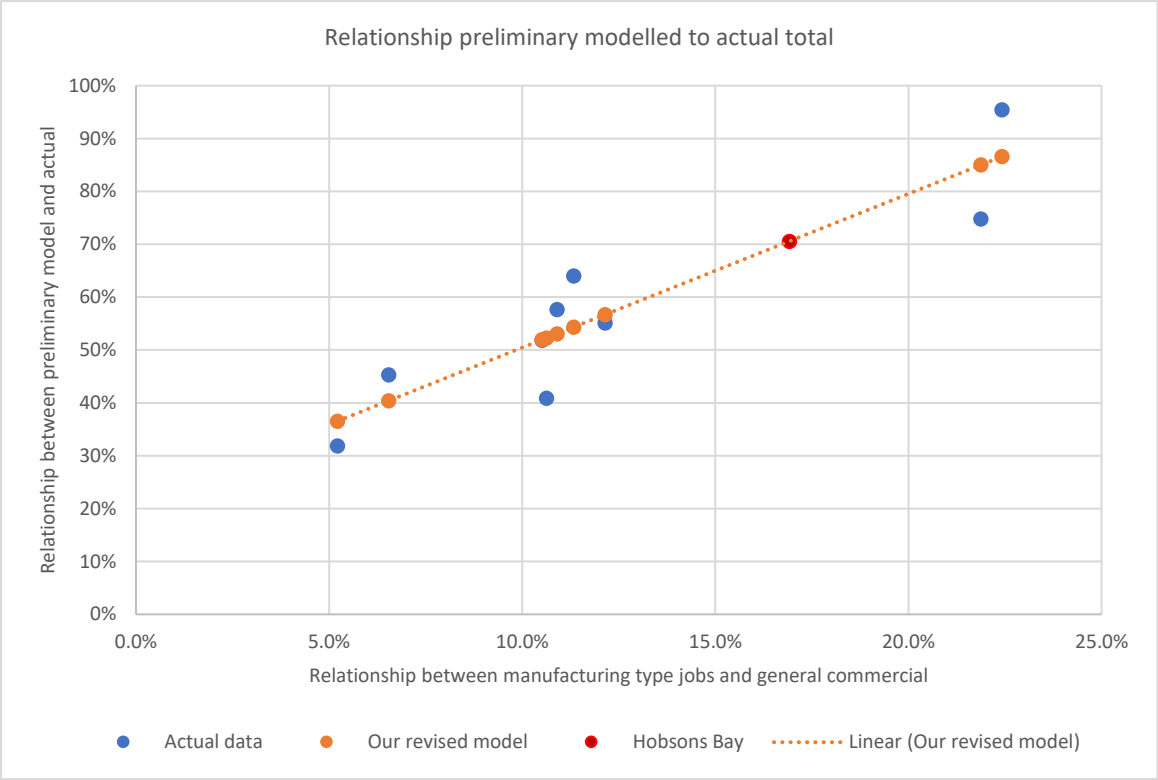

Figure 3: Relationship between manufacturing jobs and total consumption for commercial/industrial sector

What we can see in both of those graphs is that Hobsons Bay falls within the spectrum of councils for which we have measuring actual emissions. This increases our confidence in the modelled figures, however it also means that getting actual consumption data for Hobsons Bay is even more valuable going into the future (the error for the councils for which we have these models is +/-6%). A substantial variation we see from these projections means that Hobsons Bay must have importantly different characteristics from the other municipalities modeled (which vary from Melbourne to Hume), a revelation of significant advantage for councils everywhere.

Taking into account some of this uncertainty, however, Ironbark have been working on more accurate ways of allocating emissions of known characteristics of municipalities, such as employment by industry, GRP and number of enterprises, which is allowing us to better model sectors, specifically industrial consumption. Because of these new approaches, we are much more confident in establishing appropriate allocations for municipalities, and it gives us the capacity to assess the plausibility of data supplied by DNSPs if and when it becomes available.

3.2 Disclaimer

This profile has been developed in accordance with the GHG Protocol Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) by experts certified under the City Climate Planner Certificate Program.

The GPC is designed to promote best practice GHG accounting and reporting that was developed through an inclusive multi-stakeholder process. This involved input from experts from nongovernmental organisations, governments, and others convened by WRI, C40 and ICLEI.

Data has been sourced from a variety of third parties (such as electricity providers and the CSIRO). While every effort has been made to use data from reputable sources and a thorough quality assurance process undertaken, neither Council nor Ironbark Sustainability are responsible for data inaccuracies by third parties.

3.3 IPCC Greenhouse Gas System Boundary

To comply with the GPC, and indeed for any best-practice GHG profile development, a council (or organisation or sub-national body) must first define a profile boundary. This identifies the geographic area, time span, gases, and emission sources, covered by a GHG profile. Any geographic boundary may be used for the GHG profile.

For this profile, the boundary aligns with the administrative boundary of Hobsons Bay City Council and accounts for the GHG emissions in the financial year 2016/17. It covers the seven gases covered by the Kyoto Protocol.

Activities taking place within Hobsons Bay can generate GHG emissions that occur inside the city boundary as well as outside the city boundary. To distinguish between them, the GPC groups emissions into three categories based on where they occur: scope 1, scope 2 or scope 3 emissions. Definitions are provided in Figure 4, based on an adapted application of the scopes framework used in other international GHG protocol and standards.

Scope	Definition
Scope 1	GHG emissions from sources located within the city boundary
Scope 2	GHG emissions occurring as a consequence of the use of grid-supplied electricity, heat, steam and/or cooling within the city boundary
Scope 3	All other GHG emissions that occur outside the city boundary as a result of activities taking place within the city boundary

Figure 4: Emissions scopes definitions

Councils, by virtue of their size and connectivity, inevitably give rise to GHG emissions beyond their boundaries. Measuring these emissions allows cities to take a more holistic approach to tackling climate change by assessing the GHG impact of their supply chains and identifying areas of shared responsibility for upstream and downstream GHG emissions.

The GPC also includes scope 3 accounting for a limited number of emission sources, including transmission and distribution losses associated with grid-supplied energy, and waste disposal and treatment outside the city boundary and transboundary transportation.

The scopes framework helps to differentiate emissions occurring physically within the city (scope 1), from those occurring outside the city (scope 3) and from the use of electricity, steam, and/or heating/cooling supplied by grids which may or may not cross city boundaries (scope 2). Scope 1 emissions may also be termed "territorial" emissions because they occur discretely within the territory defined by the geographic boundary.

Figure 5 illustrates which emission sources occur solely within the geographic boundary established for the profile, which occur outside the geographic boundary, and which may occur across the geographic boundary.

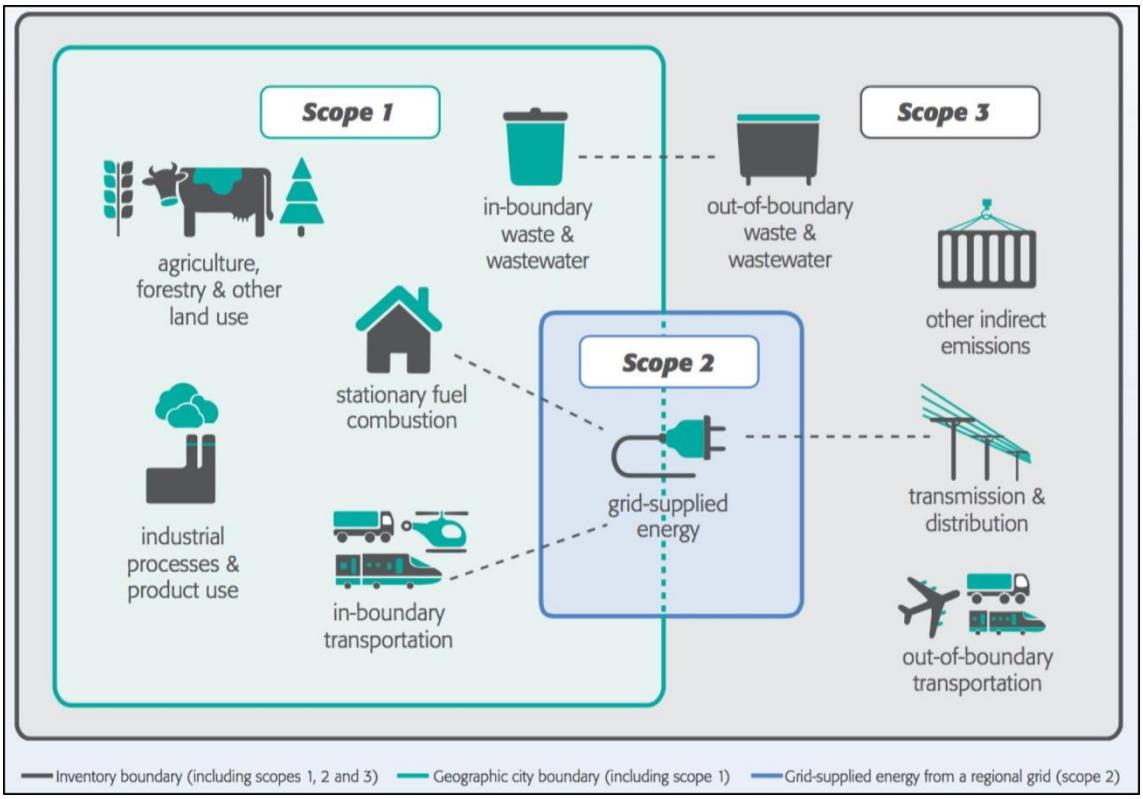

Figure 5: Representation of emission scopes and scope boundaries

4. Total Emissions Profile

4.1 Emissions Breakdown

Hobsons Bay's total annual community emissions for the financial year 2016/17 have been calculated as 1,568 kt CO_2-e.

Table 3: Total community emissions summary according to sector

Category	Emissions (t CO_2e)	Percentage (%)
Stationary Energy	1,199,771	77%
Transportation	323,233	21%
Waste	33,620	2%
Wastewater	11,011	1%
Total	1,567,635	100%

As seen in Table 3 and Figure 6, the largest source of total GHG emissions is stationary energy, which includes residential buildings; commercial and institutional facilities; and manufacturing and construction industries.

On-road transportation produced the next highest emissions per category, 21% total emissions or 323 kt CO_2-e. No emissions have been included under transport for rail, aviation, water transport or other off-road transportation sources as this data was not readily available. Where transport sources are responsible for emissions through use of electricity, such as rail, these emissions have been included under stationary energy. As more granular data becomes available the reporting of transport emissions will improve.

Waste sources produced 3% of total emissions at 43 kt CO_2-e, largely from disposal of solid waste (2%) and also from biological treatment of wastewater (1%) including sewerage.

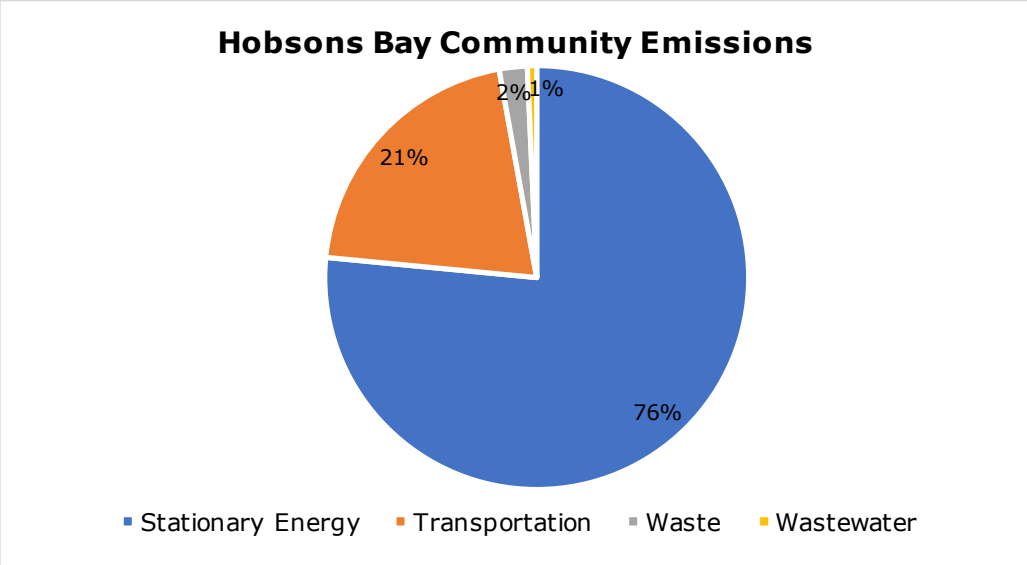

Figure 6: Hobsons Bay community emissions by source

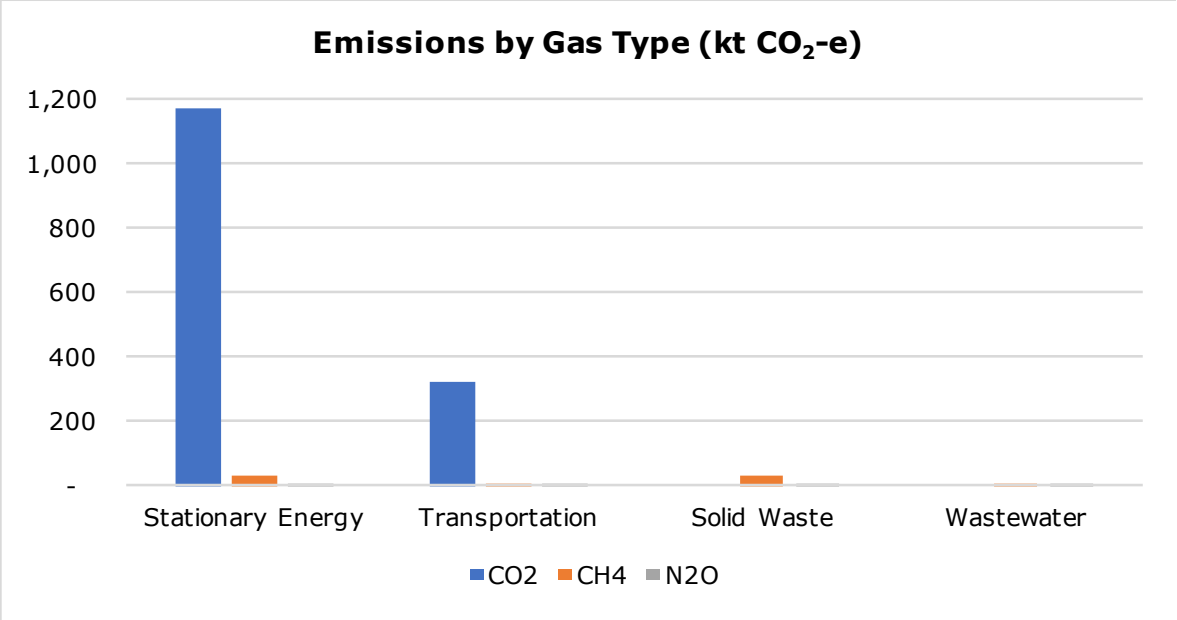

Figure 8: Hobsons Bay community emissions by gas type, according to source

Figure 8 compares the emissions by source type and also shows the amounts of each GHG that is produced either directly or indirectly through activities within the municipality. Gases are measured in carbon dioxide equivalent to ensure they are comparable. Both stationary energy and transportation are largely responsible for releasing carbon dioxide with trace amounts of methane and nitrous oxide, whilst emissions from waste are mostly released as methane (CH_4).

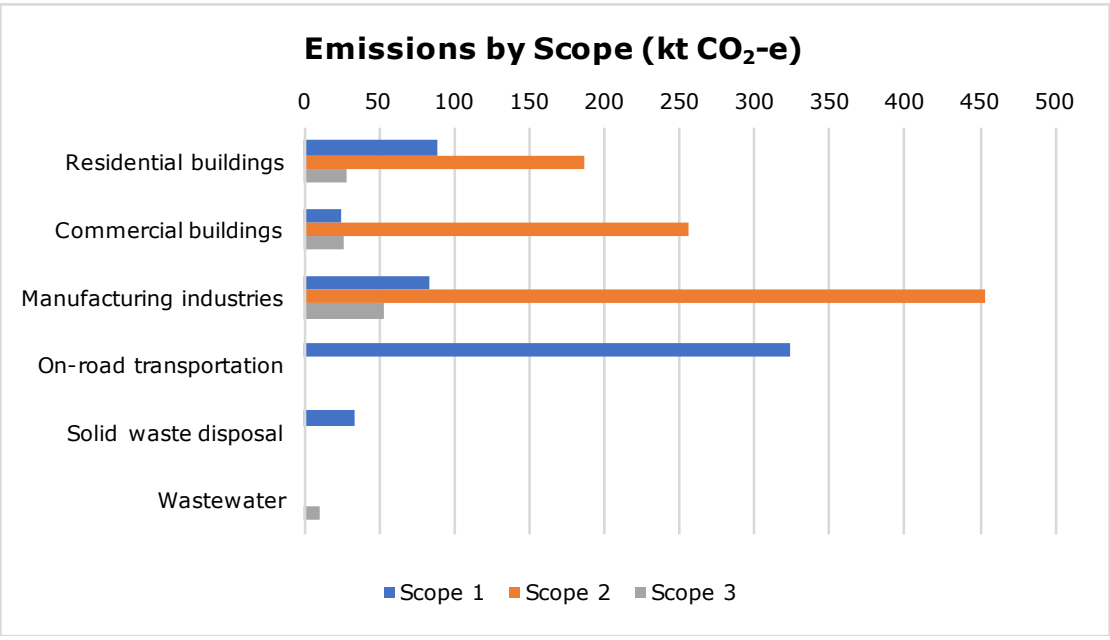

Figure 7: Hobsons Bay total community emissions categorised by scope, according to source

NB: In Figure 7 *Stationary energy has been broken down into 3 subcategories: residential, commercial and manufacturing.*

The majority of Council's community emissions fall within scope 2, which refers to GHG emissions that are released directly into the atmosphere as a result of grid-supplied energy, generally from outside of the municipal boundary to heat, steam and/or cool within the city boundary. Stationary energy is largely responsible for scope 2 emissions.

Scope 1 refers to GHG emissions being released directly into the atmosphere at the time of activity, occurring wholly within the boundary of the city. Scope 1 emissions include those produced by transport and disposal of solid waste. Wastewater treatment is considered a scope 3 emission, because waste generated within the municipal boundary is treated outside of the boundary.

4.2 Completeness

Data collection is an integral part of developing and updating a community emissions profile. Data will likely come from a variety of sources and will vary in quality, format, and completeness. In many cases, it needs to be adapted for the purposes of the profile. The GPC recognizes these challenges and sets out data collection principles and approaches. It also provides guidance on gathering existing data, generating new data and adapting data for profile use.

According to the GPC, a council's GHG profile shall follow the principles of relevance, completeness, consistency, transparency and accuracy. In regards to completeness, a council should account for all required emissions sources within the profile boundary and any exclusion of emission sources shall be justified and clearly explained.

To accommodate for limitations in data availability and differences in emission sources between cities, the GPC requires the use of "notation keys", as recommended in IPCC Guidelines. These are provided in Figure 9.

Notation key	Definition	Explanation
IE	Included Elsewhere	GHG emissions for this activity are estimated and presented in another category of the inventory. That category shall be noted in the explanation.
NE	Not Estimated	Emissions occur but have not been estimated or reported; justification for exclusion shall be noted in the explanation.
NO	Not Occurring	An activity or process does not occur or exist within the city.
C	Confidential	GHG emissions which could lead to the disclosure of confidential information and can therefore not be reported.

Figure 9: Notation keys

Where notation keys are used for this profile, an accompanying explanation is provided to justify exclusions or partial accounting of GHG emission source categories.

The GPC gives councils the option of selecting between two reporting levels: BASIC or BASIC+. The **BASIC** level covers emission sources that occur in almost all councils (stationary energy, in-boundary transportation, and in-boundary generated waste) and the calculation methodologies and data are more readily available. The **BASIC+** level has a more comprehensive coverage of emissions sources (BASIC sources plus IPPU, AFOLU, transboundary transportation, and energy transmission and distribution losses) and reflects more challenging data collection and calculation procedures.

This profile satisfies the requirements of GPC BASIC. Localised granular data has been sought where possible, however time spent seeking granular data and/or BASIC+ level data has been capped.

4.3 Data Accuracy

Due to variances in the availability of some data there was the need to extrapolate and rely on assumptions in some cases.

The quality of data has been categorised and is outlined in Table 6. Further information on the classifications is provided below.

High - Detailed Activity Data: denotes data that was directly available from a reliable source, such as energy billing data provided by Council.

Medium - Modelled activity data using robust assumptions: where more reliable data is not available granular data has been modelled.

Low - Highly modelled or uncertain activity data: denotes data that was modelled from a highly reliable source, such as the Australian Bureau of Statistics.

Overall, data accuracy for this emissions profile is considered to be medium, but compliant with the GPC BASIC requirements. Recommendations for improving data accuracy are at Section 5.

Table 4: Data accuracy classifications

Methods			
Profile Key Parameters	Method Used	Data Reliability	
		Activity data	Emissions factors
1. Basic Municipal			
BM1	BM1.1	Detailed activity data	n/a
BM2	BM2.1	Detailed activity data	n/a
2. Stationary Energy			
SE1	SE1.1	Detailed Activity Data	More general emission factors
SE2	SE2.1	Modeled activity data using robust assumptions	More general emission factors
SE3	SE3.1	Detailed Activity Data	More general emission factors
3. Transport			
TR1	TR1.2	Modeled activity data using robust assumptions	More general emission factors
Waste			
WS1	WS1.2	Modeled activity data using robust assumptions	Default emission factors
WS2	WS2.2	Modeled activity data using robust assumptions	Default emission factors

5. Recommendations and Next Steps

The development of this GPC-compliant profile is the first stage of compliance with the Global Covenant of Mayors and should be considered part of a process towards a climate mitigation system involving targets and actions. This profile has been developed in a way that future improvements in data (be that around relevance, completeness, consistency, transparency and accuracy) can be easily adapted. This starting point is about developing a platform; reaching GPC BASIC compliance; ensuring there is no double-counting across council boundaries and that metrics are consistent across time.

As discussed in Section 2.3, this profile should not be used as a baseline for developing and monitoring targets and actions. Instead, it should provide a summary of the relative GHGs for which City of Hobsons Bay is responsible and sit alongside, rather than above, these other items.

In the meantime, it is recommended that Council maintain their compliance with Global Covenant of Mayors through the development of a science-based target and implementation of their current plans and strategies for mitigating and adapting to climate change. Despite our recommendation to de-couple these items from a GHG profile for now, the savings from each action can still be closely monitored and reported separately to this profile.

It is expected that there will be changes to this profile as more granular data becomes available and methods for calculating and allocating emissions become more sophisticated. In the future, Council's community GHG profile will be considered accurate enough to link with their targets and actions as a full climate change mitigation system.

5.1 Proposed Next Steps

From here there are a number of actions that Council may undertake to maintain compliance with Global Covenant of Mayors and work towards a full climate mitigation system:

- Work with other councils, greenhouse alliances, State Government and stakeholders, such as ICLEI Oceania, WAGA (Western Alliance for Greenhouse Action) and Ironbark, to source improved and updated data that can feed into future profiles and improve accuracy.
- Continue to seek broader Global Covenant of Mayors compliance by developing community-wide emissions reduction targets. To be best-practice this should be a "science-based" target in-line with maintaining global average temperatures below a 2-degree increase.
- Continue to undertake climate mitigation and adaptation actions through the implementation of Council's various plans and strategies, and measure and report the impact of these actions through targeted monitoring.

6. Appendix 1: Data Inputs

6.1 Source Data

The following sources have been used to develop this profile.

NB: While Ironbark Sustainability has attempted to retrieve sources published at dates commensurate to the activity data generated in the community emissions profile, due to a number of factors around data confidence and publishing cycles, the quality of the reporting would be diminished if reports and recommendations are based on data from poor sources. Ironbark is always assessing the availability of data sources and aims to use more up to date and better-quality sources where possible.

Table 5: Data sources

Name	Author	Publication date
Electricity Gas Australia 2015	Electricity Gas Australia	April 2015
Small-scale Technology Certificates - Registered	Clean Energy Regulator	September 2016
Population Estimates by Local Government Area (ASGS 2015), 2006 to 2016	Australian Bureau of Statistics	July 2017
National Postcode Concordances 2011	Australian Bureau of Statistics	June 2012
ABS National Regional Profile Industry LGA 2010-14	Australian Bureau of Statistics	June 2016
Waste Generation and Resource Recovery – 2010-11	Randell Environmental Consulting	February 2014
Waste Account, Australia, Experimental Estimates 2013	Australian Bureau of Statistics	February 2013
National Greenhouse Gas Inventory 2015	Australian Department of Environment and Energy	June 2016
National Greenhouse Gas Inventory 2013	Australian Department of Environment and Energy	June 2014
National Greenhouse Accounting Factors 2017	Department of Environment and Energy	July 2017
National Greenhouse Accounting Factors 2015	Australian Department of Environment and Energy	August 2015
2016 Australian Energy Statistics Update	Department of Industry, Innovation and Science	October 2016
Derived data	NA	NA

6.2 Greenhouse Gas Emissions Factors

Emission factors convert activity data into a mass of GHG emissions; tonnes of CO_2 released per kilometre travelled, for example, or the ratio of CH_4 emissions produced to amount of waste landfilled. According to the GPC, emission factors should be relevant to the profile boundary, specific to the activity being measured, and sourced from credible government, industry, or academic sources[1]. The following tables outline the GHG emission factors used in the development of this profile.

Table 6: Grid supplied electricity emissions factors (Source: National Greenhouse Accounting Factors 2017)

Grid supplied electricity emissions factors				
State	Financial Year	Equivalent year	Scope 2 EF (kg CO_2-e/kWh)	Scope 3 EF (kg CO_2-e/kWh)
Victoria	Latest Estimate	2015.5	1.08	0.1

Table 7: Grid supplied gas emissions (Source: National Greenhouse Accounting Factors 2017, Table 2)

Emission factors for the consumption of natural gas					
Fuel combusted	Energy content factor (GJ/m^3 unless otherwise indicated)	Emission factor (kg CO_2-e/GJ) (relevant oxidation factors incorporated)			
		CO_2	CH_4	N_2O	Total
Natural gas distributed in a pipeline	39.3×10^{-3}	51.4	0.1	0.03	51.53

Table 8: Natural gas leakage factors (Source: National Greenhouse Accounting Factors 2017, Table 16)

Natural gas leakage factors			
State	Unaccounted for gas (%UAG)	Natural gas composition factor (tonnes CO_2-e/TJ)	
	UAG	CO_2	CH_4
Victoria	3	0.9	388

[1] If no local, regional, or country-specific sources are available, councils can use IPCC default factors or data from the Emission Factor Database (EFDB) or other standard values from international bodies that reflect national circumstances.

Table 9: Distribution losses (Source: Electricity and Gas Australia 2015, Table 3.5)

Distribution losses	
Data year	2013.5
State	Victoria
Loss	4.6%

Table 10: Waste emission factors (Source: National Greenhouse Accounting Factors 2015)

Waste – Emissions Factors				
	CO_2	CH_4	N_2O	Total CO_2 -e
Proportion of total CO_2-e	0.27%	96.08%	3.65%	100%

Table 11: Waste emission factors for total waste disposed to landfill (Source: National Greenhouse Accounting Factors 2017)

Waste emission factors for total waste disposed to landfill by broad waste stream category			
Waste types	Municipal solid waste	Commercial and industrial waste	Construction / demolition waste
	A	B	C
Emission factor (t CO_2-e/t waste)	1.4	1.3	0.2

Table 12: Transport fuels emission coefficients (Source: National Greenhouse Accounting Factors 2017, Table 4)

Fuel combustion emission factors - fuels used for transport energy purposes				
Fuel combusted	Energy content factor (GJ/kL unless otherwise indicated)	Emission factor (kg CO_2-e/GJ) (relevant oxidation factors incorporated)		
		CO_2	CH_4	N_2O
Pre-2004 vehicles				
Gasoline (other than for use as fuel in an aircraft)	34.2	67.4	0.5	1.8
Diesel oil	38.6	69.9	0.1	0.5
Liquefied petroleum gas	26.2	60.2	0.6	0.7
Ethanol for use as fuel in an internal combustion engine	23.4	0	0.7	1.9
Post-2004 vehicles				
Gasoline (other than for use as fuel in an aircraft)	34.2	67.4	0.02	0.2
Diesel oil	38.6	69.9	0.01	0.6
Liquefied petroleum gas	26.2	60.2	0.4	0.3
Ethanol for use as fuel in an internal combustion engine	23.4	0	0.2	0.2

Table 13: Emission breakdown by fuel type (Source: National Greenhouse Accounting Factors 2017)

Emissions breakdown by fuel type							
Data year	2013.5						
Fuel type	CO_2 emissions factors (kg CO_2-e/GJ)				Proportion of emissions		
	CO_2	CH_4	N_2O	Total	CO_2	CH_4	N_2O
Hydro	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000
Biofuels	0	0.07	1.1	1.17	0.0000	0.0598	0.9402
Black coal	90	0.03	0.2	90.23	0.9975	0.0003	0.0022
Brown coal	93.50	0.02	0.40	93.92	0.9955	0.0002	0.0043
Coal seam methane	51.4	0.2	0.03	51.63	0.9955	0.0039	0.0006
Natural gas	51.40	0.10	0.03	51.53	0.9975	0.0019	0.0006
Oil products	69.8	0	0.2	70.00	0.9971	0.0000	0.0029
Solar	0	0	0	0.00	0.0000	0.0000	0.0000
Wind	0.00	0.00	0.00	0.00	0.0000	0.0000	0.0000
Total (kg CO_2-e/GJ)	81.08	0.02	0.35	81.46	0.9954	0.0003	0.0043
Total (kg CO_2-e/MWh)	22.52	0.01	0.10	22.63	0.9954	0.0003	0.0043
	99.536%	0.029%	0.434%	1.00			

Table 14: Global warming potentials of greenhouse gases (Source: National Greenhouse Accounting Factors 2017, Appendix 1)

Global Warming Potentials		
Gas	Chemical formula	Global Warming Potential
Carbon dioxide	CO_2	1
Methane	CH_4	25
Nitrous oxide	N_2O	298

Table 15: Electricity generation fuel mixes by state (Source: 2016 Australian Energy Statistics Update, Table O)

Electricity generation fuel mixes		
Data year	2013.5	
State	Victoria	
Generation source	Value (GWh)	Proportion
Hydro	1,103.0	2%
Biofuels	898.8	2%
Black coal		0%
Brown coal	43,977.7	83%
Coal seam methane		0%
Natural gas	3,239.3	6%
Oil products	145.8	0%
Solar	755.6	1%
Wind	2,771.9	5%
Total (kg CO_2-e/GJ)	**52,892.1**	**100%**
Fossil Fuels	47,362.8	90%
Nuclear	0	0%
Renewables	5,529.3	10%

7. Appendix 2: Policy Context

International/Federal

Globally, a number of countries, states and cities are making significant changes to the way they live and work to reduce their contribution to human induced climate change. In some countries, such as Australia, it has been cities and communities that are leading the way with policies and programs to seize the opportunity of sustainability.

Australia has seen significant policy uncertainty through the introduction and repeal of policies such as the price on carbon and the protracted review of the Renewable Energy Target. Nationally, uncertainty regarding the Renewable Energy Target and carbon pricing continues to stifle investment in large-scale renewable energy to the detriment of consumer prices.

The second major Federal policy influencing Council decision-making is the Emission Reduction Fund (ERF). The methodologies and abatement pricing structures announced in the first round of the Fund provide limited opportunities for councils to participate, however the second round may provide some limited opportunity. The Australian Renewable Energy Agency and Clean Energy Finance Corporation are still attempting to fund innovation and tailored project finance to support the development of the industry irrespective of limited political support.

Australia recently became a signatory to the Paris Climate Agreement which pledges to reduce carbon emissions and limit global warming to "well below 2°C above pre-industrial levels".

State

The Victorian Government has established a climate change framework and enshrined in legislation a goal to achieve net zero emissions by the year 2050, beginning with a reduction of 15-20% on 2005 levels by the year 2020. In addition, they aim to increase renewable energy generation to 25% by the year 2020.

A key strategy to reducing emissions is the Take 2 Pledge delivered by Sustainability Victoria - a commitment to keeping global temperature increases under 2 degrees Celsius that can be signed by individuals, families, businesses or governments.

Recently, the Victorian Climate Change Adaptation Plan 2017-2020 was released, outlining key government actions to meet its GHG reduction targets.

Local

At the local level, a number of councils across Australia have shown strong leadership in climate action and derived great benefits by reducing their operational costs, carbon exposure and improving productivity. In addition, this has provided a great basis for community engagement and leadership.