

Climate Change Mitigation Strategy to 2050

4 December 2018

Presenter: Claire Ferres Miles, Director City Strategy and Place

Purpose and background

1. The purpose of this report is to seek Future Melbourne Committee's endorsement of the Climate Change Mitigation Strategy to 2050: Melbourne Together for 1.5°C (Strategy) (Attachment 1). Endorsement of the Strategy includes a Council Pledge, as required under the *Climate Change Act 2017*.
2. In 2018–19 Council requested management develop the Strategy through its Annual Plan Initiative 1.9 Finalising the Zero Net Emissions Strategy 2020–2050, recognising the need for realignment due to the following significant events:
 - 2.1. The ratification of the Paris Climate Agreement by the Australian Government in 2016.
 - 2.2. The Victorian Government passed a new *Climate Change Act 2017*, which includes a target of net zero emissions by 2050 for Victoria and prescribes a formal process for local governments to submit five year plans from 2020 to address climate change mitigation and adaptation.
3. The Council's previous target of zero net emissions by 2020 was set in 2003. Since then, ambitious actions have been taken: carbon neutral organisation, CitySwitch, 1200 Buildings, Melbourne Renewable Energy Project. Uncertainty on climate change policy in Australia has meant that zero net emissions by 2020 can only be achieved through the purchase of carbon offsets. The Strategy realigns Council action based on the above changes and provides an evidence base to achieve zero net emissions through action rather than offsets. The draft version of this Strategy was endorsed for consultation on 4 September 2018.

Key issues

4. The Strategy provides the overarching strategic vision, objectives and priorities to reduce emissions within the municipality. It reflects that Council is leading by example, demonstrating the possibilities and sharing solutions to climate change. Research was commissioned by management to establish an evidence base for two emission reduction scenarios (significant and accelerated) compared with business as usual and the purchase of offsets from 2020.
5. Endorsement of the strategy and accompanying rolling five year implementation plan will fulfil the Council Pledge requirements under the *Climate Change Act 2017*. The pledge will be the first of its kind.
6. Community and stakeholder consultation was held between 5 September and 7 October 2018.
7. Feedback from the above included a high level of interest in climate change, strong support for advocating for change and taking direct action in mitigating emissions, and strong support for the stated priorities and actions including those aimed at improving wellbeing, delivering more green space, prioritising active transport over cars, advocating for more renewable energy and assisting or facilitating the transition to renewable energy.
8. As a result, the Strategy has been updated to provide more information on the emissions profile in the context of greater Melbourne; and to refine the evidence base for climate change action.
9. The Strategy has also been updated to further explain the economic and social benefits and reference to the Intergovernmental Panel on Climate Change Special Report on Global Warming of 1.5°C released on 8 October 2018.

Recommendation from management

10. That the Future Melbourne Committee:
 - 10.1. Endorses the Climate Change Mitigation Strategy to 2050: Melbourne Together for 1.5°C which includes the Council Pledge under the Victorian *Climate Change Act 2017*.
 - 10.2. Authorises the Director of City Strategy and Place to make any further minor editorial changes to the Strategy and its graphic design prior to its release.

Attachments:

1. Supporting Attachment (Page 2 of 42)
2. Climate Change Mitigation Strategy to 2050. Melbourne together for 1.5°C (Page 4 of 42)

Supporting Attachment

Legal

1. Part 5 of the *Climate Change Act 2017* (the Act), prescribes a formal process for councils to make five year pledges in respect of greenhouse gas emissions reductions. Sections 46 and 47 of the Act provide that Council may make a statement in respect of greenhouse gas emissions reductions resulting from the performance of the Council's powers and duties under the *Local Government Act 1989* on or before 1 August 2020. In accordance with section 46(3) of the Act, the pledge relates to the period of 1 January 2021 to 31 December 2025, with a two-year preliminary period commencing 1 January 2019.

Finance

2. The cost of meeting the requirements of the final Strategy will be subject to the usual budget process.

Conflict of interest

3. No member of Council staff, or other person engaged under a contract, involved in advising on or preparing this report has declared a direct or indirect interest in relation to the matter of the report.

Occupational Health and Safety

4. In developing this proposal, the health benefits of climate change action have been identified.

Stakeholder consultation

5. A community and stakeholder engagement process was undertaken between September and October 2018, to ensure that it meets the expectations and needs of our community and key stakeholders. Consultation on the draft Strategy was carried out through:
 - 5.1. Information and feedback collected through the Participate Melbourne website, which reached more than 1019 people.
 - 5.2. Face-to-face information and feedback at 11 community pop-ups at community events and venues and community group meetings engaging 642 people across the municipality.
 - 5.3. Face-to-face conversations with key stakeholders who we will partner with to deliver the final Strategy.
 - 5.4. Email, e-newsletters and social media campaigns to encourage feedback.
6. An external reference group was set up to provide advice to the project team on the Strategy refresh. This was comprised of representatives from state government, key industries and peak bodies including Clean Energy Council, Green Building Council, RACV, Waste Management Association, University of Melbourne, RMIT, Future Business Council and the Climate and Health Alliance.

Relation to Council policy

7. The following Council policies are consistent with the draft Strategy, following extensive internal consultation with teams across Council:
 - 7.1. Future Melbourne 2026: all community goals, particularly Goal 1.
 - 7.2. Council Plan 2017–2021: all Council goals.
 - 7.3. Climate Adaptation Strategy Refresh 2017.
 - 7.4. Waste and Resource Recovery Strategy 2018.
 - 7.5. Transport Strategy 2012, (and developing draft Transport Strategy Refresh).
 - 7.6. Emissions Reduction Plan for our Operations 2016–2021.

Environmental sustainability

8. In developing the Strategy, the following environmental sustainability matters have been considered:
 - 8.1. The aim of the Strategy is to decrease the generation of greenhouse gases in response to climate change.
 - 8.2. By engaging the community in the Strategy, this raised awareness of climate change issues and how the whole community can play a part in delivering the final Strategy.

CLIMATE CHANGE MITIGATION STRATEGY TO 2050

MELBOURNE TOGETHER FOR 1.5°C



CITY OF MELBOURNE



A CITY THAT CARES FOR THE ENVIRONMENT

Environmental sustainability is the basis of all Future Melbourne goals. It requires current generations to choose how they meet their needs without compromising the ability of future generations to be able to do the same.

Acknowledgement of Traditional Owners

The City of Melbourne respectfully acknowledges the Traditional Owners of the land, the Boon Wurrung and Woiwurrung (Wurundjeri) people of the Kulin Nation and pays respect to their Elders, past and present.

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Issue X - Description of issue

XX Month 2018

Cover Image: Flinders Street Station, Photo Credit: Luke Evans

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MESSAGE FROM CITY OF MELBOURNE



Text to be inserted



EXECUTIVE SUMMARY

Local action, global leadership

The City of Melbourne is leading by example, demonstrating the possible and sharing the solutions to climate change.

In 2003, we set an ambitious target of zero net emissions for the municipality of Melbourne by 2020. We were one of the first cities to set such an ambitious target, and many other cities followed our lead. We are now part of a movement of cities around the world taking bold action for the benefit of our communities and for future generations.

The global role of cities in stepping up to act on climate change was recognised in the 2015 Paris Climate Agreement. Since that time, national and state governments, cities, investors, businesses and communities alike have begun to take action to reduce greenhouse gas emissions to help avoid a global average temperature rise of 1.5°C.

The Intergovernmental Panel on Climate Change has conveyed a clear message to leaders around the world that climate change is already impacting communities and that urgent action is needed. The Australian Government has ratified the Paris Climate Agreement and the Victorian Government has introduced the *Climate Change Act 2017*. This provides a fresh opportunity for the City of Melbourne to pursue our long-standing commitment to act on the emissions that cause climate change.

To align with the 2015 Paris Climate Agreement, we now need to reset ambitious emissions reduction targets for 2030,¹ achieve net zero emissions before 2050 and align our strategy to the C40 Climate Action Plan Framework.²

This Climate Change Mitigation Strategy identifies the actions that we can take to leverage systemic change. We want to pilot a virtual power plant powered by renewables in the city. We will expand the ground-breaking Melbourne Renewable Energy Project (MREP) to facilitate power purchase agreements for businesses across the city. This will generate investment in new renewable energy. We will also advocate for Victorian and Australian Government action to deliver 100 per cent renewable energy to our city and to increase the ambition of Australia's climate policy.

Taking bold action together

In 2016, the City of Melbourne hosted a deliberative democracy process, the Future Melbourne Refresh, to develop a community vision and set priorities for Melbourne. Reducing greenhouse gas emissions from the municipality was identified as a top priority and this is reflected in our Council Plan 2017-2021. This vision is shared across Victoria: 80 per cent of people are willing to act on climate change and 87 per cent think local government should be taking action.³

Our Council Pledge to reduce emissions is the first of its kind under the Victorian *Climate Change Act 2017*. The strategy has been developed as part of the C40 Climate Action Planning Pilot Program, sharing our approach with other cities including: Boston, Durban, Los Angeles, London, Mexico City, New York and Paris. We've developed it as an example for others to use and improve as part of our commitment to local government leadership.

The City of Melbourne will partner with industry and the Victorian and Australian Governments to demonstrate zero emissions for the Fishermans Bend and Arden precincts and remove barriers to zero emissions buildings. We will advocate for effective building standards to reduce emissions.

We will invest in better walking and cycling infrastructure and advocate for Melbourne's public transport to be efficient and powered by 100 per cent renewable energy. We will apply a circular economy approach to reduce emissions from buildings and precincts.

And we will collaborate with community organisations, businesses, cities, and government agencies to reduce climate risk to fulfil our legislative responsibilities. This strategy will be supported by a rolling five-year implementation plan fulfilling our first Council Pledge under the *Climate Change Act 2017*.



¹ The calculation for 2030 needs to follow the C40 Deadline 2020 approach with contraction and convergence of emissions by 2030.
² The C40 Cities Climate Action Planning Framework supports cities in developing climate action plans. It sets out the essential components of a climate action plan that is deemed to be compatible with the objectives of the Paris Agreement.
³ Sustainability Victoria Social Research on Climate Change 2016.

Raising our ambition

Aligning to the science-based targets in the Paris Climate Agreement requires a mix of delivery mechanisms: engaging, facilitating, collaborating and partnering. We will lead the delivery of actions within our powers and advocate for policy change and action from others. To inform the development of the strategy we analysed four scenarios:

1. Business as Usual
2. Significant Action to reduce emissions
3. Accelerated Action
4. Purchasing Offsets from 2020.

Both the Significant and Accelerated Action scenarios require investors, businesses and the Victorian and Australian Governments to take action.

The chart below summarises the four scenarios. It illustrates the reduction in emissions needed as part of the international effort to stay below a 1.5°C rise in global average temperatures.

Figure 1: Emissions reductions needed under each scenario

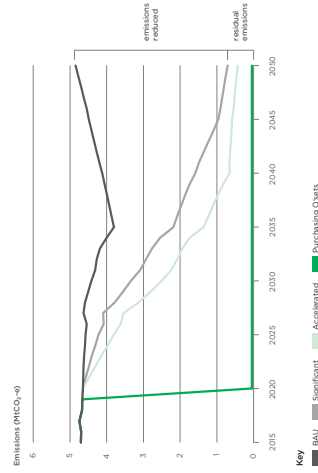


Table 1 below summarises the characteristics of each scenario and emission reductions for 2025 and 2030.⁴

Table 1: Analysis of each scenario

SCENARIO	EMISSIONS REDUCED BY 2025	EMISSIONS REDUCED BY 2030	TARGET PER PERSON IN 2030	NET ZERO EMISSIONS	ALIGNED TO 1.5°C PARIS CLIMATE AGREEMENT
1. Business as Usual	-3%**	-6%**	22.1tCO ₂ -e	never	no
2. Significant Action	-10%	-29%	14.3tCO ₂ -e	2050	yes
3. Accelerated Action	-21%	-50%	10.7tCO ₂ -e	2043	yes
4. Purchasing Offsets	-100%	-100%	22.1tCO ₂ -e	2020	no

* Compared to 2015 baseline emissions.

** Assumes Victorian Renewable Energy Target to 2025.

Our preferred approach: Significant Action Scenario

The City of Melbourne's preferred approach is to deliver the actions needed to achieve the **Significant Action Scenario** and pursue actions for the Accelerated Action Scenario where there is the opportunity to go further. This will require us to take bold action within our powers, collaborate and advocate for policy change from the Victorian and Australian Governments. Our approach aligns with the Paris Climate Agreement while acknowledging our limited powers and financial resources.

Under the Business as Usual scenario, the impacts of climate change and missed economic opportunities of transitioning to a low carbon economy will cost AU\$12.6 billion to the municipality's economy by 2050.⁵

The Significant Action and Accelerated Action scenarios not only reduce the future economic burden of climate change, but also provide economic stimulus, generating over 30,000 jobs and over AU\$5 billion in economic value by 2050.

The realisation of these benefits requires collaborative action across all three levels of government. Without effective policy changes in state and national jurisdictions, the City of Melbourne will not achieve alignment to the Paris Climate Agreement targets.

The estimated cost to the City of Melbourne of the Purchasing Offsets Scenario would be AU\$240–480 million per year and would not address the underlying causes of emissions in the municipality. For these reasons the Business as Usual and Purchasing Offsets Scenarios are not in the best interests of the municipality.

Strategic priorities

The City of Melbourne has identified four priorities for action in achieving its emissions targets:

1. 100 per cent renewable energy
2. zero emissions buildings and precincts
3. zero emissions transport
4. reducing the impact of waste.

To implement the strategy we will:

- integrate climate adaptation and mitigation
- deliver environmental, social and economic benefits to the community
- support innovation, knowledge sharing and transparency.

We will focus on reducing the largest sources of emissions in the municipality to achieve our science-based targets and align this strategy to the Paris Climate Change Agreement and C40 Climate Action Plan Framework. The strategy demonstrates our support for social inclusion and contributes to achieving the Sustainable Development Goals.

⁴ Ernst & Young (2018). Economic Analysis. Prepared for C40 and City of Melbourne.

⁵ Ernst & Young (2018). Synthesis Report. Prepared for C40 and City of Melbourne. Estimated cost of offsets in 2020 converted to Australian dollars.

Long-term thinking, short-term action

The decisions made today about energy, infrastructure, buildings and transport planning will lock in the pathway to achieving rapid decarbonisation of the municipality. This strategy is part of a suite of strategies delivering step-change for our community as part of our Council Plan 2017-2021. These include our Climate Change Adaptation, Nature in the City, Urban Forest Strategy, Transport, and Waste and Resource Recovery strategies.

“The principle of inter-generational equity recognises that decisions made today will determine the future climate that children and future generations will experience. Climate change will impact everyone who lives, works and plays in the city.”

The timeframe for this strategy is 1 January 2019 to 31 December 2050 with an interim target for 31 December 2030. This aligns to the timing of the Paris Climate Agreement. A rolling five-year implementation plan, aligned to the Council Pledge requirements of the *Climate Change Act 2017*, will accompany this strategy.

We will measure and report our progress to the community annually and evaluate the implementation plan by 2025.



LIST OF PRIORITY ACTIONS

These priority actions will inform the City of Melbourne's planning and resourcing considerations and will be subject to Annual Plan and Budget processes.

Reduce emissions from Council operations

1.0 Continue to implement emission reductions for our operations and develop a new plan for 2021.

Priority 1: 100 per cent renewable energy

- 1.1 Advocate for a more ambitious renewable energy target and changes to the National Electricity Rules.
- 1.2 Accelerate corporate Power Purchase Agreements.
- 1.3 Facilitate residential purchasing of renewable energy products.
- 1.4 Facilitate a virtual power plant or solar garden for residents or small businesses.
- 1.5 Collaborate with other cities, investors and superannuation companies to accelerate divestment from fossil-fuel energy supply.

1.6 Partner with businesses, universities, healthcare services and other organisations to promote innovative renewable energy technology and research.

Priority 2: Zero emissions buildings and precincts

- 2.1 Demonstrate innovative carbon positive design and operation of council-owned buildings and precincts.
- 2.2 Partner with industry and Victorian and Australian Government agencies to reduce barriers and deliver zero emissions buildings and urban renewal precincts.
- 2.3 Accelerate existing commercial buildings and tenants' energy efficiency programs through CitySwitch and other partnerships.
- 2.4 Advocate for energy performance disclosure for a greater range of commercial and residential buildings.
- 2.5 Facilitate the take up of the National Built Environment Rating Scheme for apartments across the municipality.
- 2.6 Renew and implement planning policies to support the development of zero emissions buildings and precincts.
- 2.7 Partner with industry to advocate for higher energy performance standards in the National Construction Code, *Building Act 1993* and regulations.
- 2.8 Advocate and facilitate to transition from gas to electricity in buildings and precincts.
- 2.9 Adopt circular economy principles to reduce the environmental impact and embodied emissions from products, materials and buildings across the city through procurement, urban design and planning.

Priority 3: Zero emissions transport

- 3.1 Reallocate road space to create more space for walking, cycling and green infrastructure.
- 3.2 Prioritise active and public transport through dedicated lanes, traffic light priorities, parking controls and road user pricing.
- 3.3 Advocate for energy efficiency public transport powered by renewable energy.
- 3.4 Advocate for the Victorian Government to extend train, tram and bus services.
- 3.5 Advocate for lower carbon intensity of motor vehicles and support transition to electric vehicles.

Priority 4: Reducing the impact of waste

- 4.1 Continue to promote and facilitate waste avoidance, recycling, recovery and diversion of waste from landfill by implementing the City of Melbourne's Waste and Resource Recovery Strategy.

Enabling actions to implement the strategy effectively

- 5.1 Promote the actions needed to achieve the emission reductions to the community, businesses and government decision-makers.
- 5.2 Identify and address synergies, trade-offs and feedback loops between the implementation of the Climate Change Mitigation Strategy to 2050, Climate Change Adaptation, Nature in the City Strategy and other relevant strategies.
- 5.3 Take an innovative, evidence-based approach to prioritising actions and open data on our emissions profile for urban researchers to develop new solutions.
- 5.4 Participate to share knowledge and continue to co-lead the C40 Low Carbon Districts and Climate Positive forum to learn from innovative international projects.
- 5.5 Report progress in reducing emissions annually and update the rolling five-year implementation plan based on progress.
- 5.6 Evaluate the implementation of the strategy by 2025 to meet the Council Pledge requirements under the *Climate Change Act 2017*.

CITY OF MELBOURNE'S COUNCIL PLEDGE

Greenhouse Gas Emissions Reduction Statement

In accordance with Climate Change Act 2017
This Statement is made by the Melbourne City Council (Council) in accordance with sections 46 and 47 of the *Climate Change Act 2017*, which provide that the Council may make a statement in respect of greenhouse gas emissions resulting from the performance of the Council's powers and duties under the *Local Government Act 1989* on or before 1 August 2020. In accordance with section 46(3), this pledge relates to the period of 1 January 2021 to 31 December 2025, with a two-year preliminary period commencing 1 January 2019.

By resolution of the Future Melbourne Committee dated 4 December 2018, the Council has pledged that it will undertake the actions outlined in the Implementation Plan at Appendix 1 by 2025, and that the Council reasonably expects these actions will contribute to the reduction of greenhouse gas emissions caused or otherwise influenced by the Council.

In implementing these actions, the Council will consider the Policy Objectives and Guiding Principles in accordance with Section 47(2) of the *Climate Change Act 2017*.

It is estimated that the total level of greenhouse gas emissions will be in accordance with those estimated and as set out in Column A of the Implementation Plan at Appendix 1.

Further greenhouse gas emission reductions are expected to result from the actions outlined in Column B of the Implementation Plan at Appendix 1.



1. STRATEGIC CONTEXT

"According to climate scientists, global average temperatures have already risen by 1°C and this is contributing to increasingly severe heatwaves, droughts, and storms."

1.1 How can we address global warming?

A 1.5°C rise in global average temperatures would have a severe impact on communities around the world due to loss of agriculture and sea-level rise.⁶ It would impact the health of people in Melbourne by exacerbating the urban heat island effect, increasing hospitalisations from asthma and other illnesses. The cost of property damage and insurance would increase due to increasingly severe storms and floods.

The greenhouse gas emissions that cause global warming are generated from electricity, gas, transport, and waste produced in our city. They are also generated by food and agriculture, goods and services, and the resources that go into packaging, clothes and building materials. Too many greenhouse gas emissions act like a blanket around the earth, causing temperatures to rise.

To reduce greenhouse emissions we need collective action by customers and businesses: commuters and transport companies, tenants and building owners, investors and government regulators. By taking action together, we can generate health and social benefits and reduce the cost of environmental impact.

The good news is change is already underway. More and more customers are choosing sustainable products and services. Melbourne's trams will soon be powered by renewable energy. Businesses all over the city are choosing greener buildings and 100 per cent renewable energy. At the City of Melbourne, we have reduced emissions from our operations and have been certified carbon neutral every year since 2012.

Reducing emissions in energy and transport sectors can reduce air pollution, which can lead to immediate improvements in cardiovascular and respiratory health, and result in fewer heart attacks and asthma attacks, and fewer hospital admissions. Reducing the carbon intensity of our diets and food systems can also decrease heart disease, help avoid obesity and diabetes, and reduce the incidence of bowel cancer. Investing in green infrastructure lowers greenhouse gas emissions, and leads to positive improvements in mental, physical and social health.



IT MIGHT BE A GLOBAL PROBLEM, BUT THE SOLUTIONS ARE RIGHT HERE IN OUR CITY

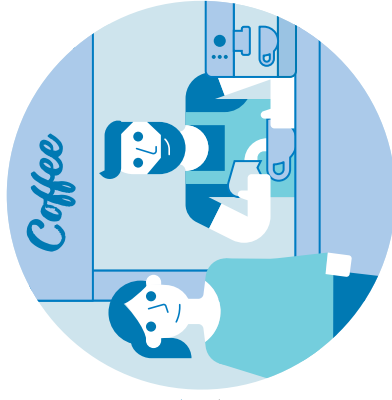
If cafes and trains in Melbourne were powered by renewable energy and buildings and freight vehicles were more efficient, then the daily activity of drinking coffee would be supporting our emission reduction goals.



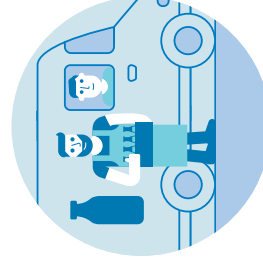
1
Jo is studying at the University of Melbourne. Each morning she catches a train to Flinders Street Station.



2
Jo orders a flat white at a café in DeGRAVES Street. The barista grinds the coffee and heats the milk.



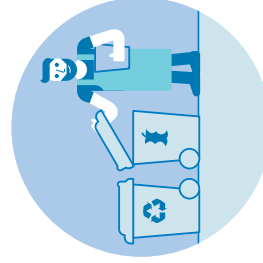
15%
Transport emissions generated
The café supplies are delivered each morning, sometimes from many kilometres away.



7%
Natural Gas emissions generated
72%
Electricity emissions generated

The café uses electricity. The efficiency of the café's refrigeration, lighting and air-conditioning makes a difference to the greenhouse gas emissions produced.

6%
Waste emissions generated
At the end of the day, the café workers separate organic waste and recycling and donate left-over food to charity, so only a small amount of waste is sent to landfill.



⁶ Intergovernmental Panel on Climate Change (2018). Special Report on Global Warming of 1.5°C

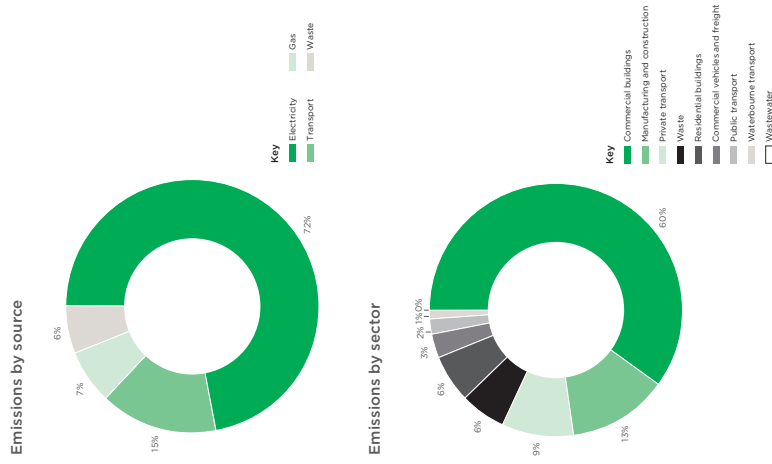
1.2 Melbourne's emissions profile

The municipality of Melbourne is 37.7 km² and includes the central business district and inner suburbs. The majority of the municipality's emissions are due to energy use in commercial buildings and transport. Our programs have addressed emissions from these sources; however, population growth, urban densification and the electrification of private vehicles means there is still much more to do.



In 2017, the municipality's emissions were 4,678,194 tonnes CO₂ equivalent, or 33 tonnes per person – one of the highest in the world on a per capita basis.⁷ This is because we have a low residential population of 152,992 and a large population of daily commuters who work in central business district office buildings. These buildings are powered by electricity generated from high emitting brown coal-fired power stations.

Figure 2: Sources of municipal emissions in 2017

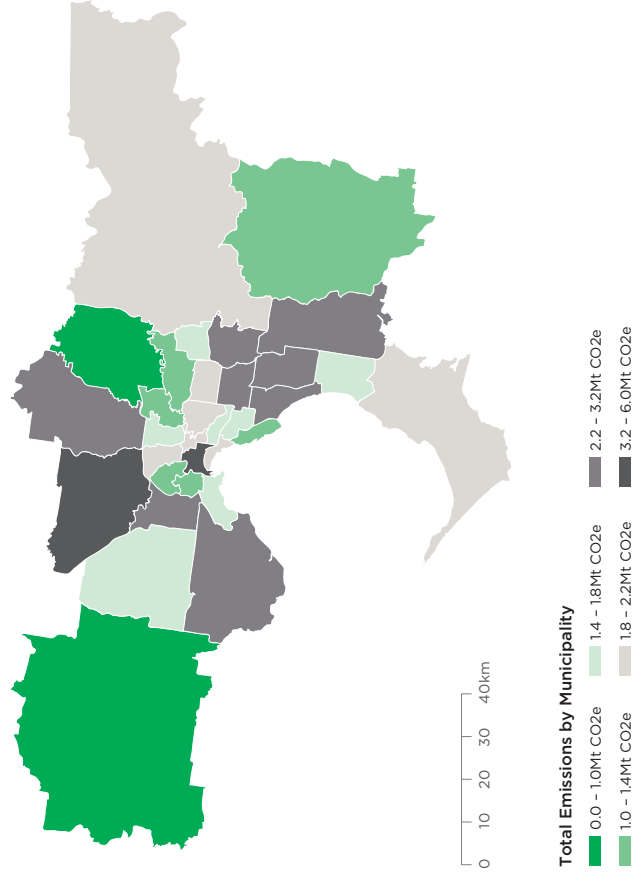


⁷ These are the greenhouse emissions for the municipality in 2017 using the Global Protocol for Communities Basic method. The emissions for our baseline year of 2015 were 4,700,672 tonnes CO₂ equivalent, or 33.8 tonnes per person. Population in 2015 was 139,000. Our per capita emissions are calculated by dividing total emissions of the municipality by the number of residents. This is the international standard used to compare the emissions of cities.

While this strategy focuses on the municipality, we also work collaboratively to reduce emissions with other local governments across metropolitan Melbourne and Victoria. Greater Melbourne covers 9,990 km² and consists of 31 municipalities with a combined population of 4,798,327 people.

Total emissions from Greater Melbourne in 2017 were 66,359,038 tonnes CO₂ equivalent or 13.94 tonnes per person.⁸ The main sources of emissions are electricity (71 per cent), and transport emissions (26 per cent). More information about Greater Melbourne's emissions can be found at Appendix 2. While these per capita emissions are lower than for the central city, they are still very high by international comparison. The average emissions for C40 cities around the world are 5.1 tonnes CO₂ equivalent per person.⁹

Figure 3: Greater Melbourne's total emissions by municipality



⁸ Ironbark Sustainability (2018). Greater Melbourne Community Emissions Inventory Report. Prepared for C40 and City of Melbourne
⁹ ARUP (2016). Deadline 2020 prepared for C40 Cities

1.3 Why we need a new approach

Zero net emissions by 2020

In 2003, the City of Melbourne set an ambitious target of zero net emissions from the municipality by 2020, prior to Australia ratifying the Kyoto Protocol. We were one of the first cities to set such an ambitious target, and many other cities followed our lead. The most recent update of the Zero Net Emissions by 2020 Strategy was completed in 2014, prior to the Paris Climate Agreement.

In 2016, the City of Melbourne hosted a deliberative democracy process to develop a community vision for the Future Melbourne Refresh, setting the priorities for the city. Reducing greenhouse gas emissions from the municipality was identified as a top priority and this is reflected in our Council Plan 2017–2021. This vision is shared across Victoria: 80 per cent of people are willing to act on climate change and 87 per cent think local government should be taking action.¹⁰

Now that the Australian Government has ratified the Paris Climate Agreement and the Victorian Government has introduced the *Climate Change Act 2017* there is a fresh opportunity to pursue our long-standing commitment to action on the emissions that cause climate change. Our city will continue to grow and the decisions we make today will lock in the future emissions profile of our energy, buildings, transport and waste management.

We completed our Climate Change Adaptation Strategy Refresh in 2017. This complementary Climate Change Mitigation Strategy focuses on reducing greenhouse emissions. It responds to the new science-based targets and frameworks introduced since the Paris Climate Agreement was ratified in 2016.

C40 Climate Action Planning Framework

C40 is a network of the world's megacities committed to addressing climate change.¹¹ To ensure our approach demonstrates global leadership, the City of Melbourne joined seven cities in a C40 Climate Action Planning Pilot Program: Boston, Durban, Los Angeles, London, Mexico City, New York, and Paris. This peer-review exchange has contributed greatly to our strategy.

Through this program, the City of Melbourne contributed to the development of the C40 Climate Action Planning Framework. Cities can use this framework to meet their commitments to the Paris Climate Agreement.

The key features of the C40 Climate Action Planning Framework are:

1. Develop a pathway to deliver an emissions neutral city by 2050 at the latest and set an ambitious interim target and/or carbon budget.
 2. Demonstrate how the city will adapt and improve its resilience to the climate hazards that may impact the city now and in future climate change scenarios.
 3. Outline the social, environmental and economic benefits expected from implementing the plan, and improve the equitable distribution of these benefits to the city's population.
 4. Detail the city's governance, powers and partners who need to be engaged in order to accelerate the delivery of the city's mitigation targets and resilience goals. Cities need to do this by:
 - Considering adaptation and mitigation in an integrated way, identifying interdependencies to maximise efficiencies and minimize investment risk.
 - Setting an evidence-based, inclusive and deliverable plan for achieving transformational mitigation and adaptation, centred on the city's powers and wider context.
 - Establishing a transparent process to monitor delivery, communicate progress and update climate action planning in line with governance and reporting systems.
- We have started a capacity building program for local governments in metropolitan Melbourne and will continue to share the lessons we learnt during the pilot program with cities around the world.



1.4 A low carbon, circular economy

Melbourne is Australia's second largest city and an important centre for finance, professional services and the knowledge economy in the Asia-Pacific region. Tourists and visitors to the city are attracted by small businesses in Melbourne's restaurant, retail and entertainment precincts. The city's environmental sustainability is central to its reputation as an attractive place to work and do business.

Cities consume 75 per cent of natural resources globally, and many cities are now taking climate change more seriously as an investment issue as well as an operational issue. The financial ratings agency Moody's recently advised US cities to start addressing climate change or face ratings downgrades.

In 2015, the City of Melbourne decided not to invest in fossil fuels or fossil fuel aligned companies and to call upon our default superannuation fund to create a fossil fuel free investment option. We also decided to consider fossil fuel exposure when awarding our transactional banking contract.¹²

The Investor Group on Climate Change, representing \$2 trillion assets under management, is encouraging companies to manage climate risks. More businesses and investors are positioning to take advantage of the opportunities of a low carbon economy. They are setting science-based emission reduction targets, purchasing renewable energy and divesting from fossil-fuels. Further, company directors are increasingly considering climate change in their decision-making.

These investors and businesses will contribute to our transition to a low carbon economy and increase our economic resilience to the risks of climate change. A low carbon economy supports business activities by generating the highest value for the least emissions. Melbourne's knowledge economy is well positioned: its strengths in professional, technical, scientific and financial services will benefit from the transition to 100 per cent renewable energy and zero emissions buildings.

A circular economy

The concept of a circular economy recognises that the way we currently design many products, buildings, transport systems and cities contributes to wasted resources. Many products generate a lot of waste in their manufacture or transport, are only used once or require excessive packaging. Wasted energy and material resources also go into buildings and car parks that sit vacant. Making urban systems more efficient reduces emissions from the wasted energy used to manufacture and operate inefficient products, buildings and transport.

The principles of a circular economy are to design out waste, keep products and materials in use at their highest value, and preserve and regenerate natural capital. Because of the emissions generated by the manufacture or transport of materials (called "embodied emissions") there is a relationship between our transition to a low carbon economy, and a more

efficient circular economy. Examples include the emissions produced by growing, producing and transporting food, the manufacture of clothing or building products, and the mining and industrial processing of raw materials for buildings and roads.

When we consider all of these "consumption-based" emissions across the city it highlights the action we can take to reduce emissions by choosing sustainable products and reducing emissions through our supply chains.

We need to reduce waste of all kinds and decouple emissions intensity from economic value. Through urban design and planning, cities can support an increase in energy efficient buildings and transport systems and a reduction in both structural and material waste.

¹² Council resolution October 2015 www.melbourne.vic.gov.au/about-council/committees-meetings/meeting-archive/meetingagendaitemattachments/706/1279/oct15%20cc%20agenda%20item%207-4.pdf

2. TAKING BOLD ACTION TOGETHER

"We've developed our Council Pledge as an example to others to use and improve as part of our commitment to local government leadership on climate change."

2.1 City of Melbourne's role

The City of Melbourne is leading by example, demonstrating the possible and sharing the solutions to climate change.

We have taken strong action to reduce emissions from our own operations and to power our buildings with 100 per cent renewable energy. In 2016, we introduced a 15°C science-based target for our operations in our Emission Reduction Plan 2016–2021.¹³ All remaining emissions are offset to enable the City of Melbourne to be a certified Carbon Neutral organisation.¹⁴ However, our operations generate less than one per cent of emissions in the municipality.

We also run many influential programs that aim to reduce emissions from the broader municipality such as CitySwitch and the Melbourne Renewable Energy Project (MREP).

There are many activities in the municipality that we have not traditionally had direct responsibility for such as transport, energy supply, and energy use in privately owned buildings. Using international standards, the emissions from these sources are still measured in the municipality's greenhouse gas accounts.

To address them, we need to work collaboratively with the community, other governments and businesses to investigate new delivery models for renewable energy powered buildings and transport for the municipality. This collaborative approach will achieve the best outcomes for current and future generations.

2.2 Australian and Victorian climate change policy

The City of Melbourne cannot mitigate climate risk for the municipality effectively without supporting action from the Victorian and Australian Governments to reduce greenhouse gas emissions. Unlike some cities in other countries, we do not have the power to regulate building energy performance standards, and we do not currently operate public transport or energy utilities. There are also some limitations to the City of Melbourne's urban planning controls.

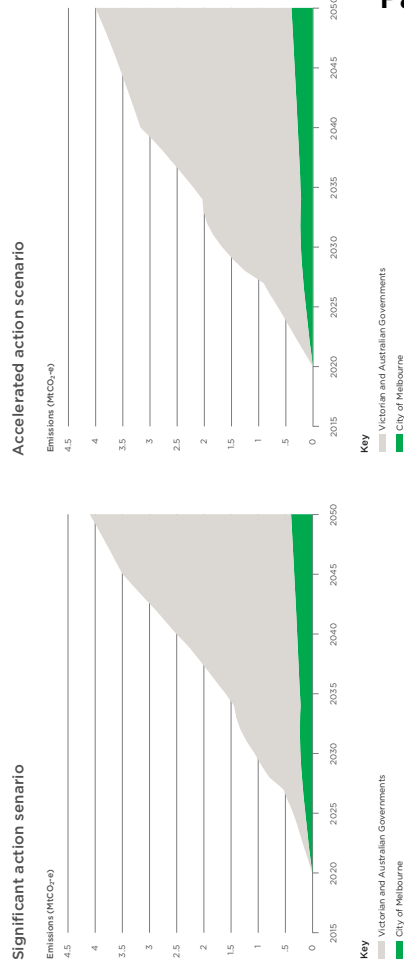
This strategy identifies opportunities within City of Melbourne's control, together with opportunities outside our control, where our role is to advocate and influence.

Figure 6 illustrates the impact that different levels of government can have on Melbourne's emission reductions through their policies.

The graphs show the reductions that can be delivered if an ambitious renewable energy target was set for 2030 and an effective national climate and energy policy implemented.



Figure 4: Potential contribution of Australian and Victorian Government policies to Melbourne's municipal emission reductions 2020–2050



As shown in Figure 4 without policy changes in state and national jurisdictions, the City of Melbourne will not be able to achieve alignment to the Paris Climate Agreement targets. These targets can only be achieved through collaborative action across all three levels of government.

The Victorian *Climate Change Act 2017* provides a framework for local governments to make a voluntary Council Pledge to implement five-year Emission Reduction Plans for the municipality from 1 January 2021. The emission reductions achieved by the priority actions described in this strategy and the implementation plan in Appendix A will fulfil our first Council Pledge by 2025.

¹³ City of Melbourne Emission Reduction Plan for our operations www.melbourne.vic.gov.au/SiteCollectionDocuments/emissions-reduction-plan.pdf

¹⁴ Australian Government Carbon Neutral Program www.environment.gov.au/climate-change/government/carbon-neutral/certified-businesses

2.3 Proposed emission reduction targets

Aligning to the Paris Climate Agreement needs a mix of delivery mechanisms: engaging, facilitating, partnering and collaborating. It also requires taking leadership and advocating for policy change and action from others.

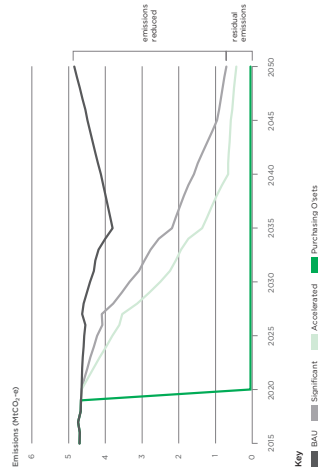
To inform the development of the strategy we analysed four scenarios:

1. Business as Usual
2. Significant Action to reduce emissions
3. Accelerated Action
4. Purchasing Offsets from 2020.

In addition to the actions within the City of Melbourne's powers, both the significant and accelerated action scenarios require investors, businesses and the Victorian and Australian Governments to take action.

The scenarios we analysed are summarised in Figure 7 below. It illustrates the emissions we need to reduce as part of the international effort to stay below a 1.5°C rise in global average temperatures and the residual emissions in 2050 that need to be further reduced or offset.

Figure 5: Scenarios for emission reduction targets



The following table summarises the characteristics of each scenario.¹⁵

Table 2: Analysis of each scenario

SCENARIO	TARGET PER PERSON IN 2030	NET ZERO EMISSIONS	ALIGNED TO PARIS CLIMATE AGREEMENT
1. Business as Usual	22.1 tCO ₂ -e	never	no
2. Significant Action	14.3 tCO ₂ -e	2050	yes
3. Accelerated Action	10.7 tCO ₂ -e	2043	yes
4. Purchasing Offsets	22.1 tCO ₂ -e	2020	no

The City of Melbourne's preferred approach is to deliver the actions needed to achieve the **significant action scenario** and pursue actions for the accelerated action scenario where there is the opportunity to go further.

This will require us to take bold action within our powers, collaborate and advocate for policy change from the Victorian and Australian Governments. Our approach aligns with the Paris Climate Agreement while acknowledging our limited powers and financial resources.

Under the business as usual scenario, the impacts of climate change and missed economic opportunities of transitioning to a low carbon economy will cost AU\$12.6 billion to the municipality's economy by 2050.

By reducing emissions across the municipality, we can reduce the future costs of climate change impacts to the city, while also generating new jobs and business opportunities.

The Significant and Accelerated Action Scenarios provide economic stimulus, generating over 30,000 jobs and over AU\$5 billion in value by 2050. Further explanation of the method used to calculate costs and benefits can be found in Appendix 2.

The estimated cost to the City of Melbourne of the Purchasing Offsets Scenario would be AU\$240 million to AU\$480 million per year.¹⁶ These scenarios do not address the underlying causes of greenhouse gas emissions in the municipality. For the reasons above, the Business and Usual and Purchasing Offsets Scenarios do not appear to be in the best interests of the community.



¹⁵ Ernst & Young (2018). Economic Analysis. Prepared for C40 and City of Melbourne
¹⁶ Ernst & Young (2018). City of Melbourne Climate Action Planning Technical Assistance Synthesis Report p.3.
 The estimated cost of offsets in 2020 was converted to Australian dollars.

Residual emissions and the role of offsets

The calculations for the Significant and Accelerated Action Scenarios do not reduce emissions to zero by 2050 because a small amount of residual emissions will still be generated. For example, not all emissions from waste management facilities are likely to be reduced to zero. Our scenario modelling is based on current technology and focussed on the largest system-wide changes needed for Melbourne. It is likely that new solutions and technology will emerge over the next decade to reduce emissions even further in all sectors. Beyond that, any remaining emissions will need to be offset to achieve net zero emissions.

Offsets also provide important environmental, social and economic benefits for reducing emissions in remote and regional Australia, and in many other countries. However, achieving emission reductions through purchasing offsets alone will not address the systemic causes of greenhouse gas emissions or achieve the full extent of benefits for Melbourne residents and businesses.

According to the World Bank, carbon offsets are expected to increase in cost exponentially beyond the year 2020 because the many countries signed up to the Paris Agreement will suddenly increase international demand for offsets.

It is anticipated that by 2025 there will be less uncertainty about the role of offsets and better estimates of potential costs as the international carbon market develops. Therefore, we will continue to monitor and review the role of offsets for residual emissions as part of our implementation plan.

The emission reduction targets that the Significant and Accelerated Action Scenarios could achieve in 2025, 2030 and 2050 are presented in the tables below. Both scenarios align to the Paris Climate Agreement.

Table 3: Emission Reduction Targets: Significant Action Scenario

Baseline		SIGNIFICANT ACTION SCENARIO		
	2015	2025	2030	2050
Absolute/Residual emissions	4.7 MtCO ₂ -e	4.2 MtCO ₂ -e	3.4 MtCO ₂ -e	0.5 MtCO ₂ -e
% reduction on 2015		10%	29%	90%
Per capita emissions	33.8 tCO ₂ -e	20.2 tCO ₂ -e	14.3 tCO ₂ -e	1.3 tCO ₂ -e

Table 4: Emission Reduction Targets: Accelerated Action Scenario

Baseline		ACCELERATED ACTION SCENARIO		
	2015	2025	2030	2050
Absolute/Residual emissions	4.7 MtCO ₂ -e	3.7 MtCO ₂ -e	2.4 MtCO ₂ -e	0.2 MtCO ₂ -e
% reduction on 2015		21%	50%	94%
Per capita emissions	33.8 tCO ₂ -e	17.7 tCO ₂ -e	10.2 tCO ₂ -e	0.7 tCO ₂ -e



Figure 6: Significant emission reduction scenario 2020-2050

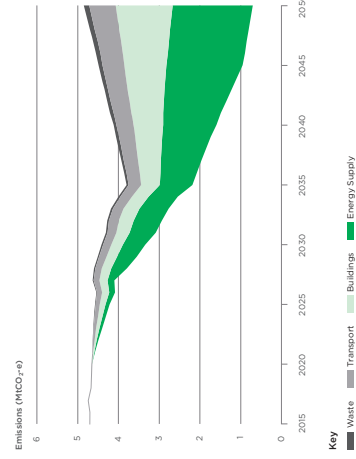
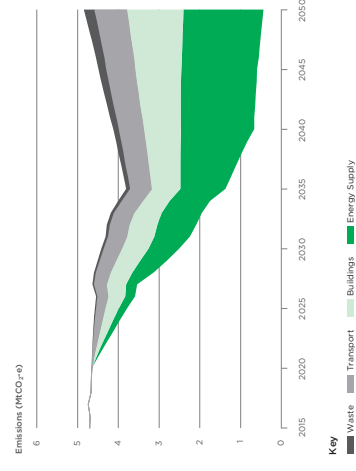


Figure 7: Accelerated emission reduction scenario 2020-2050



3. STRATEGIC PRIORITIES

"To ensure emissions are reduced as rapidly as possible, we need to put the most effort into reducing the largest sources of emissions that we can control or influence."

3.1 Where should we direct our effort?

We analysed opportunities for transformational actions relating to the major sources of emissions in the city: energy supply, buildings, transport and waste. We calculated the potential to reduce emissions from each potential action by 2025, 2030 and 2050.

To identify new ideas we investigated:

- priorities identified in the Future Melbourne community process
- actions taken by other cities around the world
- policy settings of the Victorian and Australian Governments
- climate impacts
- changes in technology
- demographics and urban densification trends
- business and economic trends
- potential to contribute to the Sustainable Development Goals.

3.2 Strategic priorities

Our actions align with four strategic priorities:

1. 100 per cent renewable energy
2. zero emissions buildings and precincts
3. zero emissions transport
4. reduce the impact of waste.

We aim to reduce the largest sources of emissions in the municipality. This will align with the requirements of the C40 Climate Action Plan Framework and achieve our science-based targets. We have included actions we can implement directly as well as those we need to collaborate on and advocate for. The strategy demonstrates our support for social inclusion and contributes to achieving the Sustainable Development Goals.

In implementing the strategy we will:

- consider climate adaptation and mitigation in an integrated way, identifying interdependencies to maximise efficiencies and minimise investment risk
- deliver environmental, social and economic benefits to the community
- take an innovative, transparent and evidence-based approach to evaluate and report our progress.

STRATEGIC PRIORITY 1: 100 PER CENT RENEWABLE ENERGY

"Local governments have demonstrated leadership for many years by bargaining with energy companies to facilitate lower cost renewable energy for the community in the form of solar panels and GreenPower."

The story so far

The Melbourne Renewable Energy Project (MREP) was a game-changing initiative led by the City of Melbourne. Bringing together some of Melbourne's leading businesses, universities, local governments and public institutions, the City of Melbourne developed an Australian first group Power Purchase Agreement. This commitment to purchase our power from a new renewable energy development enabled the construction of a 39 turbine windfarm at Crowlands, about two hours from Melbourne in regional Victoria. This project alone will increase renewable energy in the city by 3 per cent in addition to the 18 per cent currently adopted.¹⁷

Local governments have demonstrated leadership for many years by bargaining with energy companies to facilitate lower cost renewable energy for the community in the form of solar panels and GreenPower. Property owners and businesses have also benefitted from policies such as feed-in tariffs, solar rebates, and renewable energy targets implemented by Victorian and Australian Governments. These programs have contributed greatly to the uptake in renewable energy and the rapid reduction in market cost.

In the past, the higher cost of renewable energy meant purchasing solar panels and GreenPower was more expensive than standard electricity. However the costs of renewable energy have now reduced significantly, while the cost of ordinary electricity and gas has increased. This particularly affects some of our more vulnerable residents.



Challenges

While a proportion of property owners enjoy the benefits of solar power on their rooftops, access can be limited for people who are renting or living in apartments. The upfront cost of purchasing solar panels and storage systems can be a barrier, and for renters, permission is needed from their landlords. There is also uncertainty about the reliability of new technology such as storage. An alternative to installing renewable energy directly is to purchase renewable energy or carbon neutral certified electricity from an energy retailer. One of the challenges with this approach is consumer confidence that the environmental claims are genuinely reducing emissions.

In previous years, we trialled programs to support the installation of solar panels on commercial buildings. It was challenging to find suitable commercial sites for installation due to overshadowing from surrounding buildings, and regulations that made connection to the electricity grid and distribution to neighbouring properties difficult. One of the drivers for increasing electricity bills has been the fixed network and distribution charges that cannot be reduced by saving energy at home.

Investment in new renewable energy is being driven by the commitments of state governments, including the 2016 Victorian Government commitment to 40 per cent renewable energy by 2025. Without a commitment to a further renewable energy target for 2030 or science-based emission reduction targets in a national climate and energy policy, the investment needed in renewable energy is likely to stall. This would result in investor uncertainty and higher electricity prices.

¹⁷ www.ta.org.au/sites/default/files/National%20Energy%20Emissions%20Audit%20-%20Electricity%20Update%20July%202018.pdf

Strategic opportunities

To achieve our emission reduction goals, the city's buildings, precincts and transport need to be electrified and powered by 100 per cent renewable energy. This requires a transition away from gas, petrol, diesel and coal. It will generate investment opportunities in clean energy infrastructure. New and exciting technologies are being developed and present important opportunities for the City of Melbourne to harness and promote.

The influence of the Melbourne Renewable Energy Project has greatly accelerated the uptake of renewable energy in recent years. New analysis shows that nationally, a third of the contribution to the Australian Renewable Energy Target scheme is from corporate power purchase agreements.¹⁸ We can continue to amplify the impact of the Melbourne Renewable Energy Project to contribute to future Victorian and Australian Government renewable energy targets.

The development of a virtual renewable energy power plant or facilitation of renewable energy purchases for residents could help share the benefits of the renewable energy transition with people who live in apartments as well as stand-alone houses. We can also provide residents with information on how to access Victorian Government programs to increase the uptake of renewable energy, reduce barriers to install solar panels and batteries and assist renters.

Another type of virtual power plant or solar garden is a larger scale installation of solar panels and storage on a public building or a vacant rooftop with benefits flowing to nearby residents. Some communities have also developed community energy projects where residents or businesses purchase a share in, or energy from, a large scale renewable energy development outside the municipality. The energy generated is then directly counted against residents' energy use. We could also drive innovation by engaging university researchers in trialling new technology or holding design competitions.

Table 5: Strategic priority 1 Actions modelled

ACTIONS MODELLED	SCENARIO	EMISSIONS REDUCTION	DISCOUNTED BENEFITS (\$ MILLION)	DISCOUNTED COSTS (\$ MILLION)	BENEFIT-COST RATIO
<ul style="list-style-type: none"> Facilitate and support corporate Power Purchase Agreements Facilitate residential purchasing of renewable energy products Advocate for a more ambitious renewable energy target 	Significant	28.9 MtCO ₂ -e	756.55	15.70	48.18
	Accelerated	34.5 MtCO ₂ -e	1513.52	31.79	47.60

¹⁸ www.energetics.com.au/insights/thought-leadership/corporate-ppas-deliver-34-of-generation-capacity-required-under-the-rt/

The decreasing cost of renewable energy and the increasing cost of gas and coal-fired electricity has also generated community support for renewable energy and employment opportunities for regional Victorians. There is a growing consensus from investors, energy companies, and businesses that renewable energy is needed to replace coal-fired power stations. The City of Melbourne could amplify this by advocating for ambitious renewable energy targets in Victorian and Australian Government policy.

The environmental, social and economic benefits of taking action

The benefits of taking action on energy include:

- increased energy security
- increased local employment
- reduced health impacts from air pollution
- reduced ecosystem impacts from air pollution
- reduced ecosystem impacts from coal mining.

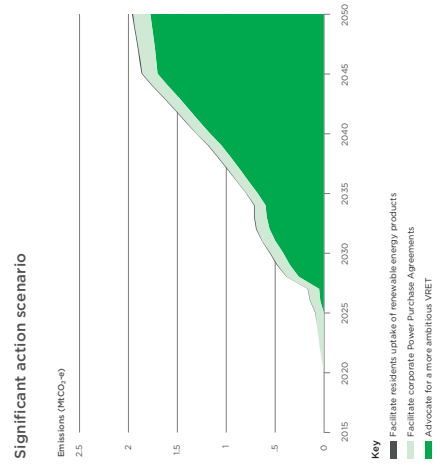
The table below outlines the actions we modelled against the significant action and accelerated action scenarios and the 'discounted benefits' - the benefits to the community compared to the business as usual scenario.



In both the significant and accelerated action scenarios, the majority of the abatement potential to 2050 is associated with advocating and achieving a more ambitious renewable energy target. In the accelerated action scenario, the higher ambition relating to facilitating corporate power purchase agreements is evident. Renewables penetration of the electricity grid reaches 100 per cent in 2040 under the accelerated action scenario and in 2045 under the significant action scenario.

The figures below show the abatement potential associated with each energy supply action under the significant and accelerated action scenarios.

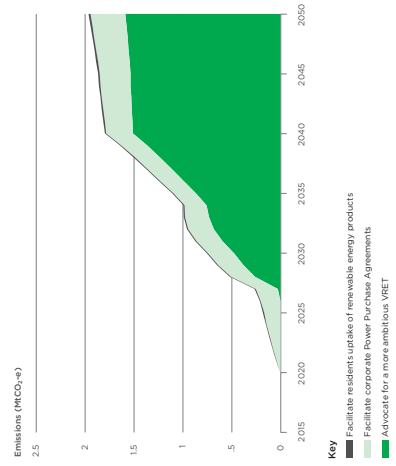
Figure 8: Emission reductions potential of energy supply actions



Case study: 100 per cent renewable energy for the Australian Capital Territory

In 2016 the Australian Capital Territory (ACT) set a bold target for the territory to be powered by 100 per cent renewable electricity by 2020. It is part of the ACT Climate Strategy to achieve net zero emissions by 2045 or earlier. Electricity and transport are the major contributors to the ACT's emissions. The ACT Government is increasing public transport use to lower emissions from driving personal cars. Many government agencies also use electric vehicles and hybrids as part of their vehicle fleet. The ACT Government is currently considering whether to apply a monetary value on any emissions above their target and reinvest these funds in emission reduction measures.

Accelerated action scenario



Case study: Melbourne renewable energy project

The Melbourne Renewable Energy Project (MREP) is a world first. The City of Melbourne partnered with 13 local governments, cultural institutions, universities and corporations to collectively purchase renewable energy. This commitment to purchase power from a renewable energy development enabled the construction of a new 39 turbine, 80 MW capacity wind farm at Crowlands, Ararat. This project alone will increase renewable energy in by 3 per cent. It also produced a guide to help other organisations pursue power purchase agreements, which is further accelerating the uptake of renewable energy as a power source. The project won the prestigious Premier's Sustainability Award in 2018.

Strategic priority 1 – Actions

- 1.1 Advocate for a more ambitious renewable energy target and changes to the National Electricity Rules.
- 1.2 Accelerate corporate Power Purchase Agreements.
- 1.3 Facilitate residential purchasing of renewable energy products.
- 1.4 Facilitate a virtual power plant or solar gardens for residents or small businesses.
- 1.5 Collaborate with other cities, investors, superannuation companies to accelerate investment from fossil-fuel energy supply.
- 1.6 Partner with businesses, universities, healthcare services and other organisations to promote innovative renewable energy technology and research.

The implementation of these actions is subject to the City of Melbourne's Annual Plan and Budget process.



STRATEGIC PRIORITY 2: ZERO EMISSIONS BUILDINGS AND PRECINCTS

"In the last five years, we have achieved a 24 per cent reduction in emissions across our building portfolio."

The story so far

The City of Melbourne developed Australia's first new 6-star Green Star rated office building in 2006 called Council House 2. This building trialled new energy saving technology, sustainable materials and a green roof garden. From January 2019, it will be powered by 100 per cent renewable energy as a result of the Melbourne Renewable Energy Project. Over the last decade, we have integrated the lessons learnt across our portfolio of public and community buildings including the Library at the Dock and the Queen Victoria Market precinct renewal.

In the last five years, we have achieved a 24 per cent reduction in emissions across our building portfolio. We have undertaken energy saving upgrades and retrofits in existing buildings, including a number of heritage listed buildings such as the Melbourne Town Hall.

We have also collaborated with apartment owners and tenants, and the commercial property sector to drive improved environmental performance. The 1200 Buildings program helped to inform building owners how to drive energy efficiency and retrofit activity in existing buildings. CitySwitch is a national program delivered in partnership with the Cities of Sydney, North Sydney, Willoughby, Adelaide, Perth and the New South Wales Office of Environment and Heritage. It achieved an emissions reduction of 667,000 tonnes of CO₂e in 2017 and won an international C40 award.

The City of Melbourne and the City of Stockholm co-lead the C40 Cities Low Carbon Districts and Climate Positive network. This international network of cities collaborates on precinct-scale solutions. In 2013, we expanded our local planning policy for sustainable office buildings to include all types of property development.

We are working with Victorian Government partners to introduce net zero emissions targets for urban renewal precincts such as Fishermans Bend and Arden, and to incorporate these into planning and implementation.

Challenges

Buildings generate 73 per cent of emissions in the municipality, mainly because the majority use energy from coal-fired power in the Latrobe Valley. Gas is another source of building emissions. Until the transition is made away from gas, having a 100 per cent renewable electricity system will still result in buildings generating emissions.

Long-term trends in population growth and urban densification mean that Melbourne is in the greatest property development boom since the 1850s gold rush. Apartment buildings are already the most common type of residence and they are growing at a rapid rate. The buildings developed today will still be part of our city in 2050.

Melbourne's buildings are not as efficient as they could be and benchmarks for measuring the performance of the city's building portfolio are not fully developed, especially for apartments. This means residents do not have information about the building's energy performance before moving in, which can lead to unexpected high energy bills. For people living in apartments, it can be a challenge negotiating changes with the body corporate. For renters this is especially challenging, because they cannot retrofit their homes to improve energy performance, and their landlords are not incentivised to ensure homes are energy efficient. A similar challenge exists with commercial office buildings because landlords can pass on the costs of higher energy bills to corporate tenants.

Because buildings retain heat they also contribute to the urban heat island effect. This can make poorly designed buildings uninhabitable if there is a power cut during a heat wave. Heat waves are occurring more frequently due to climate change as summer temperatures become more extreme.

The social impacts of building thermal performance during heatwaves and extreme weather need to be considered because some members of our community, young families, older people and those vulnerable due to health problems are more at risk. Low income households and renters have less ability to retrofit their homes to save energy and stay cool. Energy security and heatwaves also affect workers and business operations.



Strategic opportunities

By collaborating with industry, the City of Melbourne can accelerate emission reductions from buildings across the city. The Green Building Council of Australia's Carbon Positive Roadmap aligns the future energy performance of buildings to the Paris Climate Agreement. It has set an objective for new commercial buildings to achieve carbon neutrality by 2030, and existing commercial buildings to achieve carbon neutrality by 2050.

The industry-led Australian Sustainable Built Environment Council is advocating for the National Construction Code to be urgently updated so that new buildings are fit for a zero carbon future. The construction sector can improve the energy efficiency and thermal performance of buildings and integrate renewable energy into building fabric. This will reduce emissions and help the community adapt to climate change.

Shifting our focus from individual buildings to sector-wide engagement and precinct-scale development will help deliver emission reductions through long-term infrastructure, urban renewal and planning policy. Over time, existing buildings will need to be upgraded and by ensuring new buildings are built to a higher standard it will lock in future energy savings.

Applying the principles of the circular economy means buildings should be designed to provide multiple functions over their life-span, the emissions generated by building materials need to be reduced and used building materials need to be upcycled.

The environmental, social and economic benefits of taking action

The benefits of taking action on buildings include:

- energy security
- increased asset values of buildings
- urban biodiversity from green roofs
- reduced health impacts from air pollution
- increased productivity
- increased thermal comfort
- increased disaster resilience
- reduced water consumption/sewage production
- reduced urban heat island effect.

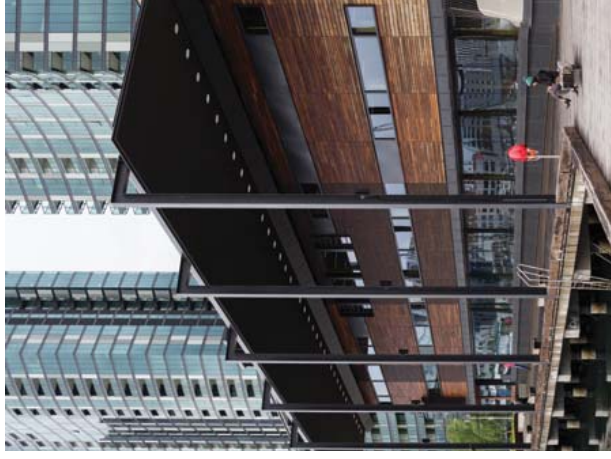
Built to Perform, a report by Climate Works Australia and the Australian Sustainable Built Environment Council, shows that setting stronger energy standards for new buildings in the National Construction Code could reduce energy bills by up to AU\$27 billion. It could cut energy network costs by up to AU\$7 billion and deliver at least 78 million tonnes of cumulative emissions savings between now and 2050.¹⁹

The table below outlines the actions we modelled against the significant action and accelerated action scenarios and the 'discounted benefits' - the benefits to the community compared to the business as usual scenario.

Table 6: Strategic priority 2 Actions modelled

ACTIONS MODELLED	SCENARIO	CUMULATIVE ABATEMENT POTENTIAL BY CATEGORY	DISCOUNTED BENEFITS (\$ MILLION)	DISCOUNTED COSTS (\$ MILLION)	BENEFIT-COST RATIO
<ul style="list-style-type: none"> • Advocate and facilitate a transition from gas to electricity • Facilitate and advocate to ensure all existing residential buildings are zero net by 2050 • Facilitate and advocate to ensure all existing commercial buildings are zero net by 2050 • Take action, collaborate and advocate to ensure all new residential buildings are zero net by 2030 • Take action, collaborate and advocate to ensure new commercial buildings are zero emissions by 2030 	Significant	16.3 MtCO ₂ -e	4103.93	2209.44	1.86
		33.6 MtCO ₂ -e	6031.80	2752.55	2.19

¹⁹ ASBEC and ClimateWorks Australia 2018. Built to Perform: An Industry Led Pathway to a Zero Carbon Ready Building Code www.asbec.asn.au/research-items/built-to-perform/

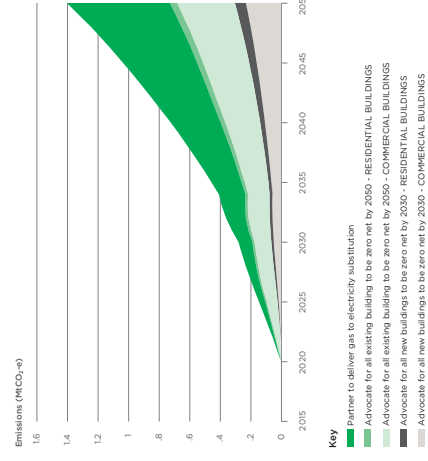


Case study: Greening our buildings

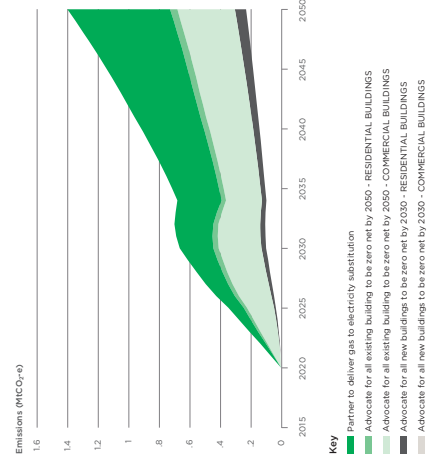
The Council House 2 is Australia's first 6 Star Green Star building. The office building is 10 storeys and houses around 600 employees. It includes sustainable materials, water and energy saving technology, a green roof garden and bike storage and changing facilities in the basement to promote cycling. Energy consumption per employee in Council House 2 is less than half of consumption in Council House 1, which was built in 1970. The City of Melbourne has progressively increased the number of Green Star-rated buildings in our portfolio. Examples include East Melbourne Library, Art Play, and Library at the Dock, which was awarded 6 Star Green Star for its design.

Figure 9: Zero emissions buildings and precincts

Significant action scenario



Accelerated action scenario



STRATEGIC PRIORITY 3: ZERO EMISSIONS TRANSPORT

Our long-term aim is that new and existing commercial and residential buildings become carbon neutral by 2050 at the latest. This ambition is aligned to the Green Building Council of Australia's Carbon Positive Road Map.

Strategic priority 2 – Actions

- 2.1 Demonstrate innovative carbon positive design and operation of City of Melbourne-owned buildings and precincts.
- 2.2 Partner with industry, Victorian and Australian Government agencies to reduce barriers and deliver zero emissions buildings and urban renewal precincts.
- 2.3 Accelerate existing energy efficiency programs for commercial buildings and tenants through CitySwitch and other partnerships.
- 2.4 Advocate for energy performance disclosure for a greater range of commercial and residential buildings.
- 2.5 Facilitate the take up of the National Built Environment Rating Scheme for apartments across the municipality.
- 2.6 Renew and implement planning policies to support the development of zero emissions buildings and precincts.
- 2.7 Partner with industry to advocate for higher energy performance standards in the National Construction Code, the *Building Act 1993* and regulations.
- 2.8 Advocate and facilitate to transition from gas to electricity in buildings and precincts.
- 2.9 Adopt circular economy principles to reduce the environmental impact and embodied emissions from products, materials and buildings across the city through procurement, urban design and planning.

The implementation of these actions is subject to the City of Melbourne's Annual Plan and Budget process.



"Transport accounts for 15 per cent of the city's emissions, the majority from private cars and freight that drive across the city."

The story so far

Public transport into the city also contributes to Melbourne's emissions profile. The city's trams will soon be powered by solar energy, yet trains still source their power from by coal-fired power.

Melbourne has a large week day population of around 900,000 people, including workers, tourists and residents, who cycle, use public transport, and drive to the city from the surrounding suburbs.

Our city also has an extensive network of pedestrian laneways that contribute to Melbourne's retail and café culture. Swanston and Bourke streets are partially closed to traffic and they support major retail precincts in the city. Many people enjoy walking and recreation in public parks and gardens. However, cycling levels remain static, and cycle routes across the city are patchy.

The Victorian Government has invested in major new rail infrastructure for Melbourne. The City of Melbourne is actively involved in planning the public space and infrastructure needed to support pedestrian access to the new train stations.



Challenges

Melbourne already experiences significant overcrowding at various locations due to substantial growth in the number of people walking, and limited pedestrian space. Footpaths need to be widened in the municipality to cater for the number of pedestrians. Currently, at the street-level, more public space is allocated to driving and parking cars than walking and cycling, even though the number of people walking and cycling is far greater.

One of the biggest barriers to increasing the proportion of people riding bicycles is safety. Current routes with dedicated cycle lanes are poorly connected. Having only a few physically protected lanes contributes to an unnecessarily stressful experience for people riding bicycles in Melbourne.

While public transport services within the city are popular, particularly the free trams in the central city, there are some barriers to more people using public transport. Barriers include overcrowding which makes journeys uncomfortable and long waiting times for buses and trains travelling into the city from Greater Melbourne and regional areas. Many people drive to reduce their travelling time. A accessibility of public transport is also an important consideration for people with a disability and those with young families.

As climate change becomes more severe, the city needs to prepare for the impact of increased temperatures, flood and drought on people walking, cycling and using public transport. Increasing green infrastructure can cool the city, reduce the impact of floods and provide shade and respite for people while they are travelling around the city. Particular attention can be given to intersections exposed to direct sun, which become hotspots during heatwaves. Priority could be given to people walking, riding bicycles and using public transport at these intersections, reducing waiting times and exposure to the weather.

The majority of transport emissions are still from private cars and freight vehicles that drive across the city. In the short term, the electrification of vehicles will increase emissions until there is adequate supply of renewable energy in the electricity grid. In the long term, cars, buses and commercial vehicles will need to be powered by 100 per cent renewable energy to reduce emissions in line with the Paris Climate Agreement. This will also improve air quality.

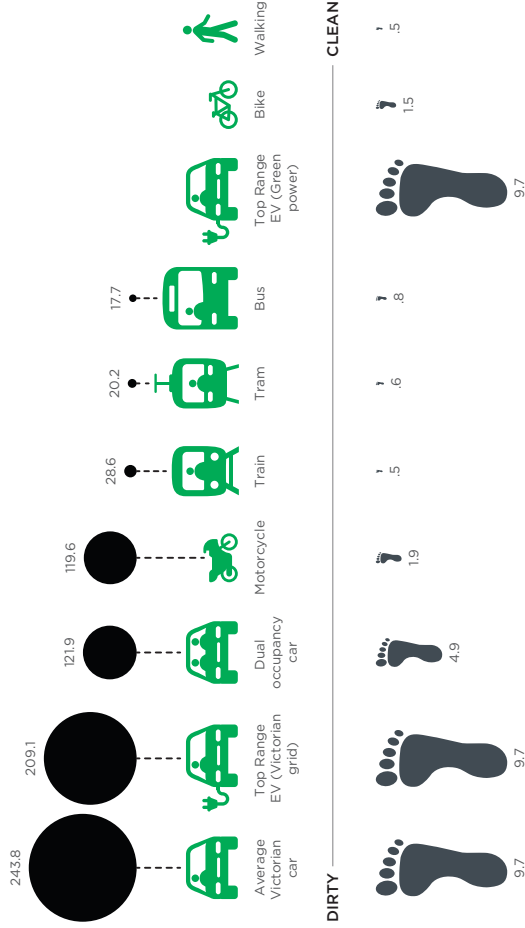
Strategic opportunities

Melbourne's rapid population growth means investment in the Melbourne Metro project will only keep up with demand for train travel.

Substantial investment in walking, cycling and public transport, and better use of existing infrastructure, is needed to reduce transport emissions and meet Melbourne's growth. The City of Melbourne's Transport Strategy Refresh is reviewing options to allocate more public space for people walking and cycling.

Trains and trams are the original electric vehicles. The Victorian Government recently delivered solar energy to power Melbourne's tram network, however trains are still powered by coal-fired power. In the future, these could be powered by 100 per cent renewable energy.

Figure 10: Emissions from different transport modes



Key

- Grams of CO2 per person kilometre travelled
- Space in square metres required per occupant



The environmental, social and economic benefits of taking action

The benefits of taking action on transport include:

- increased energy security
- reduced health impacts from air pollution
- reduced health impacts from noise
- reduced urban congestion
- reduced travel time
- increased road safety.

A combination of a reduction in air pollution from less vehicles on the road, a shift to active transport and a switch to electric vehicles presents considerable health savings. Health savings due to Quality-Adjusted Life-Years²⁰ gains from reduced pollution could be up to \$120 billion for the accelerated scenario. Increased walking is estimated to produce accumulated savings of up to \$6 billion in an accelerated scenario and up to \$3.5 billion in a significant scenario.

The table below outlines the actions we modelled against the significant action and accelerated action scenarios and the 'discounted benefits' - the benefits to the community compared to the business as usual scenario.

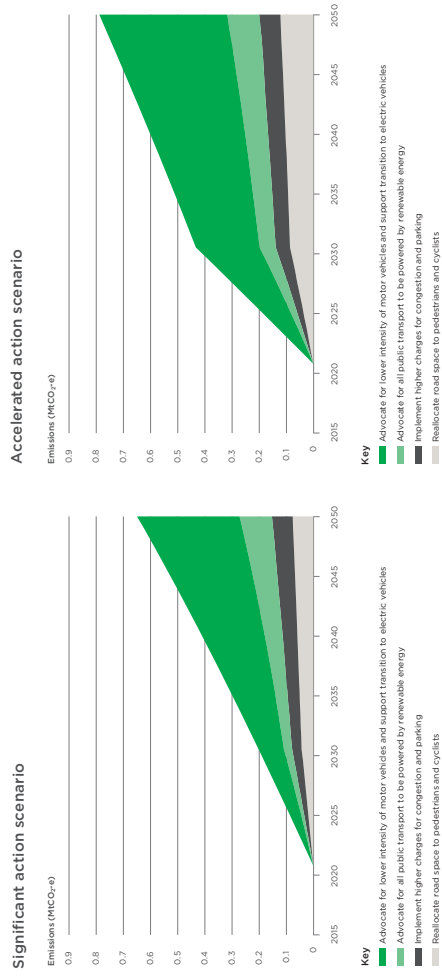
Table 7: Strategic priority 3 Actions modelled

ACTIONS MODELLED	SCENARIO	YEAR	EMISSIONS REDUCTION	DISCOUNTED BENEFITS (\$ MILLION)	DISCOUNTED COSTS (\$ MILLION)	BENEFIT-COST RATIO
<ul style="list-style-type: none"> • Reallocate road space for walking, and cycling • Implement higher charges for congestion and parking • Advocate for public transport to be powered by renewable energy 	Significant	2050	9.7 MtCO ₂ -e	129.15	9.78	13.21
<ul style="list-style-type: none"> • Advocate for lower intensity of motor vehicles and support transition to electric vehicles 	Accelerated	2050	14.7 MtCO ₂ -e	227.96	16.60	13.73

²⁰ The Quality-Adjusted Life-Year is a generic measure of disease burden, including both the quality and the quantity of life lived. It is used in economic evaluation to assess the value for money of medical interventions.



Figure 11: Transport accelerated action scenario



Strategic priority 3 – Actions

- 3.1 Reallocate road space to create more space for walking, cycling and green infrastructure.
 - 3.2 Prioritise active and public transport through dedicated lanes, traffic light priorities, parking controls and road user pricing.
 - 3.3 Advocate for efficient public transport to be powered by renewable energy.
 - 3.4 Advocate for the Victorian Government to extend train, tram and bus services.
 - 3.5 Advocate for lower carbon intensity motor vehicles and support transition to electric vehicles.
- The implementation of these actions is subject to the City of Melbourne’s Annual Plan and Budget process.

Case study:

Solar powered trams

In 2017, the Victorian Government ran a tender to help build new large scale solar farms, of which 35 MW will be linked to power Melbourne’s tram network. This initiative will reduce more than 80,000 tonnes of greenhouse gas emissions every year to cover 493 trams, and 24 routes across greater Melbourne.

Congestion prices in Stockholm

Since Stockholm introduced permanent congestion charges in 2007, use of cars and other vehicles has reduced significantly. As a result, carbon dioxide emissions have decreased by 10 to 15 per cent across the inner city, and by 2 to 3 per cent in the metropolitan area. Air quality has improved and there has been an estimated reduction in premature deaths of 25 to 30 annually.

STRATEGIC PRIORITY 4: REDUCING THE IMPACT OF WASTE

"The vast majority of waste is generated by business activities, which is collected by private operators. These waste streams have relatively high rates of recycling."

The story so far

More than 800,000 tonnes of waste (including garbage and recycling) is estimated to be generated in the municipality each year. The total waste produced generated 6 per cent of the greenhouse emissions from our municipality in 2015. Emissions from waste are included in our greenhouse inventory even though waste treatment facilities are currently located outside our municipal boundary.

The vast majority of waste is generated by business activities, which is collected by private operators. These waste streams have relatively high rates of recycling. The recycling rate is around 61 per cent for commercial and industrial waste, and 87 per cent for construction and demolition waste.

Only 6 per cent of all waste is collected by the City of Melbourne. The recycling rates are lower for the much smaller volume of waste collected from households (25 per cent) and public places (22 per cent).

The City of Melbourne's Waste and Resource Recovery Strategy aims to develop and introduce cost effective, environmentally responsible waste and resource recovery systems. The strategy is underpinned by waste hierarchy and circular economy thinking. A circular economy approach designs out waste wherever possible and keeps materials in use as long as possible through repair and reuse. It then returns materials to the economy through efficient recycling processes.

The Victorian Government sets policy for metropolitan waste and resource recovery including landfill levies, and funds waste and resource recovery programs through Sustainability Victoria.

Challenges

Waste generated in the municipality is expected to grow as Melbourne's population increases over coming decades. The City of Melbourne is responsible for collection and recycling or disposal of waste from our operations, residents and public places such as streets and parks. We do not have the responsibility for waste collection from restaurants, offices or businesses with commercial waste contracts.

State and local governments across Australia have been impacted by the changes in global recycling markets since early 2018. Councils are facing increased costs as a result of the Chinese Government's decision to tighten standards for the import of recycled materials.

Strategic opportunities

In 2017 the Australian Government released a National Food Waste Strategy with a goal to halve the nation's food waste by 2030. Organic waste is a priority because it generates greenhouse emissions twenty-five times more intense than their global warming potential than carbon dioxide. By promoting the health benefits of smaller portion sizes and supporting social enterprises to make use of leftover food, we can help to reduce food waste and cut emissions.

There is growing community support for reducing waste as a measure to address climate change. The Victorian Government recently committed to implement a ban on single use plastic bags, which has already been introduced in other states. The South Australian Government has introduced container deposit legislation to encourage the recycling of bottles and cans. The Australian Government has the power to regulate packaging standards that could significantly reduce waste.

A large proportion of materials that are sent to landfill can be reduced through better design and less packaging. Developing new products from recycled materials including building materials can also contribute to reduced emissions and a circular economy. This would also build local capability for recycling rather than relying on overseas recycling markets.



The environmental, social and economic benefits of taking action

The benefits of taking action to reduce the impact of waste include:

- improved amenity and reduced noise
- neighbourhood cooperation and participation
- improved health outcomes from better outdoor air quality
- waste education benefits.

Actions that promote community engagement and education to divert waste from landfill can contribute to neighbourhood participation, which could be worth up to \$26 million by 2050.

Table 10 below outlines the actions we modelled against the significant action and accelerated action scenarios and the 'discounted benefits' - the benefits to the community compared to the business as usual scenario. The economic analysis is based on the macroeconomic benefits of reducing greenhouse emissions from waste. It does not include the analysis of waste treatment technology.

Table 8: Strategic priority 4 Actions modelled

ACTIONS MODELLED	SCENARIO	CUMULATIVE ABATEMENT POTENTIAL BY CATEGORY	DISCOUNTED BENEFITS (\$ MILLION)	DISCOUNTED COSTS (\$ MILLION)	BENEFIT COST RATIO
<ul style="list-style-type: none"> • Divert commercial and industrial waste from landfill: 70 per cent significant, 75 per cent accelerated • Divert residential waste from landfill: 30 per cent significant, 85 per cent accelerated 	Significant	4.3 MtCO ₂ -e	444.33	36.37	12.22
	Accelerated	7.5 MtCO ₂ -e	741.24	71.57	10.36

Case study: Diverting food waste from Degraeves Street cafes

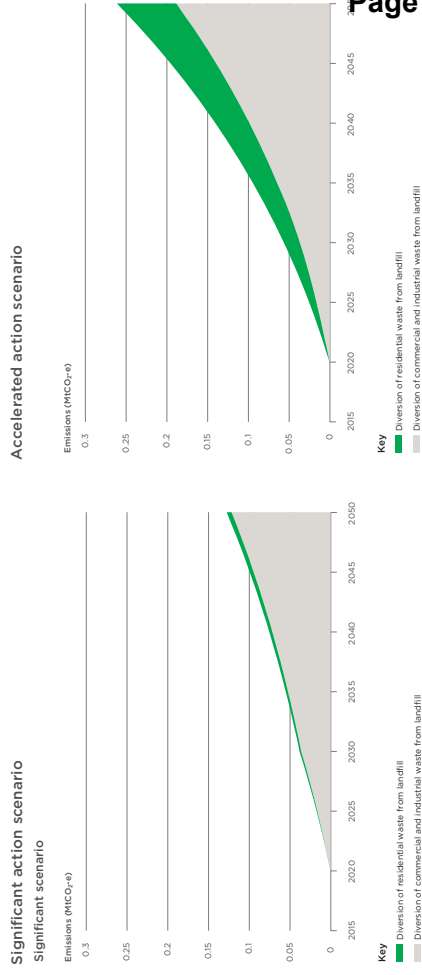
One of Melbourne's most iconic laneways is now one of its greenest, thanks to the Degraeves Street Recycling Facility. Waste audits at Degraeves Street indicated that 90 per cent of waste was either recycling or food waste and could be diverted from landfill. So in collaboration with local businesses, the City of Melbourne introduced a shared commercial recycling program and a food dehydrator to turn food waste into a compost-like soil conditioner. The program successfully diverted 237,600 litres of recyclable material from landfill. The organic waste was treated on site and used in the city's parks and gardens. Businesses on Degraeves street also noticeably improved their efforts to reduce waste.

Strategic priority 4 – Actions

1. Continue to promote and facilitate waste avoidance, recycling, recovery and diversion of waste from landfill by implementing the City of Melbourne's Waste and Resource Recovery Strategy.

The implementation of these actions is subject to the City of Melbourne's Annual Plan and Budget process.

Figure 12: Waste emissions reduction potential



4. HOW WE WILL IMPLEMENT THE STRATEGY

"We have developed a rolling five-year implementation plan to meet the requirements of a voluntary Council Pledge under the Victorian Climate Change Act 2017."

Our actions to reduce emissions will be evidence-based and we will report our progress publicly. The actions within our powers are bold and ambitious. We have also outlined policy changes and actions needed by the Victorian and Australian Governments. The strategy demonstrates our support for social inclusion and contributes to achieving our Sustainable Development Goals.

We have developed a rolling five-year implementation plan to meet the requirements of a voluntary Council Pledge under the Victorian *Climate Change Act 2017*. The implementation plan sets interim targets to be met by 2025. It will enable us to adjust our approach as Victorian and Australian Government policy settings change or if the shift to renewable energy technology occurs more quickly than expected.

In implementing the strategy we will:

- consider climate adaptation and mitigation in an integrated way, identifying interdependencies to maximise efficiencies and minimise investment risk
- deliver environmental, social and economic benefits to the community
- take an innovative, transparent and evidence-based approach to evaluate and report our progress.

4.1 Consider climate adaptation and mitigation in an integrated way

Climate change affects our health, particularly the health of young and older people and vulnerable members of our community. It will impact future generations of Melbourne and the long-term environmental, social and economic interests of the municipality.

Managing climate risk requires public institutions, investors and businesses to reduce emissions as part of their social license to operate. It also requires managing the impacts of climate change on people, assets and infrastructure and business operations. Heatwaves causing power outages in buildings and public transport is an example of how climate change adaptation and energy supply issues can cause negative consequences for the community.

Melbourne is already experiencing the impacts of climate change. Drought, flooding and extreme heatwaves have been occurring more frequently and the impacts have become more severe. Experts warn that these impacts will continue to worsen in the next few decades. We updated our Climate Change Adaptation Strategy in 2017 to respond to these challenges. It identifies climate risks and sets actions and priorities to ensure we adapt well to the impacts of climate change.

The Climate Change Mitigation Strategy to 2050 will complement and mutually reinforce the priorities of our Climate Change Adaptation Strategy.

The Climate Change Adaptation Strategy includes five goals:

1. Enhance natural environment and green spaces in our municipality.
2. Shape our built form and urban renewal areas to withstand future climate change impacts.
3. Strengthen the resilience of our inclusive, family friendly and culturally diverse community.
4. Protect and enhance our diverse economy.
5. Continue to build Melbourne's adaptation capabilities and expertise.

It is supported by the Total Watermark Strategy, which integrates water management across the municipality in response to increased drought and flooding; and the Urban Forest Strategy, which addresses the impact of drought and the rising temperature associated with the urban heat island effect. The Nature in the City Strategy aims to improve the health of animal and plant populations including their resilience to climate change impacts. These strategies use nature-based solutions to help cool our city on hot days, which improves liveability, resilience and community health. It also helps to reduce the heat load on buildings during summer, reducing the energy needed for air conditioning and peak demand on the electricity grid.

As part of our implementation plan for this strategy, we will consider the potential for positive or negative synergies, trade-offs and feedback loops between our climate change adaptation and emission reduction goals. This will ensure that we can increase community benefits and avoid unintended negative consequences.

Integrating climate adaptation and mitigation actions

Examples of synergies, trade-offs and feedback loops include: Positive synergy: energy efficient buildings that reduce emissions and also stay cooler during heat waves without the use of air conditioning.

Trade-off: competition for roof space between green infrastructure and solar panels.

Positive feedback loop: enhance the urban forest and use green infrastructure to reduce the urban heat island effect, which will reduce both flood risk and the impact of heat on buildings.

Negative feedback loop: irrigating green infrastructure increases demand for water and can also increase greenhouse emissions through pumping and treatment of water supply.



4.2 Health benefits

Health benefits are generated when actions to reduce emissions also address existing health challenges. This includes preventable lifestyle diseases (cardiovascular disease, obesity, Type 2 diabetes), respiratory diseases linked to air pollution (asthma, lung cancer), and mental health (stress, anxiety and depression). Health and social benefits are also achieved when climate strategies positively impact on the social determinants of health. These are the wider forces that shape the conditions of daily life – economic factors, social and environmental conditions, education, cultural influences, gender equity and personal autonomy.

Daily activities such as walking and cycling can contribute to reducing greenhouse gas emissions. These activities produce zero greenhouse gas emissions compared to cars and contribute to mental and physical health. Eating a healthy diet, reducing portion sizes to avoid food waste, and consuming less meat can also contribute to lower greenhouse gas emissions. Buying locally produced food, rather than food transported long distances, also reduces greenhouse gas emissions. Energy efficient homes are better at keeping warm in winter and cool in summer, saving money on energy bills and protecting people during heatwaves.

The health care sector is a large source of greenhouse gas emissions in the city due to the energy use of hospitals and the transport of health care workers. There is opportunity to collaborate across local and state government agencies to reduce emissions and contribute to public health outcomes.

We engaged expert consultants to conduct community focus groups, research the links between climate change and health and identify social impacts of our priorities and actions.

The health benefits identified by the Climate and Health Alliance are included in the table below.

Table 9: Health benefits from climate action

TOPIC	ACTION	HEALTH BENEFITS
Transport	Increased active/public transport; replacement of diesel/petrol vehicles with clean-powered electric vehicles	Reduced prevalence of cardiovascular and respiratory illness, type 2 diabetes, dementia and cancer
Buildings	Improving energy efficiency in buildings, improved insulation and natural ventilation; designing for physical activity and social interaction	Reduced risk of heart disease, strokes, injuries, asthma and other respiratory diseases; improved mental health and psychological well-being; reduced visits to GPs, fewer hospitalisations and days off work or school
Energy	Substituting fossil fuels with renewable energy for electricity and transport	Potential for thousands of avoided premature deaths nationally, substantial savings for healthcare budgets
Food	Increasing proportion of plant-based products in diets; local food production; avoiding overconsumption	Reduced heart disease, obesity and bowel cancer; improved community resilience; improved psychological wellbeing
Green infrastructure	Increased urban tree canopy, parks and gardens, green roofs	Reduced respiratory disease (from improved air quality); better overall health, reduced stress and an enhanced sense of personal wellbeing; reduced heat stress; positive mental health
Healthcare	Reducing healthcare waste through recycling and low carbon procurement; improved energy efficiency; encouraging active transport/clean power vehicles; delivering healthcare at home; investing in renewable energy	Reduced environmental pollutants; improved air quality; reduced morbidity and mortality; improved physical and mental health; reduced healthcare costs

4.3 Enhancing social inclusion and social benefits

Our aim is for a socially inclusive strategy, in keeping with the values of fairness and equity that people expressed during community consultation and the Future Melbourne deliberative democracy process in 2016.

These community priorities are reflected in the description of the goals included in the Council Plan 2017–2021:

A City for People (Goal 2)

A city for people welcomes all. It is accessible, affordable, inclusive, safe and engaging. It promotes health and wellbeing, participation and social justice. It respects, celebrates and embraces human diversity. People of all ages and abilities feel secure and empowered. City planning puts people, families and community at the forefront.

A City with an Aboriginal Focus (Goal 9)

Aboriginal culture, knowledge and heritage will enrich the city's growth and development. The City of Melbourne can improve economic outcomes for Aboriginal people by creating economic development opportunities for Aboriginal people and their communities.



²¹ Climate and Health Alliance. (2018). Prepared for the City of Melbourne.
²² City of Melbourne, Tertiary Student and Education Profile, 2016

Social impacts

The principle of intergenerational equity recognises that decisions made today will determine the future climate that children and future generations will experience. Climate change will impact everyone who lives, works and plays in the city. However, some members of our community are more vulnerable to heatwaves, energy prices and reliability, rising food prices and the accessibility and affordability of buildings and transport infrastructure. This is because factors such as low income, age, gender, disability and background can contribute to inequities in social status and wellbeing. Together, these are the social and ecological determinants of health.²¹ This will enhance the fair distribution of benefits from the implementation of the strategy.

Social Inclusion

Melbourne is a culturally diverse city and this is one of our city's greatest strengths. Nearly half of the population was born in a non-English speaking country, and 38 per cent speak a language other than English at home (Australian Bureau of Statistics, 2011). The municipality also has a number of large universities attracting nearly 40,000 international students who contribute to the youthful and multicultural fabric of the community.²² Language and educational background can greatly influence an individual's understanding and access to climate change solutions. Some disciplines, such as science, technology, engineering and maths also have a gender gap that industry leaders are trying to address. New technology can also be a barrier to older people or people with a disability or low income.

We will continue to engage with community stakeholders to identify barriers, social impacts and opportunities to enhance social inclusion. This will enhance the fair distribution of benefits from the implementation of this strategy.

Table 10: Examples of a socially inclusive approach

SOCIAL FACTOR	CONSIDERATIONS
Aboriginal communities	Identify Aboriginal owned businesses and social enterprises to tender for carbon offsets, renewable energy projects and other opportunities.
Income inequality	Consider the impact of energy prices and the upfront cost of installing renewable energy or retrofitting buildings including the vulnerability of renters. Consider the social impact of public and private transport costs in accessibility to employment and the transition to electric vehicles.
Educational background	Develop engaging and accessible communication materials to explain programs delivered under this strategy.
Disability	Collaborate with community organisations to identify vulnerabilities and reduce barriers to access programs, integrate social and environmental goals to avoid trade-offs and in building design standards and transport planning, provide accessible versions of communication materials.
Age	Provide opportunities for face-to-face engagement as alternatives to online participation and engage older people as peer educators and ambassadors. Consider the need for energy security during heatwaves for the young and for older people including child care and health care centres. Consider the cumulative impact of cultural and linguistic diversity, disability, risk of social isolation and health issues for older people.
Gender	Collaborate with professional bodies and educational institutes to promote the participation of women and girls in science, technology, engineering, maths and occupations where there is a large gender or salary gap. Consider the cumulative vulnerability of women impacted by energy pricing as a higher proportion of part-time and casual workers, primary carers and older people.
Culturally and Linguistically Diverse Communities	Translate communication materials for residential programs into common languages in the municipality and promote them to local media in languages other than English.

4.4 Innovation, knowledge sharing and transparency

Developing and sharing new solutions

Advances in building intelligence systems provide the foundation for using technology to enable a smarter city. The City of Melbourne has demonstrated new energy saving technologies including one of the first large solar arrays on the sheds of the Queen Victoria Market, and we trialed micro-turbines on the rooftop of Council House 2.

The installation of smart meters in buildings across the city, and technological advances in building intelligence systems provide the foundation for using technology to enable a smarter city. We collaborated with the University of Melbourne and Royal Melbourne Institute of Technology, launching an innovation precinct to test smart city technology.

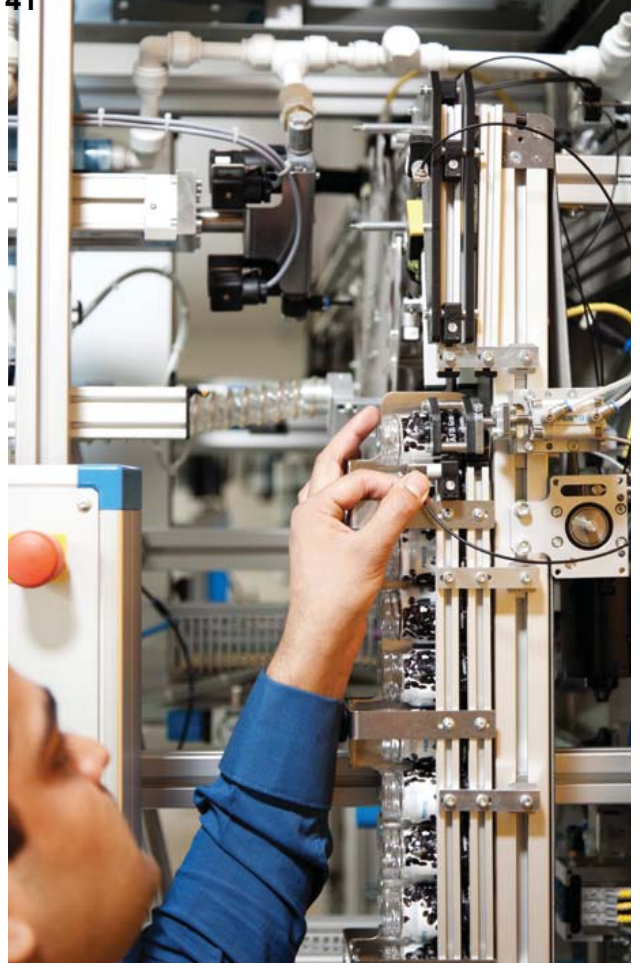
We work with governments, international and local city networks and university researchers on demonstration projects, pilot programs, and testing new solutions. We also sponsor competitions and hack-a-thon events for university students to develop the skills needed for the low carbon economy of the future.

The City of Melbourne also participates in several international and local city-networks that support knowledge sharing between cities on climate change solutions. The development of this strategy was part of an international pilot program run by C40 for cities to share solutions. We contribute to the international efforts of cities to address climate change through the International Council for Local Environment Initiatives (ICLEI), the Carbon Neutral Cities Alliance and 100 Resilient Cities. We collaborate with other Australian capital cities and metropolitan Melbourne local governments in the delivery of programs.

We will support innovation by using the city as a lab to test and refine solutions. Real-time, publicly accessible data about the city's energy performance and emissions profile would enable people to develop new digital, transport and energy solutions. Multiple research gaps and information barriers must be addressed before real-time city-wide data could be made available. Some basic data, including the average energy performance of apartments, is not currently available.

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More research is needed to identify the best methods to avoid waste and achieve carbon positive buildings and precincts, zero emissions transport and renewable energy. By collaborating with other cities and urban researchers, we will be better able to identify gaps and commission urgent research to help us track our progress.



4.5 Alignment to the Sustainable Development Goals

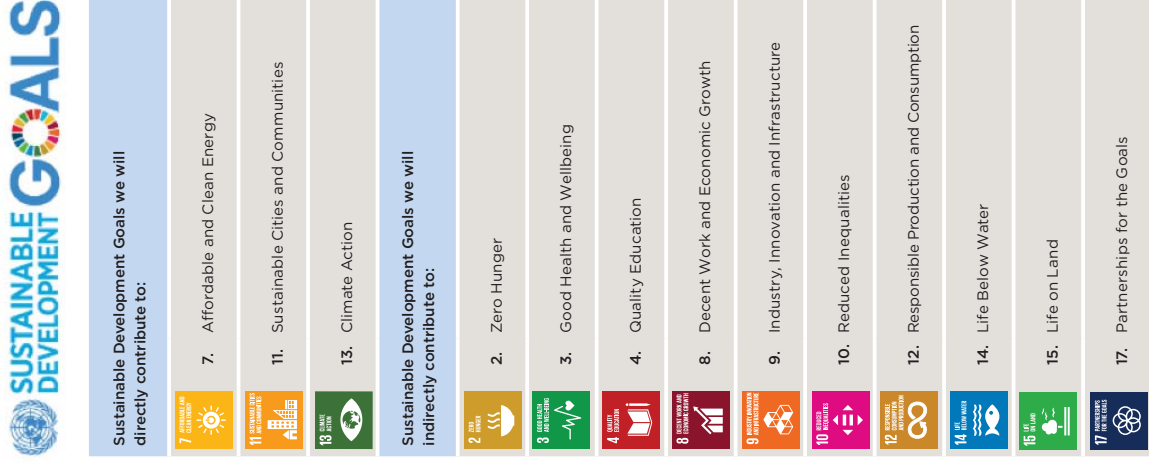
The United Nations Sustainable Development Goals were adopted in 2015, the same year as the Paris Climate Agreement. They provide a blueprint to address global challenges related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice by 2030.²³

There is a close alignment between the Sustainable Development Goals and our responsibility as a local government to consider the long-term environmental, social and economic interests of our community.

By addressing climate change, we will contribute to this international effort. This is because the emissions we generate in our city will impact communities around the world by exacerbating poverty caused by drought and natural disasters, and contributing to sea-level rise which will flood Pacific Island communities.

Increasing temperatures and changes to seasonal patterns and natural disasters will increase habitat loss and ocean acidification. According to the Intergovernmental Panel on Climate Change (IPCC), global warming above 1.5°C means it is highly certain that 70-90 per cent of the Great Barrier Reef will be lost.²⁴

Figure 13: The sustainable development goals



4.6 Measuring, reporting and evaluating progress

We have developed a comprehensive measurement and evaluation plan to accompany the strategy. Progress will be reviewed each year to adjust the five-year rolling implementation plan. It will also fulfil the requirements of the Council Pledge made under the *Climate Change Act 2017*, to evaluate and report on the implementation of emission reductions by 2025. We will review progress each year and conduct a comprehensive evaluation after five years of implementation in 2023.

We will report our progress annually as part of our commitment to the Global Covenant of Mayors, supporting the transparency priorities of the Future Melbourne 2026

Plan and the *Local Government Act 1989*. We will report our municipal greenhouse gas emissions according to the Global Protocol for Community-scale greenhouse gas emissions, and report our residual emissions.

Our reports will also be publicly accessible on the Carbon Disclosure Project Cities platform. The Carbon Disclosure Project provides a holistic reporting framework to report the emissions profile of the municipality, emission reduction actions, greening, and climate adaptation. This will allow our performance to be tracked, evaluated, and benchmarked against other cities.

APPENDIX 1: IMPLEMENTATION PLAN

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
Strategic Priority 1: 100% renewable energy						
OUTCOMES						
1: Large organisations and businesses invest in 100% renewable energy						
2: Stronger renewable energy targets and transition to zero carbon sources of energy						
3: Residents and small businesses purchase renewable energy products and services						
2.1 Outcome 1: Large organisations and businesses invest in 100% renewable energy						
1.1 Advocate for a more ambitious renewable energy target and changes to the National Electricity Rules	Advocate for an ambitious renewable energy target	N/A	The Victorian Government has targets in place to 2025	Year 1-5	Local governments, Victorian and Australian Governments, peak industry and community organisations	Business as usual budgets and processes
	Advocate to regulators and network distributors to make the electricity network 'renewable ready'			Year 1-5	Victorian and Australian Government regulators, network distributors, generators and business and community representatives	Business as usual budgets and processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
1.2 Accelerate corporate Power Purchase Agreements	Facilitate and support corporate Power Purchase Agreements through the expansion of Melbourne Renewable Energy Project (MREP)	265,553		Year 1-5	Large businesses and organisations, energy sector	Year 1 existing budget allocation, Years 2-5 subject to annual plan and budget processes
	Advocate that the Victorian Government purchases 100 per cent renewable energy for its operations			Year 1-5	Victorian Government	Business as usual budgets and processes
1.3 Facilitate residential purchasing of renewable energy products	Increase uptake of awareness and uptake of local rooftop solar, green power and other emerging opportunities. Target less represented sectors such as strata housing, social and community housing, and the not-for-profit and community services sectors as well as commercial businesses	14,304	N/A	Year 1-3	Residents, building owners and tenants, Victorian Government agencies, Victorian Greenhouse Alliances	Subject to annual plan and budget processes
1.4 Facilitate a virtual power plant or solar garden for residents or small businesses	During Year 1, complete a feasibility study to determine the best opportunity and roles within the municipality. This may include a facilitation role in aggregating demand, partnering with suppliers or brokering offsite supply		Year 1-5	Victorian Government agencies, universities, technology providers, community groups	Subject to annual plan and budget processes	
1.5 Collaborate with other cities, investors, superannuation companies to accelerate divestment from fossil-fuel energy supply	Conduct an assessment of public and private sector opportunities to reduce climate risk in the municipality and promote divestment from fossil fuels consistent with the Taskforce on Climate Related Financial Disclosures	NA		Years 1-5	Local governments, financial industry	Subject to annual plan and budget processes
1.6 Partner with businesses, universities, healthcare services and other organisations to promote innovative renewable energy technology and research	Develop a shared research agenda with universities Collaborate with universities and community organisations to identify research priorities and promote renewable energy technology through knowledge and innovation programs including the Melbourne Innovation District	NA		Year 1-5	Universities, businesses, technology providers	Subject to annual plan and budget processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
Strategic Priority 2: Zero emissions buildings and precincts						
OUTCOMES						
1: Buildings within the municipality transition from gas to electricity						
2: New buildings within the municipality are carbon neutral by 2030						
3: Existing buildings within the municipality are carbon neutral by 2050						
2.1 Demonstrate innovative carbon positive design and operation of council-owned buildings and precincts	Ensure that City of Melbourne continues to lead and innovate in sustainable building and precinct design and operation, including the Bourke Street Precinct redevelopment, Queen Victoria Market and existing council buildings	*		Year 1-5	Property, development and construction industries	Subject to annual plan and budget processes
2.2 Partner with industry and, Victorian and Australian Government agencies to reduce barriers and deliver zero emissions buildings and urban renewal precincts	Advocate for all existing buildings to be carbon neutral by 2050. Includes: <ul style="list-style-type: none"> Engaging and influencing property sector stakeholders to improve building performance. Engaging and influencing private residential building owners to improve building performance. Collaborating with the Victorian Government, industry and professional associations to deliver Carbon Positive Roadmap (including GBCA, ASBEC and Sustainability Victoria) Collaborating with the City of Sydney through the Better Buildings Partnership and CitySwitch programs 		251,804	Year 1-5	Building owners and tenants, owners corporations, Victorian and Australian Governments, property industry organisations and peak bodies, energy efficiency industry	Subject to annual plan and budget processes
2.3 Accelerate existing commercial buildings and tenants' energy efficiency programs through CitySwitch and other partnerships	Develop new interventions and partnerships to incentivise and drive the uptake of energy efficiency measures in existing commercial buildings. Increase the number of commercial office based businesses committing to reduce emissions from their tenancies via the CitySwitch program, and increase the rate of emissions reduction. Improve baseline building performance data			Year 1-3	Business community, property industry, peak bodies	

* Calculated as part of the emissions reductions from Council operations, see below

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
2.4 Advocate for energy performance disclosure for a greater range of commercial and residential buildings at the point of sale	Evaluate the potential impact on municipality of periodic disclosure of emissions as well as at the point of sale or lease, especially for the mid-tier commercial office market. In partnership with peak bodies, advocate to the Australian Government for the extension of Commercial Building Disclosure legislation.			Year 1-3	Australian Government, mid-tier office market, property industry, peak bodies	Subject to annual plan and budget processes
2.5 Facilitate the take up of the National Built Environment Rating Scheme (NABERS) for apartments across the municipality	Develop a program to support residents and owners corporations and facilitate the increased uptake of NABERS for apartments			Year 1-3	Owners corporations, property management industry, residential community	Subject to annual plan and budget processes
2.6 Renew and implement planning policies to support the development of zero emissions buildings and precincts	<ul style="list-style-type: none"> Introduce progressively higher minimum standards and enforcement in the City of Melbourne Planning Scheme to achieve carbon positive developments and reduce climate risk - this work is aligned with ongoing actions under the Green Our City Strategic Action Plan. Ensure that Structure Plans and Precinct Plans developed by City of Melbourne integrate climate mitigation actions - for example, the West Melbourne Structure Plan 		56,479	Year 1-2	Victorian Government, urban renewal agencies, property development and construction industries	Business as usual budget and processes
2.7 Partner with industry to advocate for higher energy performance standards in the National Construction Code	Advocate for a clear trajectory towards zero net emissions buildings within the National Construction Code to enable the property development and construction industries construction industry to prepare and respond			Year 1-5	Industry peak bodies, Australian and Victorian Governments	Business as usual budget and processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
2.8 Advocate and facilitate to transition from gas to electricity in buildings and precincts	<ul style="list-style-type: none"> Advocate for specific requirements in the National Construction Code (NCC). Collaborate with developers and building owners to promote the transition from gas to electricity. Collaborate with urban renewal agencies. Develop a long-term strategy for converting existing buildings 		116,599	Year 1-5	Victorian and Australian Governments, development and construction industries and peak bodies	Business as usual budget and processes
2.9 Adopt circular economy principles to reduce the environmental impact and embodied emissions from products, materials and buildings across the city through procurement, urban design and planning	<p>Integrate circular economy principles into:</p> <ul style="list-style-type: none"> City of Melbourne procurement and events. Bourke Street Precinct design and construction. <p>Seek ways to partner with other large purchasers to stimulate the market for reused and remanufactured products</p>			Year 1-3	Business community, property industry, peak bodies	Subject to annual plan and budget processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
<p>Strategic Priority 3: Zero emissions transport</p> <p>OUTCOMES</p> <p>1: Road space strategically reallocated towards sustainable modes of transport 2: Intersection priority increased for sustainable modes of transport 3: The way users pay for motor vehicle use is changed to favour lower emissions usage patterns 4: The emissions intensity of motor vehicles is decreased 5: Public transport is optimised</p>						
3.1 Continue to reallocate road space to create more space for walking, cycling and green infrastructure	<p>In line with the City of Melbourne Transport Strategy 2019, identify opportunities and implementation priorities to reallocate road space for:</p> <ul style="list-style-type: none"> pedestrians expanded and enhanced dedicated cycling routes public transport priority lanes urban greening public space 			Year 1-5	VicRoads, Victorian Government, business and residential community	Subject to annual plan and budget processes
3.2 Prioritise active and public transport through dedicated lanes traffic light priorities parking controls and road user pricing	<p>In line with the City of Melbourne Transport Strategy:</p> <ul style="list-style-type: none"> Identify priority locations and implement improved intersection priority for people, bikes and public transport Investigate variable pricing for on-street parking Ensure that the City of Melbourne Structure Plans and planning scheme encourages transport mode shift Advocate for the early delivery of public and active transport in urban renewal areas 	62,446		Year 1-5	VicRoads, Victorian Government, business and residential community	Subject to annual plan and budget processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
3.3 Advocate for energy efficient public transport powered by renewable energy	<ul style="list-style-type: none"> Advocate to the Victorian Government to enter into a Power Purchase Agreement to power Metro Trains with 100 per cent renewable energy Advocate for electrification of the bus fleet as part of ongoing fleet renewal Advocate for electrification of regional rail lines, with the Geelong line as priority 		39,056	Year 1-2	Victorian Government and agencies	Business as usual budget and processes
3.4 Advocate for the Victorian Government to extend train, tram and bus services	<ul style="list-style-type: none"> Advocate for the Victorian Government to build "Metro 2" train infrastructure for Melbourne, and tram lines and bus routes into new urban renewal areas such as Fishermans Bend Advocate for tram network extensions, particularly to Arden and Fishermans Bend Advocate for 10-minute frequencies on all core public transport routes between 6am and midnight seven days a week 			Year 2-5	Victorian Government and agencies	Business as usual budget and processes
3.5 Advocate for lower carbon intensity of motor vehicles and support transition to electric vehicles	<p>Advocate to the Australian Government for:</p> <ul style="list-style-type: none"> International best-practice emissions standards for petrol and diesel engines Policy to support the transition to electric vehicles powered by renewable energy, prioritising buses and last-kilometre freight Encourage private providers to provide electric vehicle charging facilities 		145,426	Year 1-5	Australian Government, community and industry	Business as usual budget and processes

Action	Description	(A) Emissions reduced by 2025 City of Melbourne direct influence (tonnes CO ₂ -e)	(B) Further emissions reduced by 2025 indirect influence (tonnes CO ₂ -e)	Timeframe	Collaborators and delivery partners	Business impact
Strategic Priority 4: Reducing the impact of waste						
OUTCOMES						
1: Diversion of residential, commercial and industrial waste from landfill.						
4.1 Continue to promote and facilitate waste avoidance, recycling, recovery and diversion of waste from landfill by implementing a waste and resource recovery strategy.	<p>Implement actions from the waste and resource recovery strategy with the greatest impact on emissions, such as:</p> <ul style="list-style-type: none"> developing and implementing an organic waste segregation and collection plan that covers residential and commercial and industrial properties. investigate an alternative waste processing facility continuing to reduce waste from council operations and events. establishing a Waste Minimisation and Innovation Fund and delivering annual grant program. 	2654	47,391	Year 1-5	Victorian Government and agencies including Sustainability Victoria, Metropolitan Waste and Resource Recovery Group, waste and resource recovery industry, residents and businesses	Subject to annual plan and budget processes
COUNCIL OPERATIONS						
Continue to lead by example by reducing emissions from our operations, supply chain and business practices.	Continue to implement emission reductions for our operations and develop a new plan for 2021-2025	109,604	80,065	Year 1-5	Supply chain, subsidiaries	Subject to annual plan and budget processes
Total emission reductions to 2025 (tonnes of CO₂-e)		454,561	736,820			

ENABLING ACTIONS				
1: Integrate climate change adaptation and mitigation 2: Deliver environmental, social and economic benefits and enhance social inclusion 3: Take an innovative, transparent and evidence-based approach				
Action	Description	Timeframe	Collaborators and delivery partners	Business impact
5.1 Promote the actions needed to achieve the emission reductions to the community, businesses and government decision-makers.	Deliver a climate change communications campaign to raise awareness, promote action and support advocacy. Engage the community through public art, festivals and events, and digital engagement. Ensure communications are accessible and inclusive.	Year 1-5	Australian and Victorian Governments	Business as usual budgets and processes
5.2 Identify and address synergies, trade-offs and feedback loops between the implementation of the Climate Change Mitigation, Climate Change Adaptation, Nature in the City and other relevant strategies including transport and waste.	Hold an annual cross-organisational workshop as part of the business planning process to identify synergies and address trade-offs and consider environmental, social and economic impacts. Develop guiding principles for climate risk and integrate into council decision-making. Develop a long term research agenda to identify feedback-loops between natural and human systems that will impact the municipality. Update the organisational risk register to reflect the integration of climate change adaptation and mitigation.	Year 1-5	Local and Victorian Governments, businesses and industry representatives, professional associations, community organisations, and universities	Business as usual budgets and processes
5.3 Take an innovative, evidence-based approach to prioritising actions and open data on our emissions profile for urban researchers to develop new solutions.	Collaborate with innovators, urban researchers, community organisations and other cities on a research agenda to identify long-term strategic opportunities to reduce emissions. Consider social impact and inclusion. Provide open access to data on municipal emissions for international city networks, urban research networks, students and academics.	Year 1-5	Urban researchers and academics, community organisations, students, universities, other cities and city networks	Business as usual budgets and processes
5.4 Participate in city networks to share knowledge and continue to co-lead the C40 Low Carbon Districts and Climate Positive forum to learn from innovative international projects.	Participate in knowledge exchange with other cities through C40, ICLEI and Global Covenant of Mayors for Climate and Energy, Carbon Neutral Cities Alliance, Council of Capital City Lord Mayors, Resilient Melbourne and Local Government Professionals (LGPro). Collaborate with the Victorian and Australian Governments to reduce emissions from cities. Report progress in reducing emissions through the Carbon Disclosure Project online platform. Develop and share case-studies about our work to share with other cities and local governments.	Year 1-5	City networks, cities and local governments, Victorian and Australian Governments	Business as usual budgets and processes
5.5 Report progress in reducing emissions annually and update the rolling five-year implementation plan based on progress.	Integrate measurement and evaluation plan with corporate reporting. Publicly report the emissions inventory for the municipality each year, including residual emissions, according to the Global Protocol for Communities method.	Year 1-5	Carbon Disclosure Project, Carbon Neutral Cities Alliance, C40	Business as usual budgets and processes
5.6 Evaluate the implementation of the strategy by 2025 to meet the Council Pledge requirements under the <i>Climate Change Act 2017</i> .	Evaluate progress in implementing the strategy by 2025. Consider the latest science-based targets, and environmental, social and economic impacts.	Year 3-5	Global Covenant of Mayors for Climate and Energy, Carbon Disclosure Project, C40, Carbon Neutral Cities Alliance, Victorian Government, urban researchers, academics and universities	Business as usual budgets and processes

ACKNOWLEDGEMENTS

The City of Melbourne would like to acknowledge the generous funding from Bloomberg Philanthropies, the support of the C40 Cities Climate Action Planning Pilot Program and the cities that participated in the program.

Many people contributed their time and expertise to the development of this strategy. Thank you to the members of the external reference group, community, government and business representatives, expert consultants, City of Melbourne councillors and staff. The City of Melbourne would also like to thank the representatives from the many local and international cities who have peer-reviewed our progress to date and who continue to collaborate on solutions.

This strategy is one of a suite adopted in conjunction with the Council Plan and should be read as consistent with the overall vision and outcomes of the Council Plan. Note that any specific actions or initiatives outlined in this strategy are not binding upon the City of Melbourne but will inform its planning and resourcing considerations and may be endorsed as part of its Annual Plan and Budget.

Citation

City of Melbourne. (2018). *Climate Change Mitigation Strategy to 2050: Melbourne Together for 1.5°C*. ISBN Reference (TRBC)

ABBREVIATIONS

C40: C40 Cities is a network of the world's megacities committed to addressing climate change. C40 supports cities to collaborate effectively, share knowledge and drive meaningful, measurable and sustainable action on climate change.

GBC-A: Green Building Council of Australia

ICLEI: International Council for Local Environment Initiatives

IPCC: Intergovernmental Panel on Climate Change

NABERS: National Australian Built Environment Rating System

UNFCCC: United Nations Framework Convention on Climate Change

ZNE: Zero Net Emissions

GLOSSARY

Aboriginal: The term 'Aboriginal' is used to refer to both Aboriginal and Torres Strait Islander people. Use of the terms 'Koori', 'Koorie' and 'Indigenous' are retained in the names of programs, initiatives and publication titles, and unless noted otherwise, are inclusive of both Aboriginal and Torres Strait Islander people.

Carbon offsets: Carbon offsets are tradeable units that represent abatement of greenhouse gas emissions. Offsets represent the rights to a greenhouse gas reduction. The carbon offsets purchased are retired through a registered third party so they cannot be counted twice.

Carbon neutral: Being carbon neutral means that the net greenhouse gas emissions associated with an organisation's or city's activities are equal to zero. It is achieved through a combination of measuring and reducing greenhouse gas emissions and purchasing carbon offsets. The terms zero net emissions and carbon neutral can be used interchangeably.

Emissions: This term is used interchangeably with greenhouse gas emissions, unless specifically stated that it relates to air quality pollutants.

Greenhouse gas emissions: The greenhouse gas emissions from human activities that cause climate change: carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), ozone (O₃), and synthetic gases such as chlorofluorocarbons (CFCs) and hydrofluorocarbons (HFCs).

Paris Climate Agreement: The Paris Climate Agreement entered into force on 4 November 2016. The Paris Agreement is made under the United Nations Framework Convention on Climate Change (Climate Change Convention, also referred to as the UNFCCC). Australia announced its ratification of the Paris Agreement on 10 November 2016. Its stated goal is to limit the increase in the global average temperature to 'well below 2°C' above pre-industrial levels, that we should 'pursue efforts' to limit the temperature increase to 1.5°C (Article 2). In addition, parties are aiming to peak global greenhouse gas emissions 'as soon as possible' (Article 4). According to the Intergovernmental Panel on Climate Change (IPCC), global warming of more than 2°C would have serious consequences, such as an increase in the number of extreme weather events.

Science-based targets: The amount of emissions that need to be reduced to avoid the 1.5°C increase in global average temperatures as recommended by the IPCC and referred to in the Paris Climate Agreement.

Zero emissions or Zero net emissions: The net greenhouse gas emissions associated with an organisation's or city's activities are equal to zero.

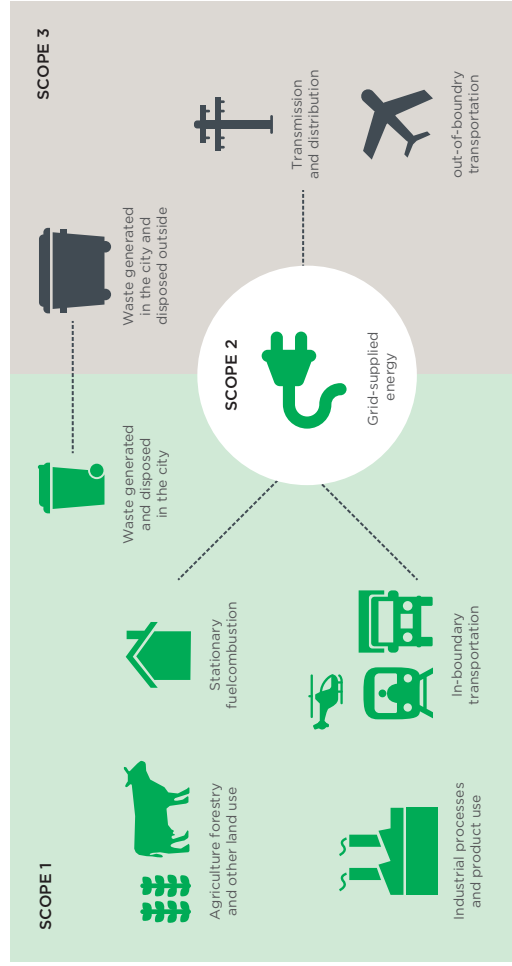
APPENDIX 2: TECHNICAL NOTES

City of Melbourne's greenhouse gas emissions profile

The City of Melbourne uses the Greenhouse Protocol for Communities (GPC) method to measure and report municipal greenhouse emissions. Emissions are reported annually through the Carbon Disclosure Project (CDP) platform, which is a requirement of Global Covenant of Mayors and C40 membership. We collect data and report

emissions according to the Basic and Basic+ methods. For the purpose of easy comparison with other cities, the data used in this strategy is according to the Basic method. The sources of emissions that are reported using this method are illustrated in the diagram below.

Figure 14: Global Protocol for Communities emissions inventory boundary (GPC)



To calculate our emission reduction targets we used the baseline year of 2015. The figures are for the Australian financial year 1 July 2014 - 30 June 2015. The calculations for transport were improved for accuracy compared to the emissions reported through the Carbon Disclosure Project for that year. Future years are reported according to calendar years starting 1 January 2017 to align with the Victorian Climate Change Act 2017.

Greater Melbourne emissions profile

This emissions profile was calculated for the 2017 calendar year according to the Global Protocol for Communities Basic methodology. There are some differences with the more detailed inventory that the City of Melbourne reports each year principally to avoid double counting of scope 3 emissions between municipalities.

Table 11: Sources of emissions from Greater Melbourne

CATEGORY	Emissions (t CO ₂ e)	Percentage (%)
Stationary Energy	47,171,124	71
Transportation	17,228,638	26
Waste	1,403,868	2
Wastewater	555,408	1
TOTAL	66,359,038	100

Consumption-based emissions profile

A second method for measuring emissions is called the consumption-based approach. This takes into account takes into account the upstream and downstream impacts of products and services that Melbourne consumes including imports and exports from the city. Under this method, the emissions produced by growing, producing and transporting food, or the manufacture of clothing or building products, and the mining and industrial processing of raw materials are also included.

This method is important for international comparison because it acknowledges the impact of exporting and importing fossil fuels and agricultural products between countries which has a large impact on emissions. However it is more challenging to calculate these emissions on an annual basis and few cities are currently using this method, which makes comparison difficult.

The City of Melbourne's consumption-based emissions for the calendar year 2011 were 3,114,928 tonnes CO₂-e which was 28.19 tonnes CO₂-e per person.

Calculating costs and benefits

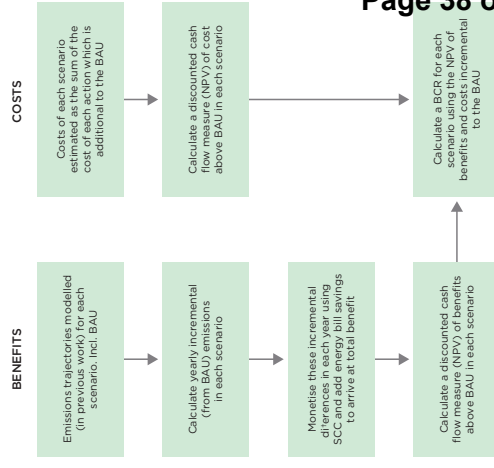
In this analysis, economic benefits are represented by the avoided social and economic damage costs of greenhouse gas emissions. These benefits were quantified by consultants using the Social Cost of Carbon (SCC). The SCC "is a comprehensive estimate of climate change damages and includes, among other things, changes in net agricultural productivity, human health, property damages from increased flood risk and changes in energy system costs, such as reduced costs for heating and increased costs for air conditioning."²⁵

In addition to the benefits and costs that can be quantified, there are benefits and costs that are harder to quantify. This is an area for further research.

The cost benefit analysis captured a wide range of economic costs and benefits within each modelled scenario, taking account of the timing of costs and benefits to arrive at an overall measure of net benefit which provides an objective measure for comparing scenarios (i.e. a Benefit Cost Ratio – BCR).

Figure 17 provides an overview of the steps undertaken in modelling the costs and benefits of the scenarios.

Figure 15: Method of economic analysis of climate actions



²⁵ EPA 2015, Social cost of carbon fact sheet

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Economic contribution is a measure comprising all market-related expenditure generated by a specified industry or an activity. Economic contribution studies do not consider the substitution effects to other industries (i.e. what might happen to expenditures if the specific industry or activity were lost). As such economic contribution is a gross measure rather than a net measure.

Three common indicators of an industry or economic size or value are:

- Gross output – Market value of goods and services produced, often measured by turnover/revenue.
- Gross output is also referred to as 'gross economic contribution'
- Value added – Market value of goods and services produced, after deducting the cost of goods and services used
- Jobs – Number of jobs generated by an industry or attraction.

This study focuses on value add and peak employment as key measures of the economic contribution to the Melbourne LGA, the rest of Greater Melbourne and the rest of Victoria.

In comparing an industry's size against others, it is generally accepted to discuss this in terms of its industry value add. Industry value add measures economic activities net of the costs of production (that is, inputs sourced from other sectors), from the industry's outputs. This avoids the inclusion of revenues to other industries and any associated double counting.

In practice, industry value add largely comprises wages, salaries and the operating surplus of an industry (i.e. the industry's income). Attention should be placed on industry value add measures when making comparisons to other industries. The value add measure is commonly put forward as the most appropriate measure of an industry's contribution to the national economy.

Quantified benefits

The SCC was developed by the US Environment Protection Authority (EPA) to assess the cost of actions with marginal impacts on cumulative global emissions. It estimates the dollar figure of damages over the next 100 years (or more) from one extra tonne of greenhouse gas emissions.

This marginal cost is calculated using three integrated assessment models translating emissions into changes in atmospheric greenhouse concentrations, atmospheric concentrations into changes in temperature and changes in temperature into economic damages. A range of plausible socio-economic and emissions trajectories are used. Marginal cost is increasing in time as future emissions are expected to produce larger incremental damages as physical and economic systems become more stressed in response to greater levels of climate change. SCC values are therefore 'year specific'.

The EPA's model looks at the future impacts (out to 2300) of emitting one tCO₂-e today. It quantifies the damage costs caused by global temperature increases due to an additional tonne and discounts this back to today's value.

Quantified costs

Each modelled scenario is comprised of a number of climate actions which need to be undertaken to meet the emissions trajectory of the scenario. The consultant's modelling estimated the cost actions incremental to directly related costs which would arise in the absence of the action. For each action, the overall quantum of the activity is compared to the amount expected under the BAU scenario, and the incremental expense of the proposed action in the scenario is used to calculate a total cost of the action.

Analysis of economic contribution

This analysis aims to measure the economic contribution of actions under the modelled scenarios. Only actions with market based expenditure are modelled using this technique and as such, only a subset of actions within each scenario is assumed to provide an economic contribution.

The direct and indirect economic contribution has been calculated by estimating the direct contribution of capital expenditure associated with each scenario relative to the Business as Usual scenario. The economic contribution was then calculated over a 31 year period (between 2020 and 2050) in order to demonstrate the value of the ongoing spending, and hence contribution, of each scenario. Tailored input-output multipliers were developed that reflect the specific characteristics of the Melbourne LGA. Rest of Greater Melbourne and Rest of Victoria. The consultants applied the input-output modelling approach to quantify the contribution. Note that this model accounts for 'leakage' of direct expenditure from the economy in its multipliers. This feature also allows for an analysis of the effects in the different geographies as a result of domestic 'imports' and 'exports' between the Melbourne LGA, Rest of Greater Melbourne and Rest of Victoria.



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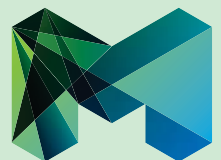
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