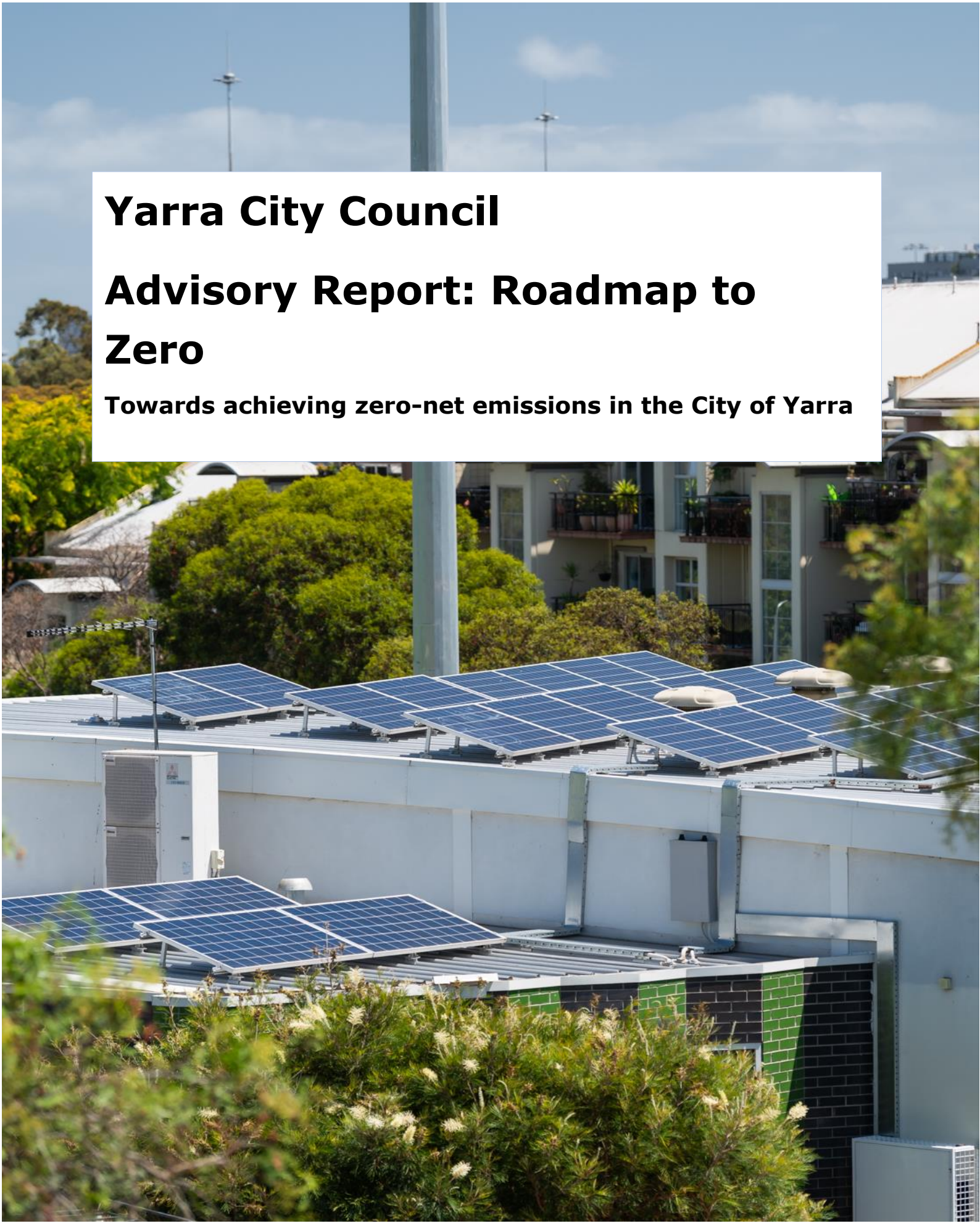

Yarra City Council

Advisory Report: Roadmap to Zero

Towards achieving zero-net emissions in the City of Yarra

Prepared for
Yarra City Council

Version	Author	Date	Description of changes
V2a-b	Sandra Mack, Hannah Snape	Nov 2021	Draft revision and updates
V3a-c	Hannah Snape	Dec 2021	Adjustments to structure and content
V4a-e	Hannah Snape, Hannah Preece, Paul Brown, Sandra Mack	Jan-Feb 2022	Final report and amendments

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About Ironbark Sustainability
Ironbark Sustainability is a specialist consultancy that works with government and business around Australia by assisting them to reduce energy and water usage through sustainable asset and data management and on-the-ground implementation.

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

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

Ironbark are a certified B Corporation. We have been independently assessed as meeting the highest standards of verified social and environmental performance, public transparency, and legal accountability to balance profit and purpose.

Contents

1. Executive Summary

In its Climate Emergency Plan 2020 (CEP), Yarra City Council set an ambitious objective for the municipality to achieve zero-net emissions by 2030, recognising that deep and rapid cuts to emissions are needed to prevent the worst impacts of climate change.

Without significant and rapid change by other actors the objective of zero-net emissions by 2030 cannot be realistically achieved. However, Council has an important part to play and the Roadmap to Zero Advisory Report outlines pathways for the City to be a key partner in accelerating action to zero-net emissions.

This report begins by outlining the vision for zero emissions by 2030 and Council's role in that vision. The roadmap then explores activities over the coming decade to progress this vision, including the roles that Council could play, as well as the action needed by other parties.

The development of this Roadmap has been grounded in evidence and understanding of the current emission sources and reduction activities as well as future emissions projections, trends and potential actions. Detailed analysis has been integrated into the preparation of the Roadmap report.

Yarra's Community Emissions Profile

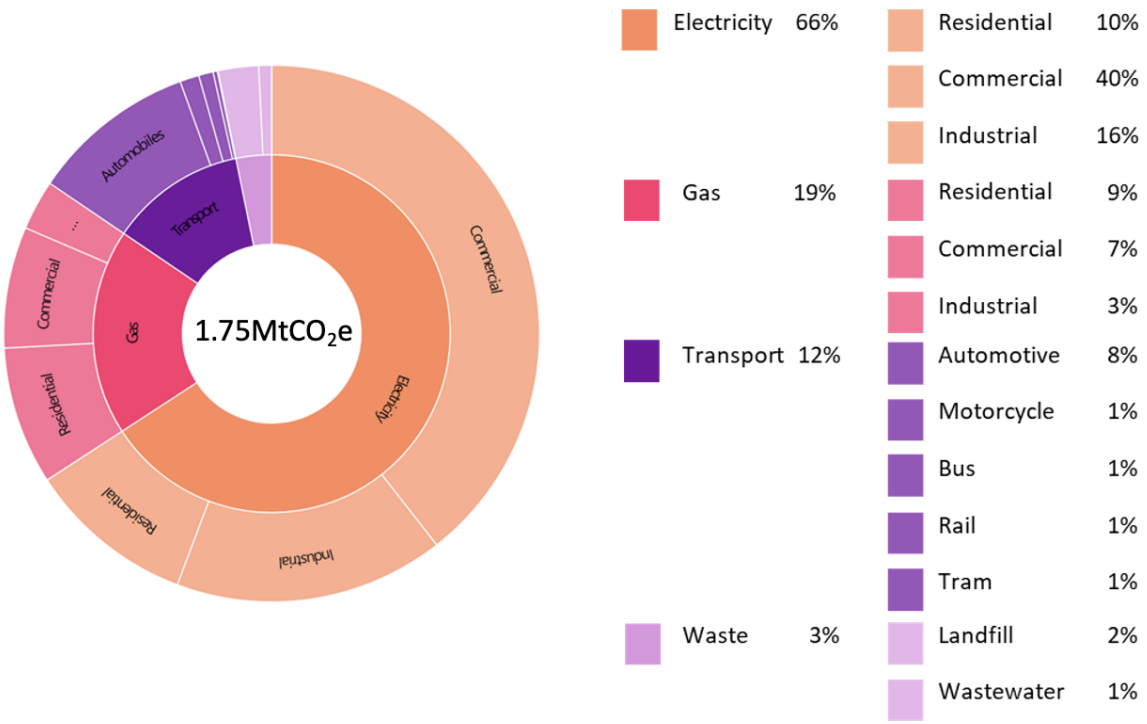


Figure 1: Community emissions profile for City of Yarra, 2018/19

Emissions in the City of Yarra were around 1.75Mt CO_2e for the year 2018/19. The major sources of emissions in the City of Yarra are stationary energy, largely servicing the commercial sector, but also

including activities from the residential and industrial sectors. On-road transport is further source of emissions, with a small portion of emissions from waste.

Over the coming decade, without strong action, emissions in Yarra will be subject to upwards forces such as population growth and economic growth. Downwards pressures, such as decarbonisation of the electricity grid and technology improvements, are projected to drive emissions reductions. Overall, with no further action, emissions in Yarra in 2030 would be higher than they are in 2018/19.

Yarra's Future Emissions Scenario

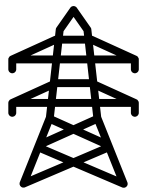
Key to achieving a zero emissions future will be the use of 100% renewable energy – meaning all electricity would be derived from zero carbon energy sources, such as solar or wind, with no burning of fossil fuels, such as gas for energy. The technology is already available to do this in almost all applications. This is something that can be accelerated, and strong efforts should be made to execute this transition to its maximum potential.

The transport system broadly should be reformed, including both personal transport and freight. This means increasing the uptake of active transport and public transport. It also means that any time a vehicle with an engine is used, car, truck, bus or otherwise, it should be zero emissions and ideally, accessed through car share and alternatives to car ownership.

With these key components alone – shift to 100% renewable energy and reforming transport – Yarra could theoretically reduce annual emissions by **97%** at some point in the future. The remaining 3% of emissions would be related to waste, both landfill and wastewater.

Carbon sequestration (or storage) plays an important role in enabling emissions that are currently unavoidable to be offset while solutions for these harder-to-mitigate emissions are developed. The report focusses on sectors and emissions sources where actual emissions reductions can be made rather than having a strong focus on offsetting.

Pathways to Zero Emissions

	**Zero carbon electricity for households and businesses** The technology is already available to generate electricity without the release of greenhouse gas (GHG) emissions. This technology needs to be deployed at a large scale, through a combination of more renewables in the electricity grid, onsite renewables, battery storage and innovative energy solutions, such as integrated local networks.
	**Zero gas for households and businesses** Quite simply, achieving zero-net emissions is not possible whilst fossil fuels are being burned for energy in homes and businesses. All new gas connections need to be ceased and existing gas appliances and equipment should be transitioned to electric alternatives. For some applications, particularly in the industrial sector, this will mean research, innovation and testing of new technologies that are not yet available.

	**Zero carbon buildings** Yarra is a growing area and over the coming decade thousands of new homes and commercial properties will be constructed, each lasting anywhere from 60-100 years, or more. Ensuring these buildings are designed to be highly energy efficient with renewable energy installation and provision for electric vehicle charging can lock in emissions savings over a long period.
	**Zero carbon transport: Active, public and shared** To achieve zero-net emissions, there needs to be a major shift in how people travel and in freight delivery. Where possible, trips should be taken by walking or cycling and via accessible and frequent public transport. Where car travel is necessary, ideally, it should be shared and zero emissions.
	**Zero carbon transport: Zero emissions vehicles** There will continue to be a role for on-road vehicles - be they trucks, buses or cars - in future. However, these need to transition to be zero emissions and low emissions vehicles, mainly electric, powered by renewable electricity. The technology for this is already available for electric bikes, scooters, motorbikes, cars and buses is rapidly expanding into heavy vehicles. International market trends and vehicle manufacturers will continue to influence uptake, while preferential government policies and consumer demand is also required.
	**Zero emissions from waste** Activities in the City of Yarra give rise to small amounts of emissions from both wastewater and landfill (3%). These are not a core focus of this Roadmap report and are addressed through other plans.
	**Climate Leadership** The transition to zero-net emissions requires strong action from every level of government, businesses and households, both within and outside of Yarra. Council as a clear advocate and leader for the community and the local government sector will accelerate action towards net-zero emissions.
	**Carbon offsets for residual emissions** Even if all feasible emissions reduction actions could be deployed at speed in the coming years, in 2030 there will be residual community emissions in Yarra. The priority needs to remain on reducing emissions at the source, and that is the focus of this Roadmap report. Offsets are however a useful way to rapidly abate emissions until they can be completely avoided.

Yarra Emissions Trajectory

As discussed in the previous section, if accelerated action is not taken, emissions in the City of Yarra are projected to increase to be more than 2MtCO_2e by 2030. This is shown in Figure 2.

An emissions trajectory for ambitious and urgent action on climate has been modelled. It includes a shift to 100% renewable electricity, which could occur through a combination of measures including decarbonisation of the grid, purchased renewable energy, rooftop solar and batteries, and innovative energy solutions. It acknowledges the efforts of the wider community to shift energy and transport behaviours and it also requires strong government support and policy at all levels.

The "community action" wedge in Figure 2 includes action taken by households and businesses in Yarra, such as electrifying appliances, shifting to renewable energy and purchasing electric vehicles. The "Council action" wedge refers to the additional impact that could be achieved through Council programs to further support and accelerate community action over the coming decade. This would be in addition to the expected impact of the business as usual "community action" wedge. The "accelerated action" wedge could be achieved in multiple ways, but largely refers to greater support from the Victorian and Federal governments, achieving 100% renewable electricity by 2030 and a 50% transition away from gas appliances and equipment.

In the scenario explored in Figure 2 zero-net emissions is not achieved by 2030. This is due to residual emissions from transport and gas. Options for managing these emissions through carbon offsets until they are fully resolved, could be explored.

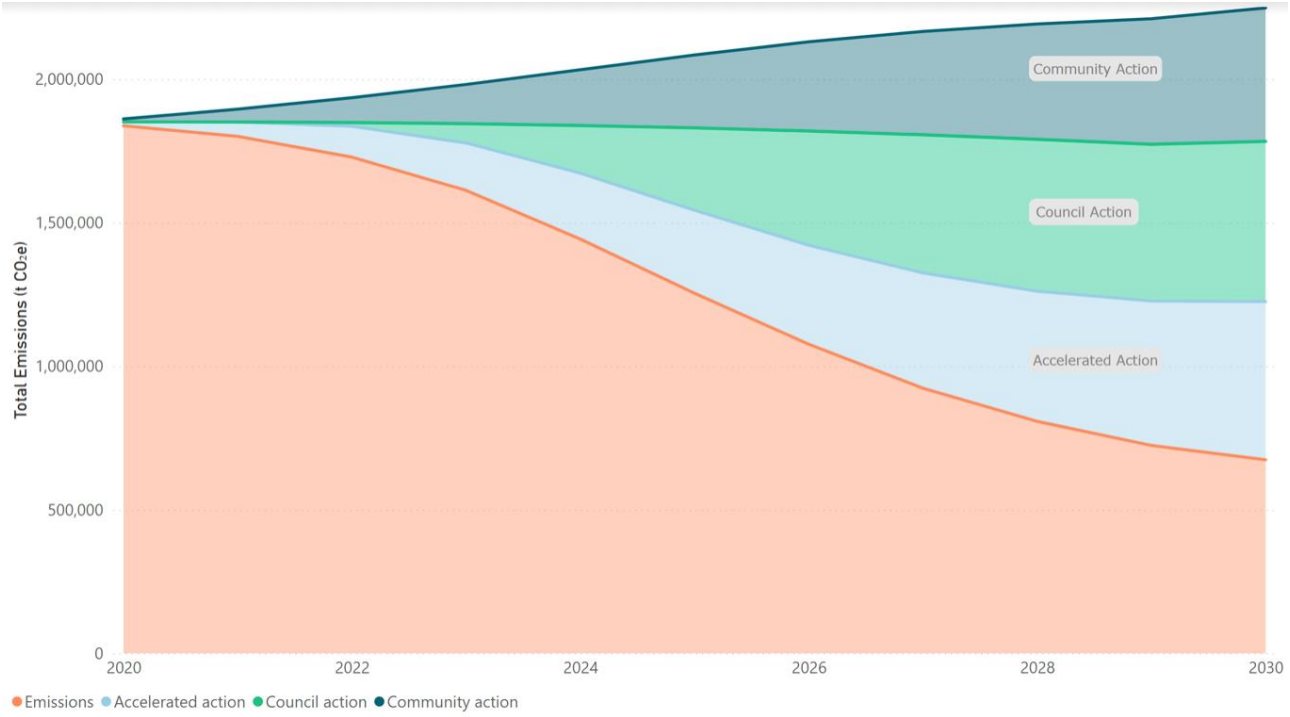


Figure 2: City of Yarra emissions projections to 2030

Actions for the Yarra Community, Council and Other Parties

To maximise our progress towards zero-net emissions by 2030, a monumental effort is required from all sectors of the wider community. This requires technologies to be deployed to their fullest potential, difficult problems to be tackled head-on and strong commitment to change. Table 1 outlines the next steps that can be taken over the coming years to support the trajectory to zero-net emissions in Yarra.

Table 1: Summary of action needed to achieve zero-net emissions

Zero Carbon Business ***Achieving large scale emissions reductions by addressing Yarra's most prominent source of emissions***			
	To make strong progress towards zero-net emissions, businesses in Yarra can enact the following: • Purchase 100% renewable electricity, through Green Power or a Power Purchase Agreements (PPAs) • Electrify all operations and cease gas usage • Install commercial-scale solar and battery storage • Implement energy efficiency and conservation measures • Offset remaining emissions	To support zero carbon businesses, Council can enact the following: • Continue to educate and facilitate large-medium businesses to take up renewable energy, such as through PPAs • Support commercial energy solutions such as onsite renewables and batteries, energy efficiency and degasification by educating and connect businesses together and with funding bodies, energy advice experts and technology providers and installers	To support zero carbon businesses, other key actors can do the following: • State and federal governments to deliver strong energy and emissions reduction policy and accelerate the decarbonisation of the energy grid. They also have a role in supporting businesses and can drive innovation for industrial technology solutions • Others that have a role in zero carbon businesses are business groups and industry peak bodies, consumers and investors
Zero Carbon Households ***Accelerating the transition off gas to all electric homes powered by renewables, and providing targeted support to key segments of the community: apartments, rental properties and vulnerable households***			
	To make strong progress towards zero-net emissions, households in Yarra can enact the following: • Purchase 100% renewable electricity, through Green Power • Upgrade gas appliances to electric, including planning to do so before failure or renovation • Install rooftop solar and battery storage • Implement energy efficiency and conservation measures	To support zero carbon households, Council can enact the following: • Facilitate the purchase of Green Power through a retailer partnership • Support households to take up zero emissions actions (listed at left) through education and linking through to service providers, energy experts and funding • Work with apartments and through the strata governance process to design a solution for apartment buildings to install solar and energy efficiency measures,	To support zero carbon households, the State and Federal government can do the following: • Take action to rapidly decarbonise the electricity grid • Deliver and fund support programs to assist households to transition to zero carbon, including renters, apartments, and households on low incomes

	• Purchase offsets to live a carbon neutral lifestyle	which could be delivered at scale by Yarra and other municipalities • Support the rental market, both landlords and tenants, through education and facilitating solutions to split incentives	• The Victorian Government, through its upcoming Gas Transition Roadmap, could ban all new gas connections • The Victorian Government could regulate minimum standards for rental properties focused on energy efficiency and thermal comfort • Others with roles in zero carbon households include existing programs and tools, landlords and real estate agents
Zero Carbon New Developments ***Creating structural change that can ensure buildings in Yarra and beyond are built to zero-emissions standards***			
	To create zero carbon new developments, developers would design and construct buildings to meet the highest possible ESD standards	Council is already leading the state in support for zero carbon new developments. Through an initiative with the Council Alliance for a Sustainable Built Environment (CASBE) and 31 other councils, Council is aiming to see the planning scheme updated with ambitious Environmentally Sustainable Design (ESD) standards. This can be further supported through working directly with developers to improve practices, promoting sustainable buildings and ensuring buildings meet standards as-built	Policy settings at state and federal level are essential to support zero carbon buildings. Examples of where this is particularly important, include: • Changes to the National Construction Code, reviewed every 3 years by the Federal Government • Victorian Planning Provisions
Zero Carbon Transport ***Creating an enabling environment that accelerates uptake of active and public transport, and where required that vehicle transport is shared and powered by renewable electricity***			
	To support zero carbon transport, the Yarra community can: • Take active or public transport wherever possible • Reduce car ownership and instead engage in car sharing services	To support zero carbon transport, Yarra Council can: • Support mode shift to active, public and shared transport through installing cycling infrastructure, policy settings and advocacy	To support zero carbon transport, other key parties can do the following: • The Victorian Government can support mode shift to active transport by funding and constructing safe, accessible and connected infrastructure for people

	• Where car ownership is required, ensure that an electric vehicle is purchased • Businesses with fleets can reduce operational emissions and support the second-hand market by transitioning their fleets to electric vehicles • Freight providers and delivery services can explore the use of e-bikes and e-scooters	• Facilitate the expansion of the EV charging network through supporting partnerships and connections between electricity distribution businesses, landowners and private charging companies • Encourage the uptake of e-bikes and e-scooters, including for last-kilometre freight and delivery services • Transition council fleet to electric vehicles to reduce operational emissions and support the second-hand market	walking, wheeling and cycling, particularly on arterial roads • The Victorian Government to further invest in public transport improvements to provide frequent, convenient, well-connected and accessible services • Industry support for the design and manufacture of zero emissions vehicles locally, such as e-bikes and buses • The Victorian Government can strongly accelerate its adoption of electric buses, noting that NSW have committed to electrify their entire bus fleet by 2030 • The Victorian and Australian governments can adopt favourable policies (e.g. strong targets, taxes, tariffs, stricter emissions standards) to accelerate the transition to low emissions vehicles of all types • There are many others with a stake in zero carbon transport, from international car manufacturers, freight companies, data providers like Google, car share companies and peak bodies. All of these can enable and support a transition to zero-net emissions for transport
Zero carbon community innovations ***Exploring innovative energy solutions for the community, such as integrated energy systems***			
	To support zero carbon innovations, the Yarra community can: • Participate in innovative pilot projects such as the roll out of community batteries and exploration of other potential innovations (e.g. integrated energy systems, energy trading, demand	To support zero carbon innovations, Yarra Council can: • Be responsive to the latest technology trends and the needs of the community	To support zero carbon community innovations, other key parties can take the following roles: • State and federal governments can continue to provide funding, support and discrete programs targeted to

	management and virtual power plants). These may variously involve households, electricity distribution businesses, technology providers and governments	• Facilitate community support, partnerships, fund research or implementing pilots • Initially support an expansion of the existing community battery pilot with YEF and CitiPower and exploring other models for integrated energy systems	energy solutions, which is crucial to driving innovation • Due to network risks, Distribution Network Service Providers (DNSPs) must support approaches like community batteries and load management approaches • Universities, research organisations and technology providers can come up with new solutions • Large-scale investors can support innovation through funding

2. Introduction

The City of Yarra has a strong history of climate action leadership, both in partnership with the community and in Council operations. Yarra was one of the first local governments in Australia to be certified carbon neutral for its operations and to declare a climate emergency. In June 2020, Council endorsed its first Climate Emergency Plan (CEP) to set out priorities and proposed actions in response to the Climate Emergency declaration.

The City of Yarra's Climate Emergency Plan sets an ambitious objective to:

"Achieve zero-net emissions across the entire Yarra community by 2030, and accelerate the removal of excess carbon emissions",

alongside the objectives to:

- Enable the community to take effective climate action — pushing for urgent change and changing the way we live and work
- Ensure the community is safe, healthy and resilient — especially those most vulnerable to severe climate Impacts
- Create a city that continues to adapt to a changing climate and is ecologically healthy for all species
- Collaborate and advocate with others in the climate emergency movement to increase the City of Yarra's impact

The CEP includes a commitment for Council to develop an evidence-based 'Roadmap to Zero', analysing the emissions reductions potential and cost effectiveness of possible actions, to reduce community greenhouse gas emissions to 2030.

About this report

This report complements the CEP and provides advice to Yarra Council on the action needed to drive significant carbon emissions reductions towards zero-net emissions. It puts forward advice on the major changes and collective effort needed by business, households, individuals and governments to achieve zero-net emissions.

This report presents analysis on the priority opportunities to reduce emissions in Yarra, covering:

- Yarra's current community emissions profile
- Emissions trends that are projected to impact Yarra for the coming decade
- The vision for a zero-net emissions future
- The broad pathways to achieve zero-net emissions
- Specific actions that can be taken by the community, Council and other stakeholders

An evidence-based approach

The development of this Roadmap has been grounded in an understanding of the current emission sources and reduction activities, as well as future emissions projections, trends and potential actions.

Detailed analysis has been carried out, drawing from a range of sources, including projected population changes and economic growth, understanding how government policies are expected to impact emissions, as well as 'disruptive events', such as the point when electric vehicles reach cost-parity with petrol and diesel-powered vehicles.

To understand how best to intervene in the current emissions trajectory and bring it down towards zero-net emissions, the report has been informed by an evidence-base of the most effective government programs locally and internationally. The analysis is also forward-looking and considers the need to drive innovation and assist the community to take up emerging opportunities and new technologies.

To develop and refine the suggested actions Council could take, targeted consultation was carried out with Council staff, experts in the sector and local community groups.

3. Background and Context

The Yarra Community

The City of Yarra is an inner metropolitan municipality on the traditional land of the Wurundjeri Woi Wurrung people, and is home to a diverse community of around 100,000 people[1]. Covering a land area of 20km[1] (or 2,000 ha) the City of Yarra has a population density of 51 persons per hectare making it a busy and vibrant area.

Yarra is a key business, cultural and social hub within Melbourne with a vibrant community life of arts, culture, eateries and shops. The municipality comprises a mixture of residential, industrial, and commercial activity with major features including St Vincent's Hospital, Victoria Park Football Ground and Yarra Bend Park. The three largest industry sector employers are professional, scientific and technical services (17%), health care and social assistance (12%), and education and training (10%)[2]. Housing in the City of Yarra is 85% medium or high-density dwellings (compared to 33% for Greater Melbourne). Increasingly popular amongst working professionals, the City of Yarra is made up of 30% lone person households, with 50% of households renting[3].

Yarra's Community Emissions Profile

Emissions in the City of Yarra were quantified as approximately 1.75 $MtCO_2e$ per year in 2018/19. The largest source of emissions was electricity, largely from the commercial and industrial sectors, which comprise around 66% of emissions. The residential sector is responsible for around 19% of emissions whilst transport accounts for 12%. Emissions from waste are small at 3%.

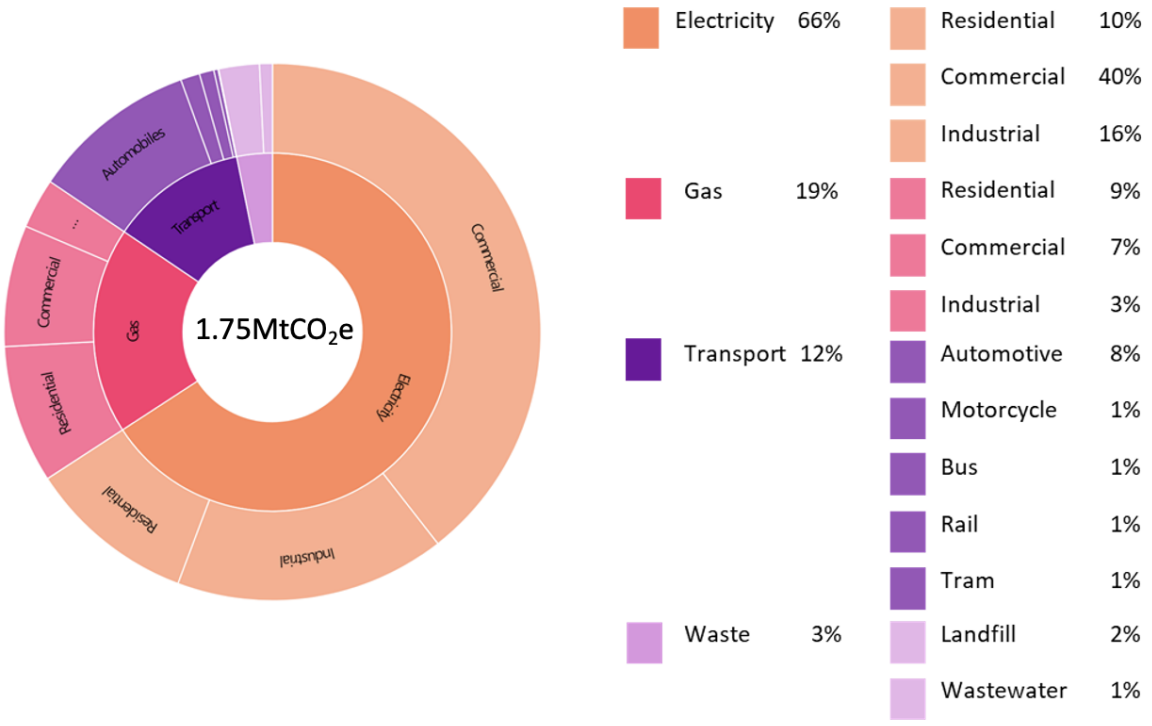


Figure 3: Community Emissions profile for City of Yarra, 2018/19

The community emissions boundary aligns with the Global Protocol for Community-scale Greenhouse Gas Inventories (the GPC) and the Common Reporting Framework (CRF). It includes the following emissions sources:

- Scope 2 and 3 emissions from electricity
- Scope 1 and 3 emissions from gas
- Scope 1 emissions from transport
- Scope 1 and 3 emissions from waste (calculated at the source of generation)

Emissions within the City of Yarra are also influenced by activities occurring outside the City boundary, for example by the emissions intensity of the energy grid or by energy used to manufacture products that are exported to other areas. Similarly, activities within the City of Yarra give rise to emissions outside of the Yarra boundary. For this Roadmap, the focus is on reducing emissions that are within the scope of the community emissions profile in Figure 3.

Whilst the community emissions profile shows emissions resulting directly from activities within Yarra, it is also important to understand how activities within Yarra contribute to emissions generated elsewhere. Consumption-based methods provide an alternative perspective on the emissions impact of communities. Whilst difficult to calculate with accuracy, due to the globalised nature of production and consumption, Figure 4 provides an example of the relative impact that the Yarra community has on agriculture and aviation emissions within Australia.

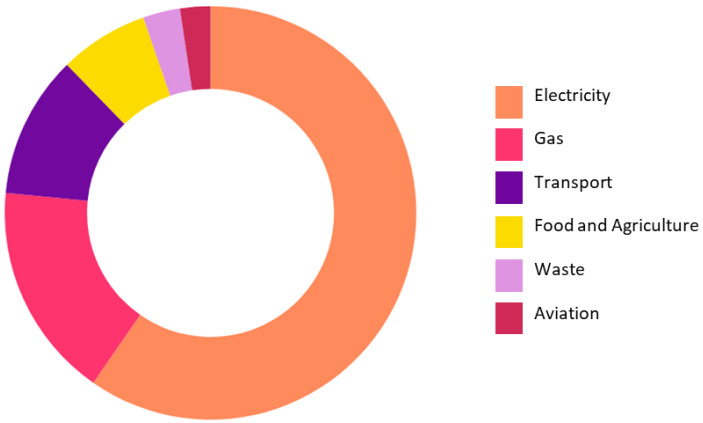


Figure 4: Pie-chart illustrating the potential impact of emissions from consumption

Acknowledging that it is outside the scope of this Roadmap report, there are worthwhile opportunities for Yarra Council to engage the community around reducing consumption-based emissions, especially emissions associated with food.

The full community emissions profile report and data is provided as an appendix to this report.

Trends Influencing Emissions

Table 2: Trends influencing emissions in the City of Yarra

Population growth	The City of Yarra's population is forecast to grow by almost 49% between 2021 and 2040. This growth will be reflected in increased energy consumption from housing, commercial activity and transport.
Economic growth	Increased economic activity is seen as a desired outcome or marker of success for most cities, and it is expected that there will be economic growth in the City of Yarra in the decade to 2030. Historically economic growth in cities have typically meant increases in emissions. It is technologically possible however to decouple economic activity from emissions, such that businesses can thrive whilst also reducing emissions.
Electricity grid emissions intensity	It is projected that the emissions intensity of the grid in Victoria will decrease by 46% between 2020 and 2030. This is due to more renewable electricity being fed into the grid and in-line with the Victorian Government's target of 50% renewables by 2030.
Technology improvements	Emerging technologies provide new opportunities for emissions reductions. Electric vehicles and household batteries are the two primary examples in 2021. As these technologies are refined and taken up, they will become cheaper, which is projected to further increase their take-up.
Rising car usage and ownership	Significant population growth over the last 20 years has increased travel demand, and much of the increase in trips have been via private vehicles. The number of car trips starting, ending and occurring within Yarra is increasing and, without intervention, is forecast to reach 42,800 trips by 2031, which is equivalent to a 48% increase over 20 years. Rates of car ownership have also increased significantly in recent (pre-pandemic) years. In 2016 there were approximately 40,000 vehicles owned in Yarra, out of a total population of only 93,000 residents at that time. Between 2011 and 2016 car ownership increased by nearly 20%. If this were to continue the number of cars in Yarra could increase to 50,000 by 2026.
Uptake of zero emissions transport	Electric passenger vehicles are projected to achieve cost-parity with internal combustion engine cars in around 2024. This is due to changes in the market as a result of other countries setting strong EV sales targets, and car manufacturers responding by dates to phase out the production of fossil fuel powered vehicles. Studies indicate that by 2030 EVs could make up about 4-10% of cars in Victoria without additional policy action, or about 27% with additional policy support.
Uptake of renewables	The number of annual solar installations in Yarra almost doubled in 2019 compared to 2015. Currently, approximately 11% of detached or semi-detached dwellings in Yarra have solar installed. The lowest uptake is in suburbs where apartments are the majority dwelling type. It's expected that in Yarra total solar installations could increase by around 16% per year, with around 17% of total dwellings (including detached, semi-detached and apartments) having solar installed by 2030.
Transition away from gas	The Victorian Government is currently exploring sustainable alternatives and pathways for the gas sector to transition to zero-net emissions and is developing a Gas Substitution Roadmap throughout 2021. This strategic framework for decarbonising natural gas in Victoria will assist in supporting the community in Yarra to reduce gas consumption.
Policy Environment	The policy environment at a state and federal level can both encourage and hinder emissions reductions, by providing certainty and support for various actions. Currently, the Victorian State Government has established legislated emissions reduction targets, but at a federal level there is lack of adequate climate and energy policies.

4. A Zero-Net Emissions Future

Electricity, as a source of energy, is one that can be produced with zero greenhouse gas emissions through renewable sources, such as wind and solar.

If all fossil fuel use was converted to electricity as an energy source, and all electricity was created from renewable sources, then emissions in the City of Yarra would be around 3% of what they are currently.

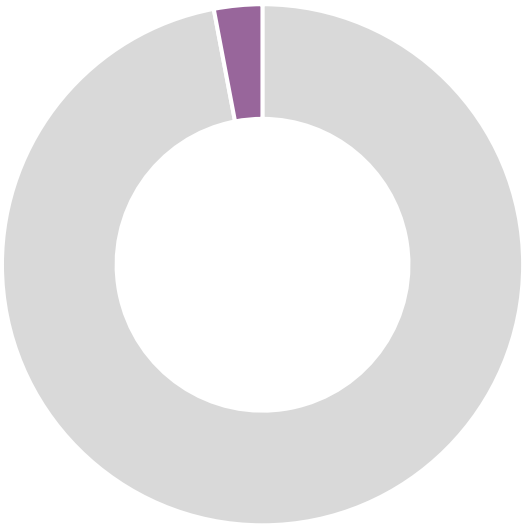


Figure 5: Community emissions profile, showing only 3% emissions from waste (in purple). The grey area represents emissions that could be reduced in an all-electric, no fossil fuels scenario.

What this means in practice, is that the most direct path to zero-net emissions involves a significant push to electrify all appliances (water heating, air-conditioning and cooking), vehicles and industrial machinery. There also needs to be a concurrent push to change grid-supplied electricity to be from 100% renewable sources, cease the consumption of gas and all fossil fuels, and to reduce overall energy use. Measures that support local renewable installations and innovative energy systems provide additional local economic and energy resilience benefits.

It will be important that all newly constructed buildings are built to a high standard, which means they will use electricity from renewable energy sources, achieve high energy efficiency standards and provide a thermally safe building for occupants.

As the population grows, it is expected that there will be a need for far greater uptake of active transport such as walking and cycling, public transport, and light electric vehicles such as e-bikes and e-scooters. Where travel by car is necessary, this would be powered by renewable electricity and, where possible, would involve other alternatives to private car ownership, such as share cars.

The drawdown of carbon from the atmosphere — such as through storage in soils and vegetation — is expected to be a key part of the global solution to the climate crisis. Due to the geography of Yarra, and the scale of change required to drawdown carbon, these would occur outside the municipal boundary.

5. Practical Pathways to Zero-Net Emissions

This section provides an outline of the actions needed in the coming decade to progress towards zero-net emissions by 2030. This involves changes at all levels of government, across industry sectors, individuals, developers and from energy and transport providers. The challenge is monumental, but strong progress towards zero-net emissions could be achieved if all actors are to go "all-in", that is, to fully deploy all options including offsets.

All efforts will need to be made to transition all electricity to renewable sources, and all fossil fuels, including gas and transport fuels, to electric alternatives.

The Federal and Victorian Government have both committed to zero-net emissions by 2050 targets. This is significantly lower than the strongest zero-net by 2040 target recommended by the Intergovernmental Panel on Climate Change (IPCC). Advocacy to government to strengthen targets and decarbonise the energy sector should therefore continue to be a focus for Yarra Council.

Zero Carbon Electricity: for Households and Businesses

Zero carbon electricity is essential to achieving zero-net emissions. This will be affected by several factors. Primarily, the introduction of strong policy support for the energy sector to transition needs to come from the Federal Government. The Victorian Government currently has a target to achieve 50% renewables by 2030 and is on track to meet or exceed that. The impact on the Victorian electricity coefficient (which reflects the amount of GHG emissions released per kWh energy consumed in $kgCO_2e/kWh$) of this increased grid penetration of renewable energy, is reflected in Figure 6.

This ambition could be accelerated to achieve zero-net emissions from grid-electricity by 2030, through driving investment in large scale renewables and a swift exit from fossil fuels. If this was achieved, the Victorian electricity coefficient would go down to zero, which would mean that all electricity consumed would be free of GHG emissions. This is also reflected in Figure 6.

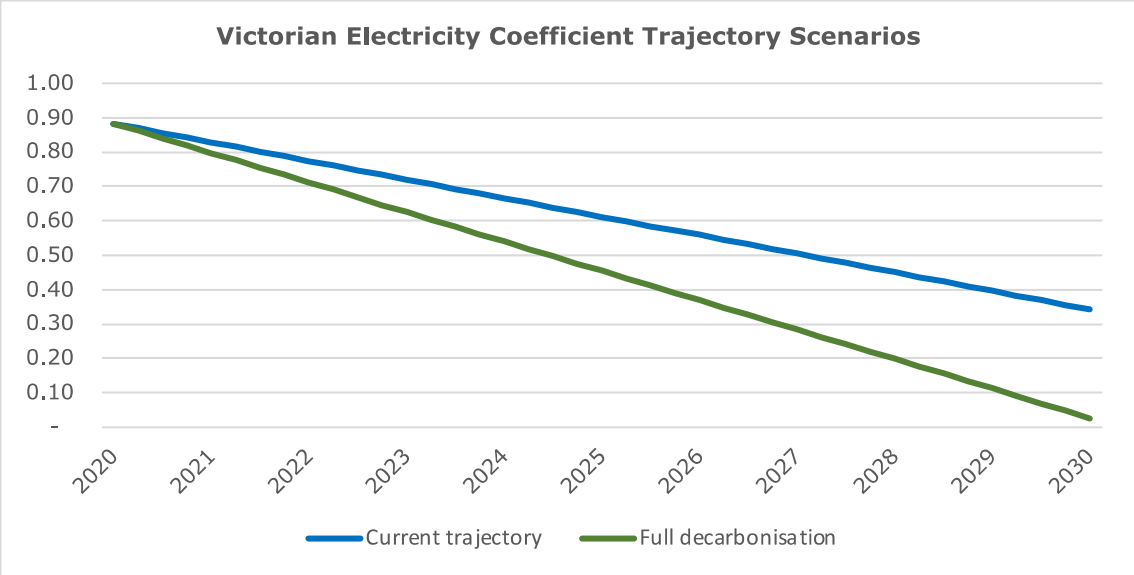


Figure 6: Graph showing different trajectory scenarios for the Victorian electricity grid

Households and businesses can play a part in the drive towards zero carbon electricity by installing rooftop solar and battery storage, purchasing Green Power or engaging in Power Purchase Agreements (PPAs). This can be made easier and cheaper by reducing overall electricity consumption through energy efficiency and conservation measures. This is already happening with some significant players such as Coles Group, Aldi and Woolworths making significant commitments to zero carbon electricity by 2025.

As well as known solutions like purchased renewables, rooftop solar and a decarbonised grid, there are other solutions that can contribute to achieving 100% renewable electricity in Yarra. Integrated energy systems connect generation, transmission and distribution, storage, loads and behaviours in a coordinated way. There are innovative solutions and smart technology that can tap into various parts of that process to ensure that energy is used more efficiently and ultimately, save emissions. Examples of this include community batteries, virtual power plants and demand management.

Zero Gas: for Households and Businesses

To drastically reduce emissions, the burning of fossil fuels for energy needs to end. Any new homes built with gas connections and appliances are committing to another 10-25 years of fossil fuel consumption, which means continued release of greenhouse gas emissions. Policy and regulatory changes are needed to normalise developments with no gas connections.

Households and businesses need to plan for a transition from gas appliances to electric. This means understanding products, financing options and the process to upgrade before the pressure of a technology failure or a renovation occurs. If 50% of businesses and homes in Yarra that currently use gas were to transition to electric equipment and appliances that are powered by 100% renewable electricity, around a cumulative 435,000 tCO_2e could be saved between 2021 and 2030. In 2030 alone around 90,000tCO_2e would be saved, which is equivalent to around 5% of the emissions released in 2018/19.

To facilitate a fast transition, state and federal governments should provide significant support to industrial-scale businesses to test and implement new technology solutions to transition away from gas-

fired machinery and equipment. For some applications, suitable alternatives may not be available yet, so research and development will be important.

To progress towards zero-net emissions by 2030, state and federal governments should not approve any new gas, coal and other high-emissions projects, and they should institute a rapid phase out of existing fossil fuel based energy generation.

Zero Carbon Buildings

All new buildings and infrastructure in Yarra must be set up for the future, avoiding long-term operational emissions and the need for future retrofitting. Every new building constructed can be expected to last at least 60 years, though it's reasonable to expect that sturdy constructions may last up to 100 or more years. Therefore, ensuring the building is designed and constructed for a zero carbon future is imperative.

This should be mandated via the Victorian planning system and the National Construction Code. There should also be mechanisms in place that ensure that compliance with these standards is achieved.

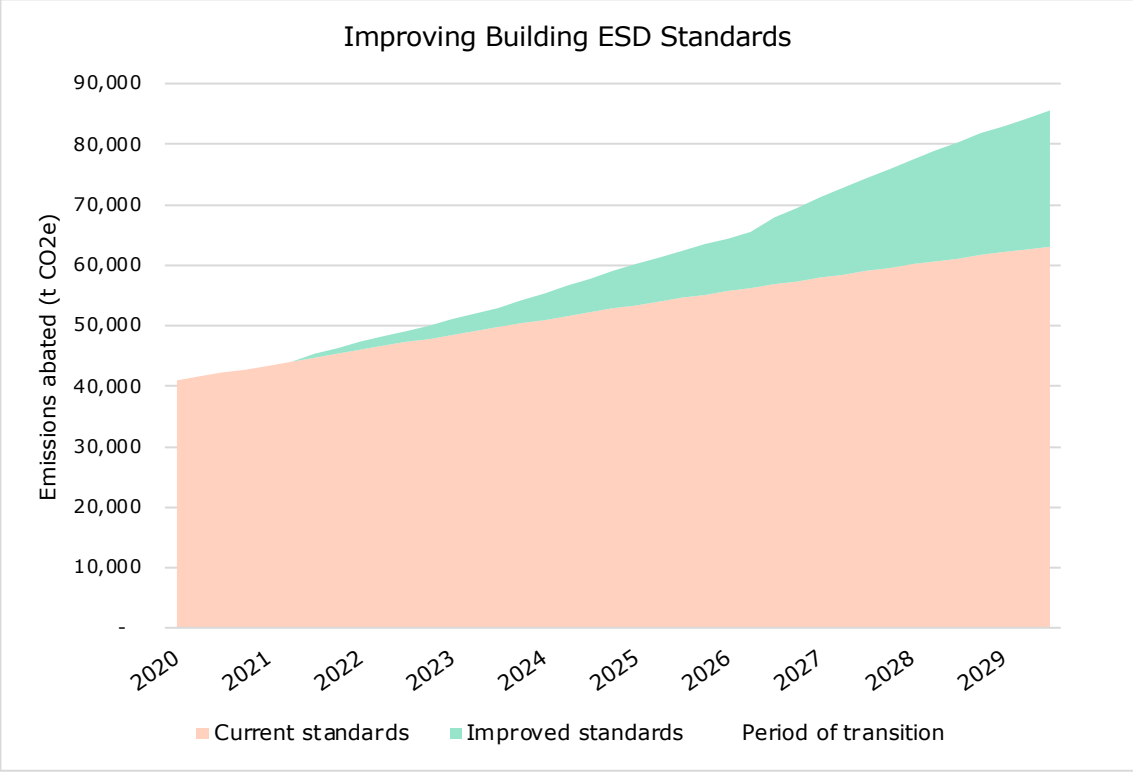


Figure 7: Potential impact of improved ESD standards in the planning code

Figure 7 shows that currently there are emissions savings from buildings constructed to a high standard, and that is continuing to increase. It also shows the projected impact and systemic change that proposed improved ESD standards in the planning scheme would have on emissions from new developments in Yarra, which is expected to result in higher emissions savings.

Zero Carbon Transport: Active and Shared

Many shorter trips can be reduced to zero emissions through walking and cycling. Maximising the uptake of these transport modes will not only reduce emissions but also contribute to a significantly healthier community and reduce traffic congestion. The City of Yarra is a national leader in cycling and car share infrastructure and has good links to public transport. In some areas however, more needs to be done to increase the uptake of these transport options. Building on existing cycling networks to and improving links to public transport hubs would further increase the numbers of people riding bikes.

Public transport provides an option for much lower emissions travel. By governments ensuring that public transport is frequent, convenient, timely, connected and accessible, it is projected that more people will be able to benefit from low-emissions travel. Furthermore, public transport needs to be powered by 100% renewable energy. Currently, the Victorian Government is undertaking an electric bus trial that will be rolled out across the network in time. Trams in Victoria are powered by renewable energy, with the state government also committed to power all trains by 100% renewables and for all new buses to be zero emissions by 2025.

Where car travel is required, ideally this is accessed through car sharing and alternatives to car ownership. Car sharing fleets are often newer than average vehicles and emissions are typically offset, meaning that this is a lower impact mode of travel than the average privately owned vehicle. Finally, the mentality around the cost of using a car changes from an occasional lump sum to a pay-per-use, which makes public or active transport preferable for some trips. Enabling the Yarra community to reduce personal car ownership and take up car sharing services will drive emissions from transport down. Council has already taken an active role through policy support to drive the uptake of car share, and could provide further support as an educator and facilitator.

Zero Carbon Transport: Zero Emissions Vehicles

The achievement of zero-net emissions requires considerable reduction of emissions from the use of fossil fuel powered on-road vehicles. It is not realistic that transport will be zero emission by 2030, however there are a wide range of actions that can accelerate the transition and the next ten years will be critical to this. Mode shift to active, public and shared transport is important in reducing transport emissions, however the reality is there will still be cars, trucks, buses and heavy vehicles in use in 2030. Every measure available should be taken to accelerate the shift for these to be electric or other zero emissions vehicles.

The use of a range of electric vehicles should be actively encouraged, with a preference for smaller, lighter weight, efficient vehicles and reduced road congestion, such as electric bikes, scooters and motorbikes, followed by electric cars (EVs). Electric bikes and scooters can reduce some common barriers to the use of conventional bicycles, including physical limitations of the rider, arriving at work without perspiring and the ability to ride with greater loads (for example, children or groceries). They also have the potential to replace some car use[4].

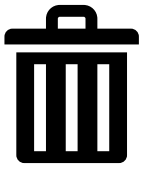
Policy settings are an important tool for state and federal governments in accelerating the transition to EVs. This includes favourable taxes and tariffs for EVs, as well as regulations on tailpipe emissions. In 2020 less than 1% of all new car sales in Australia were electric vehicles. The Victorian Government has a target of increasing this to 50% of all new car sales by 2030. Other countries are already seeing massive

uptake of EVs due to favourable government policies; in Norway EVs comprise 73% of new car sales and in the UK, this is 10%[5]. Strong national government policy could bring Australia closer to these figures.

International vehicle markets are important in supporting the transition. Major economies like the UK, Japan and Europe are setting ambitious targets for EV sales and car manufacturers are responding by phasing out petrol engines. Over time EVs are expected to become cheaper than petrol vehicles with some modelling suggesting this may occur around 2024[6].

Australia has a large second-hand car market which is partly enabled by the turnover of corporate fleet. The transition of fleets by large companies and governments to EVs will mean more affordable EVs are available.

An enabling environment for electric vehicle (EV) charging should also be created, including public chargers for people passing through the municipality and solutions for residents that do not have off-street parking. Through land use and infrastructure planning, Council can play a key role in facilitating public EV charging capacity.



Zero Emissions from Waste

Waste accounts for around 3% of total emissions in Yarra, including solid waste and wastewater.

Reducing the amount of waste going to landfill is a significant way to reduce emissions. Council is currently evaluating options to determine a suitable municipal-wide food and organics (FOGO) service. Diversion of food and organics waste from landfill can reduce emissions from waste by around 25%, which in 2018/19 would represent around 10,000tCO_2e of Yarra's emissions[7].

There are a number of ways to reduce the methane produced by landfills, including exploring waste-to-energy systems or methane cap-and-flaring. Landfill operators, including other councils, have a significant role to play in exploring these opportunities to reduce emissions from waste.

Adopting circular economy approaches, continuing to roll out waste education, behaviour change initiatives, and improve waste infrastructure and services will further drive down emissions from waste. These are not a core focus of this Roadmap report and are addressed through other plans.

Leadership on Climate Action

Widespread, rapid deployment of mature technologies could immediately achieve much of what is needed to reduce emissions this decade. Additional investment in research, development and commercialisation of new technologies and processes can further narrow the gap towards achieving zero-net emissions across all sectors.

Yarra City Council can continue to play a leadership role within the Yarra community and the wider local government sector. Council can break ground for others to follow, promote success stories, celebrate and enable emissions reductions by others.

Council has a role in partnering with others to support programs and drive innovation. This includes local governments, the Victorian Government, research institutions and private enterprises. Council support could take the form of funding research or testing processes, technologies and approaches.

Finally, Council currently advocates and can continue to advocate for change at other levels of government. Whilst the efforts of Council and the Yarra community are considerable, it is imperative that changes occur at other levels of government by major business and industry, in order to work towards zero-net emissions by 2030. Stances that could be pursued for stronger action at other levels of government include:

- Ambitious renewable energy targets and stronger national energy policies
- A supportive policy environment for low carbon transport
- A supportive policy environment for low carbon, resilient buildings
- Support for innovation in carbon drawdown technologies and approaches

Carbon Offsets

The focus for Yarra's Roadmap to Zero should stay on systemic and technological changes that result in long-term emissions reductions. However, carbon offsets can play a role in achieving zero-net emissions whilst solutions for hard-to-mitigate emissions sources are developed or need further time to be fully deployed, as in the case of electrifying transport or ceasing gas consumption.

Carbon drawdown technologies such as carbon sinks and changes in land management practices continue to be developed and more investment in research and projects is needed at the national level to drive progress in this area. Council could stay up to date with emerging approaches to drawdown and partner with others to advocate for effective and scalable drawdown methods. There may be future opportunities for partnerships with regional councils to jointly invest in regenerative land management practices to sequester carbon and contribute to regional economies.

Emissions Projections: Ambitious Emissions Reductions

An emissions trajectory to 2030 based on ambitious and urgent action has been modelled and presented at Figure 8. It is based on a shift to 100% renewable electricity, which could occur through a combination of decarbonisation of the grid, purchased renewable energy, rooftop solar and batteries, and innovative energy solutions. It is based on there being strong efforts from the community to shift energy and transport behaviours and it also requires strong government support and policy at all levels.

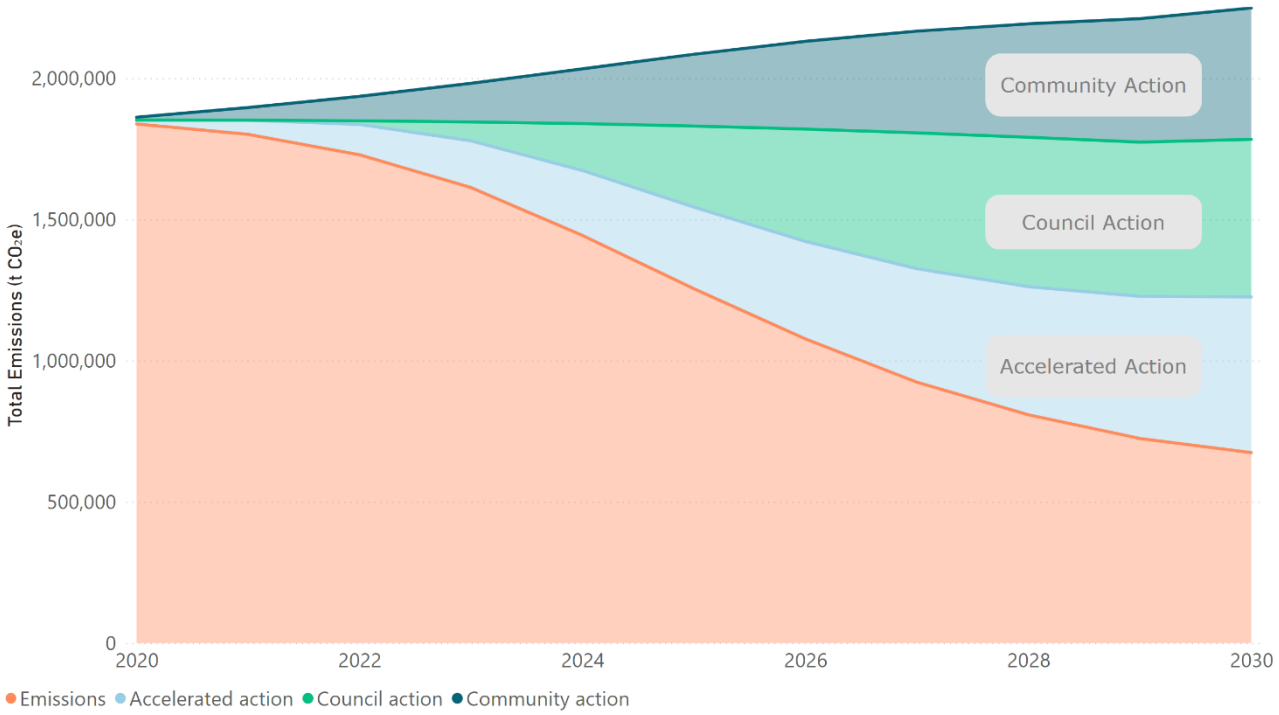


Figure 8: City of Yarra emissions projections to 2030

The scenario at Figure 8 includes an ambitious 50% transition away from gas usage in homes and businesses by 2030. The process of electrification must align with the decarbonisation of electricity. If electrification is to happen faster than that, there will be overall higher emissions released over the period to 2030.

If action is not taken, emissions in the City of Yarra are projected to increase to be more than 2MtCO_2e per year by 2030.

The "community action" wedge in Figure 8 includes action taken by households and businesses in Yarra, such as electrifying appliances, shifting to renewable energy and purchasing electric vehicles, as well as other actions outlined further in this Roadmap report. The "Council action" wedge refers to the additional impact that could be achieved through Council programs to further support and accelerate community action over the coming decade. This would be in addition to the expected impact of the business as usual "community action" wedge. The "accelerated action" wedge could be achieved in multiple ways, but largely refers to greater support from the Victorian and Federal governments, achieving 100% renewable electricity by 2030 and a 50% transition away from gas appliances and equipment.

In the scenario explored in Figure 8 zero-net emissions is not achieved by 2030. This is due to residual emissions from transport and gas. Options for managing these emissions through carbon offsets until they are fully resolved, could be explored.

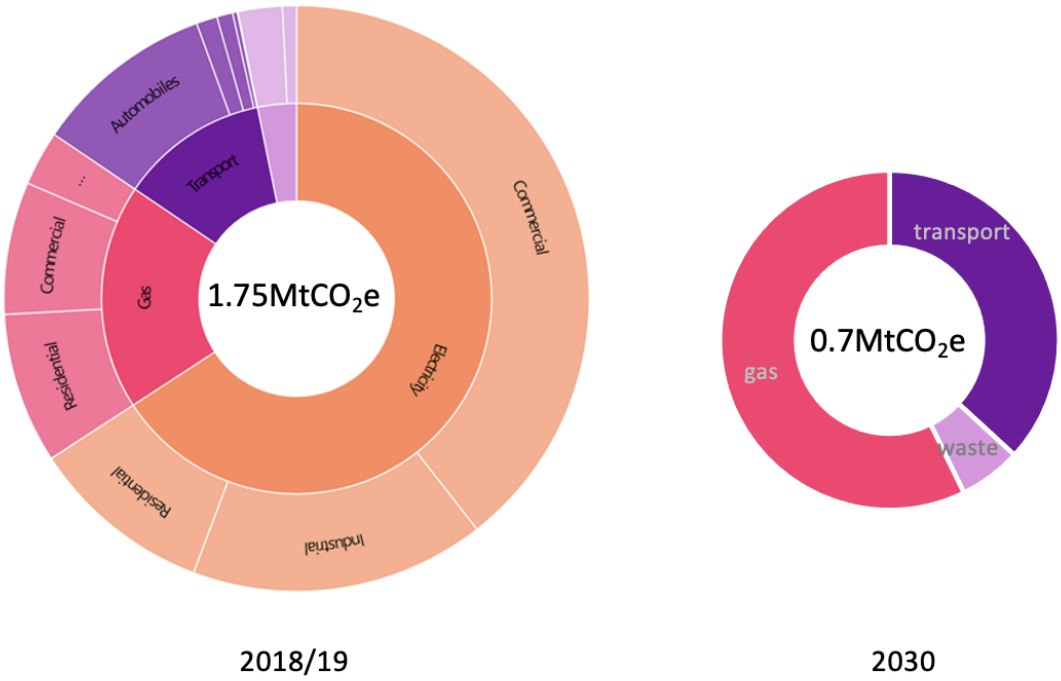


Figure 9: Community emissions profile for City of Yarra in 2030, with ambitious and urgent action

Yarra Council's Role in Facilitating a Zero-Net Future

The UN Paris Agreement, developed in 2015 and ratified by the Australian Government in 2016, explicitly recognises the role of local and subnational governments in addressing the climate crisis.

Council is uniquely placed to support the target of zero-net emissions in the City of Yarra. Local governments work within the community, are engaged with what's happening "on-the-ground" and understand local opportunities and challenges. Working at this scale enables Council to be nimble, experimental, and progressive. At the same time, Council is big enough to be impactful and influential with strong links to other levels of government and has authority with important stakeholders.

Council can continue to work in partnership with other organisations and councils towards reducing community emissions. The Yarra Energy Foundation (YEF), established and funded by Council since 2010, provides a range of energy related services and programs to households, businesses and community organisations. YEF is also leading the Metropolitan Community Power Hub, an initiative of the Victorian Government.

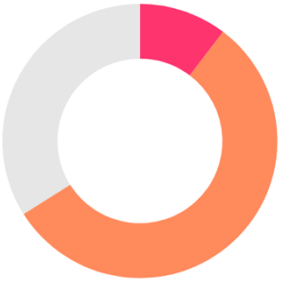
Council plays key operational roles in the municipality that are relevant to addressing climate change. This includes land-use and transport planning, waste management, developing and managing local policies, operating and building city infrastructure and wide-ranging community support and engagement.

Yarra Council is a leader amongst local governments in Australia. Its role to influence, lead, facilitate and advocate has the potential to reduce emissions well in excess of those from the Yarra community. For example, by introducing zero carbon standards for new developments, this provides a precedent for action elsewhere.

By taking ambitious action, Council can inspire others, shape social norms and influence a cultural shift towards a zero emissions future. This can contribute to increased uptake of sustainable behaviours on a large scale. This report puts forwards a range of actions that Council could take to enable businesses, residents, organisations and developers to reduce emissions. These would require considerable engagement effort, and Yarra Council is well-placed to build on the existing 'Take Climate Action' communications and engagement initiative to mobilise the community to reduce emissions.

In a business-as-usual scenario, it's expected that emissions would increase to around 2.2MtCO_2e for the year 2030 and around 21MtCO_2e would be released over the period to 2030. Based on the recommendations in this Roadmap report, it's expected that Council efforts could see 2030 emissions up to 25% lower than they otherwise would have been, achieving total cumulative savings of around 1MtCO_2e and possibly as high as 2.3MtCO_2e over the 9 year period.

6. Zero Carbon Business

Potential Impact of Zero Carbon Businesses	Sectors Targeted
Cumulative Impact to 2030: 3.6 Mt CO_2e Annual Impact in 2030: 655 ktCO_2e Reduction from total BAU emissions in 2030: 30% Reduction from BAU commercial and industrial emissions in 2030: 49%	 This pie chart highlights the emissions from commercial and industrial energy consumption in the City of Yarra in 2018/19.

The total cumulative impact for zero carbon businesses includes the impact of 100% renewable electricity by 2030, which could be achieved by onsite renewable energy generation, purchased renewable electricity or through grid changes that are above and beyond the business-as-usual trajectory. Emissions saved due to the business-as-usual projected changes to the state electricity emissions factors have not been included in the total cumulative impact for zero carbon businesses.

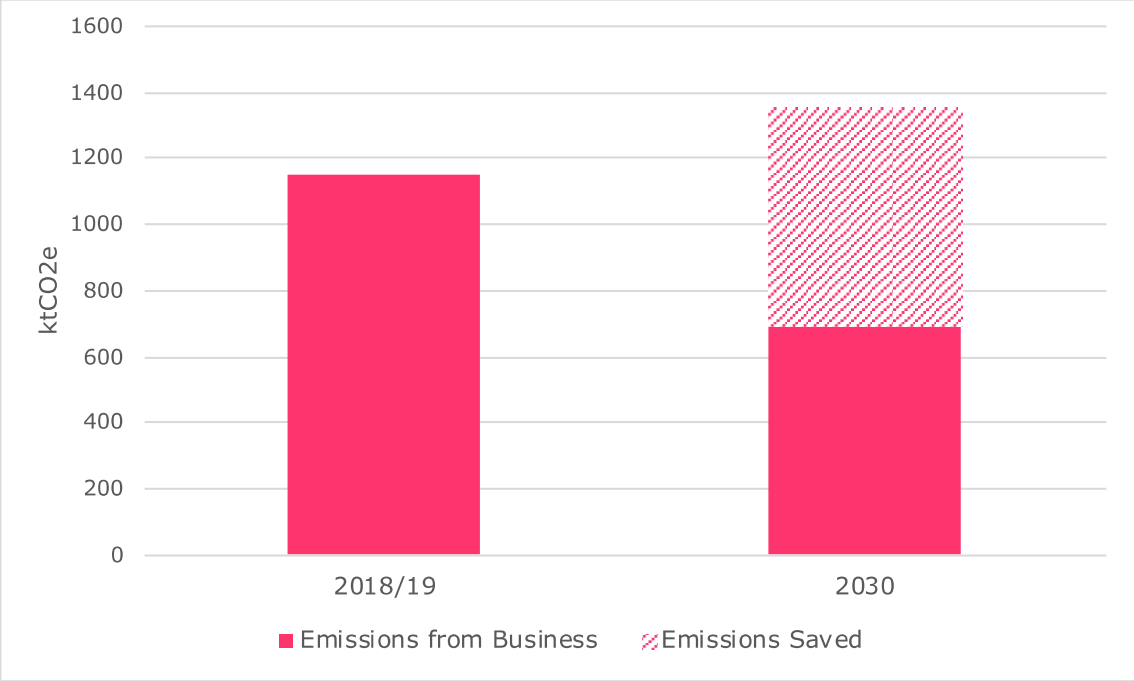


Figure 10: Impact of Zero Carbon Businesses compared to BAU

Areas of Focus	
	100% renewable electricity
	Zero use of gas

Co-benefits	
	This area presents an opportunity to support the growing renewable energy industry in Victoria. It also directly supports technology providers, local installation businesses and the growth of energy solutions providers generally.
	Potential for cost savings for participating businesses through favourable energy contracts and improved certainty around future energy pricing. Further cost savings for businesses through improved energy efficiency and onsite solar PV.
	Greater resilience to network issues such blackouts and improved building user comfort during extreme heat events.

Emissions from the commercial and industrial sectors account for 66% of Yarra's emissions profile across around 16,000 businesses, which is why it's been recommended as a key focus for Council over the coming five years. If emissions from businesses do not reduce, by 2030 around 1.3MtCO_2e per year will be released by the commercial and industrial sectors.

Prior to the Covid-19 pandemic, around 30 businesses in Yarra employed 200 or more people and would be considered large businesses, whilst around 500 businesses employ between 20-199. Around 5,000 businesses employ fewer than 20 people and around 10,000 businesses in Yarra are sole traders. The vast majority of these businesses lease the premises from which they operate.

Yarra is largely a commercial centre, with some industrial emissions coming from breweries and other food and beverage manufacturing, mechanical services, transport and warehousing services and other light manufacturing. Small-medium businesses are spread across all sectors, though the more heavily represented are commercial categories such as financial services, retail and hospitality.

In the wake of the Covid-19 pandemic more than ever, the focus for businesses is on "keeping the doors open". Small-medium businesses in particular are traditionally time-poor, focussed on producing widgets or delivering services, and do not have the capacity to research emerging technologies or changes to their operations to improve sustainability. Furthermore, with such a high proportion of businesses renting their premises in Yarra, the opportunity to retrofit buildings is not always within their scope of control.

However, larger businesses are making changes that will open up new opportunities for the broader business sector. Increasingly Australian businesses and institutions are taking up PPAs, including Yarra Council through the Melbourne Renewable Energy Partnership (MREP), and a further 46 Victorian councils through the Victorian Energy Collaboration (VECO). Telstra and Aldi already source energy through PPAs, whilst Woolworths and Coles Group along with other large corporates have made commitments to power all operations with renewable energy by 2025. This will impact emissions in Yarra, which is home to six major supermarket stores alone. It could also influence other major retailers to consider similar action.

Zero Carbon Actions for Businesses

For businesses, there can be considerable financial incentive to reducing emissions because energy efficiency measures typically pay for themselves in a short time period, and from there are cost-positive. The type of measures that businesses can take are outlined below.

Purchase 100% renewable energy

With 56% of business emissions coming from electricity use, a fast way to reduce emissions is by purchasing renewable electricity. Compared to on-site solar installations, buying renewables can be more accessible to businesses, regardless of their tenancy or building type. It also doesn't involve upfront capital or investment of resources. Energy can be purchased through a renewable electricity Power Purchase Agreement (PPA) or through electing to purchase Green Power through a business's energy retailer.

It's expected that if this action was implemented to its full potential, the uptake of PPAs could mitigate 80% of electricity emissions from the commercial and industrial sector. Based on 2018/19 emissions this is equivalent to saving 780,000tCO_2e in one year.

For large energy-using businesses, long term PPAs can enable access to affordable renewable electricity and fix rates to mitigate future price volatility. A PPA is an agreement between an electricity generator and a consumer for the sale and supply of 100% renewable electricity. It provides consumers with zero emissions energy, whilst providing confidence to generators to invest in new renewable energy infrastructure.

Electrify gas appliances and equipment

Electrification of gas appliances and equipment is important because electricity can be produced from renewable sources, whilst fossil fuels like natural gas cannot.

For small-medium businesses gas is largely used for domestic-style space heating and cooling, hot water heating and cooking. For these applications, electric alternatives are available, and businesses can plan for upgrades to this equipment so that at the point of replacement or failure they can transition to electric appliances.

For some specialist industries, gas is used to power large machinery and achieve industrial heat for catalysing chemical reactions, fusion of materials, large-scale water heating and steam production. In these cases, electric alternatives are often, but not always, available, and viable. However, there is ongoing research being conducted (e.g. by CSIRO and others) and trials occurring throughout the country on options for larger industrial consumers.

Conserve energy and introduce energy efficient technologies

Energy conservation, in simple terms, means ensuring that where possible energy is not used at all. The classic example of this is turning off all lights and equipment at the end of the day. This is a zero cost, behavioural change that is available to all businesses, right now. For more advanced solutions, smart technology is now available that works on timers or includes the ability to dim lights or adjust settings to conserve energy at certain times. Or, other conservation measures such as using passive heating and cooling controls can be introduced.

Businesses can also introduce energy efficient technologies. These are available right now and generally have relatively quick return on investment. Examples like LED lighting upgrades and appliance upgrades can be applied to almost all business models, have low up-front capital costs and there is often financing support available.

Through measures such as this, Yarra businesses could save between 240,000 – 290,000 tCO_2e per year, based on 2018/19 emissions (and not considering reductions in emissions intensity of electricity sources).

Install on-site renewables and battery storage

Yarra currently has 6,800kW of solar installed at a commercial scale (above 10kW) on 194 buildings[8]. With around 6,000 "bricks and mortar" businesses in Yarra, and around 10% of businesses owning their space, there is theoretically scope for an additional 400 businesses to easily install onsite solar by 2030. The cost of battery storage is declining meaning that this could soon be a viable option for business with nighttime operations as well. This could save around 65,000tCO_2e per year.

For commercial landlords, there is unrealised potential to install solar and use financing mechanisms and agreements to receive a return on investment. There is also the opportunity to explore solar sharing technologies that enable energy sharing across multiple tenancies. This opportunity is potentially quite large, with around 5,600 businesses in this category that could shift towards zero-net emissions from electricity through this action.

Offset remaining emissions

With the full deployment of actions to conserve energy and transition to renewable electricity, businesses in Yarra are likely to still have residual emissions from gas appliances or equipment that are yet to be

upgraded or do not have viable electric solutions. There also may be emissions from fleet, transport or industrial processes and product use remaining.

Businesses can consider offsetting these emissions through the purchase of Australian Carbon Credit Units (ACCUs) or Verified Carbon Units (VCUs), also known as "offsets". Each unit represents the drawdown or mitigation of one tonne of carbon dioxide equivalent (1 tCO_2e) that has not yet been counted as an emissions reduction in any other carbon accounting process. The price of carbon offsets is expected to increase in future as demand grows. For example, as of 22nd January 2022, the price for ACCUs was at a record high of \$55.25/tCO_2e, up from the previous record of \$18.88 in September, due to increased demand for offsets[9]. The price of VCUs vary greatly.

How Yarra Council Can Enable Zero Carbon Businesses

To address emissions from this sector, there has been consideration for the different needs, challenges and engagement methods for different business types and sizes. This has resulted in recommending that Council work with larger businesses to increase the uptake of purchased renewables through Power Purchase Agreements (PPAs); and support smaller businesses, particularly "mid-tier" businesses with a range of commercial energy solutions.

Renewable Energy Power Purchase Agreements (PPAs)

PPAs do not require upfront capital investment or changes in process or technology for businesses. Whilst a PPA is in theory a simple contract mechanism, they are not yet a mainstream way of procuring electricity. For businesses, navigating the details of a PPA to procure energy can be complex and present a barrier to uptake. This may include gaps in technological, financial, legal and energy market expertise.

It is recommended that Council build on its work with large-medium energy using businesses to increase the uptake of renewable electricity through PPAs. Council is leading a joint project already underway with Darebin, Moreland, Port Phillip, and City of Melbourne. The aim of this project is to develop a replicable process whereby groups of medium to large energy consuming companies can procure affordable renewable energy via PPAs. Building on this initial project Council could then extend the reach of the initiative to involve a greater number of businesses. Partnering with a third party to support consumers, potential modes of engagement could include workshops or direct consultations with local experts to provide advice and guidance. It's expected that this could build a culture amongst Yarra's business sector of striving for zero-net emissions, build relationships and enable knowledge sharing between businesses.

To support this, education to businesses on the establishment of PPAs could support further businesses to understand and engage with this action. Educational resources could address barriers such as lack of knowledge about PPAs, and provide simple how-to guides on navigating the sometimes-complex legal, financial and technical options.

It's estimated that all together at least one very large business and around 10 medium-large businesses per year would take up PPAs as a result of this initiative. With Council providing support over five years, this would influence at least 55 large businesses and save around 530,000 tCO_2e out to 2030.

Commercial Energy Solutions

Council can educate businesses about GreenPower retail options, including through webinars, instructional videos, web content and online comparison tools. Through the ongoing 100% Renewable Yarra campaign Council could further promote the uptake of GreenPower by local businesses.

The potential Council partnership with a vetted electricity retailer to provide affordable renewable electricity (described in Section 7) would enable small businesses as well as households to more readily switch to renewable electricity.

Council could also provide support to the broader business community to increase the uptake of energy efficiency and low carbon technologies and processes. The actual measures adopted by businesses could range from solar PV, LED lighting upgrades, energy efficiency retrofits, batteries, degasification, or purchased renewables.

Council could partner with providers holding commercial energy expertise (YEF and/or other providers) to provide a range of services to businesses that would adapt over time to meet the needs of businesses. Whilst accessible to all businesses, this could largely be targeted to mid-tier businesses, where there are higher rates of ownership over building and equipment, as well as greater opportunity for impact. Specific services provided by Council partners could include:

- Energy audits and expert advice on all-electric energy efficient operations and building improvements (solar PV and batteries, lighting upgrades, degasification)
- Advice on funding, rebates and grants
- Connecting with reputable, vetted installers, equipment and service providers
- Through to advice and services to increase the uptake of energy efficiency and low carbon technologies and processes
- Navigating complexities, such as multiple commercial tenancies for sharing the benefits of solar installs and other building upgrades.

Council could also share its experience achieving carbon neutrality, and knowledge of offsets market to assist businesses to abate residual emissions.

There are many examples of methods of delivery for education, but it's possible that this could take the form of online resources, workshops or one to one energy advice provided by a Council partner that connects businesses through to experts.

It's estimated that of the businesses that interact with this initiative, around 100 per year would go on to implement energy efficiency actions, 50 per year would install solar and around 10 larger businesses per year would go on to implement deep energy efficiency or electrify their operations.

Potential Impact of Council Action

Table 3: Impact associated with Council support for zero carbon businesses

	Impact in 2030 (% of BAU commercial and	Impact in 2030 (tCO_2e/year)	Cumulative Impact to 2030 (tCO_2e)	Cost for 5 year implementation

	industrial emissions)			
Supporting PPA uptake	6%	79,000	530,000	$700,000
Commercial energy solutions	3%	45,000	300,000	$720,000

Other Actions to Enable Zero Carbon Businesses

State and Federal Governments

Significant energy and emissions policy reforms by other levels of government are needed to achieve zero-net emissions; these are beyond the remit of local governments.

To help accelerate such reforms that would aid the transition of businesses to zero emissions, it is recommended that Council continues to advocate to state and federal governments to take the following actions:

- Currently, the Victorian Government is on track to exceed 50% renewable energy by 2030, however the state renewable energy target could be increased to 100% by 2030, driving further investment in large scale renewables and smoothing the transition away from fossil fuel fired power generation.
- The Victorian Government should commit to no new gas exploration or development and put in place strong policy signals to drive the level of investment needed by businesses and investors to transition the economy away from gas.
- At the federal government level, there's an urgent need for strong climate and energy policy to slash emissions across our economy this decade, including a legislated 2030 emissions reduction target; rapid phase out of existing fossil fuel generation, and a commitment to no new fossil fuel projects; and a just transition for all Australians to renewable energy.
- Both levels of government could invest in building the skills and expertise across trades and professional workforces to deliver the services required to transition to a renewables-based, all-electric, energy efficient economy. This could position Victoria as a market leader for innovative emissions reduction solutions.
- Significant financial support and incentives from state and federal governments would help businesses fully deploy proven solutions to transition away from gas-fired machinery and equipment. There are currently a range of valuable discounts, business tax incentives, rebates and loans from the Victorian government for solar, batteries and energy efficient equipment. These could be evolved into programs to cease support for gas equipment.
- Government investment in research and development is needed for those applications where suitable zero emissions alternatives are not yet available or financially viable.
- The federal government can use its regulatory role to drive improvements in appliances and equipment by raising the energy rating standards.
- The Victorian Government can increase investment in the transmission network and reduce the soft costs associated with new renewable energy projects by streamlining grid connection regulations and working with electricity distributors to speed up approval processes for power upgrades.

Businesses and associations

Businesses and associations have a unique opportunity to drive lasting cultural and structural change from within the sector by working with industry and commerce bodies or representative organisations to build capacity and enable emissions reduction actions. This leadership from the local level can support industry bodies to embed practices at a sectoral level. As an example, South East Melbourne Manufacturers Alliance (SEMMA) has been working closely with local councils to encourage environmental commitment amongst the 200 manufacturing company members within the South East region through advice and forums[10].

Community expectations

Consumers increasingly expect businesses to ensure products and services are delivered in a sustainable and ethical way. On a much larger scale, there is pressure from international trading partners to ensure that Australian exports are not reliant on fossil fuels.

At a State and Federal level, community pressure is calling for governments to cease investment in new high-emissions projects such as coal and gas and commit to a more ambitious climate and energy policies including setting an ambitious and legislated 2030 zero-net emissions target.

Investing in available technologies

Across Australia there have been many successful pilot programs run to improve industrial and commercial sites and there are a range of technological solutions available to improve energy efficiency and enable on-site renewable electricity generation. Much of this has been supported by large-scale investments in research and innovation. Investors like the Cannon-Brookes Foundation and Elon Musk have dramatically changed the emissions landscape already, and further investments in clean energy and new industrial technology will continue to drive down emissions.

Examples and Inspiration

Power Purchase Agreements - City of Melbourne MREP2

The City of Melbourne's second Melbourne Renewable Energy Project (MREP 2) includes seven large energy users: RMIT University, Deakin University, CBUS Property, ISPT, Fulton Hogan, Citywide Asphalt, and Mondelez International.

Tango Energy provides 110 GWh of renewable electricity per year to the purchasing group, over 10 years. The Wind power primarily comes from the Yaloak South Wind Farm near Ballan, with the remaining energy coming from other wind farms in regional Victoria.

The electricity is being used to power 14 shopping centres, nine office buildings, seven educational campuses, and four manufacturing facilities across greater Melbourne. The MREP 2 deal is equivalent to providing enough renewable energy to power more than 22,000 Australian households a year. It will reduce greenhouse gas pollution by 123,000 tCO_2e a year[11].

Low Carbon Business - Darebin City Council

Darebin City Council are facilitating several energy-efficiency programs for businesses. The Light$mart program has been running for many years to assist businesses to change to LED lighting with trusted suppliers and a subsidy. Through the We Are Greening Our Business program, Council are visiting businesses and assess them across a wide range of areas including energy, water and waste, and provide advice on how they can improve. Businesses can then be certified as a Green Business if they pass enough areas[12].

Energy Savers - Eastern Alliance for Greenhouse Action (EAGA) Energy Savers is led by the Eastern Alliance for Greenhouse Action (EAGA) and provides advice to businesses in participating council areas. Businesses register interest via a web portal and are then assessed for government subsidies and connected with accredited installers who provide a quote. If the business agrees to the install, the installers will organise the paperwork for the subsidies as well as completing the install removing the administrative burden for the business[13].
Industry Working Groups - Australian Industry Energy Transition Initiative Convened by the not-for-profits ClimateWorks and Climate Kic, the Energy Transition Initiative brings together eleven industry participants from five supply chains, which combined account for 14% of Australia's industrial emissions. The working groups aims to support Australian industry to develop pathways and take action towards zero-net emissions across critical supply chains of the Australian economy through exploration and piloting of innovative technologies and processes. This Project has received funding from ARENA as part of ARENA's Advancing Renewables Program[14].

7. Zero Carbon Households

Potential Impact of Zero Carbon Households	Sectors Targeted
Cumulative impact to 2030: 1.2 Mt CO_2e Annual impact in 2030: 124 ktCO_2e Reduction from total BAU emissions in 2030: 6% Reduction from BAU residential emissions: 42%	 This pie chart highlights the emissions from the residential sector in the City of Yarra in 2018/19.

The total cumulative impact for zero carbon households includes the impact of 100% renewable electricity by 2030, which could be achieved by onsite renewable energy generation, purchased renewable electricity or through grid changes that are above and beyond the business-as-usual trajectory. Emissions saved due to the business-as-usual projected changes to the state electricity emissions factors have not been included in the total cumulative impact for zero carbon households.

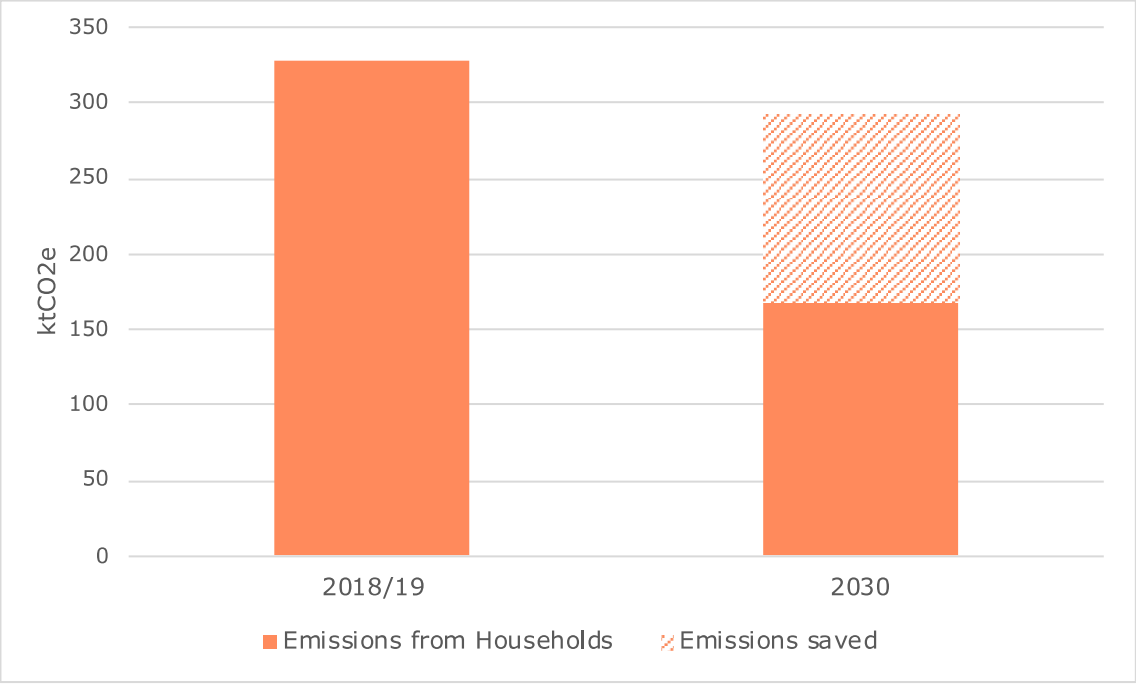


Figure 11: Impact of Zero Carbon Households compared to BAU

Areas of Focus	
	100% renewable electricity
	Zero use of gas

Co-benefits	
	Supports the growth of technology providers, and renewable energy industry.
	Cost savings for household through improved energy efficiency and rooftop solar.
	Greater resilience to network issues such blackouts and improved building user comfort during extreme heat events.

Residential buildings in Yarra account for around 19% of emissions, due to the burning of fossil fuels for electricity and gas usage. The residential sector in Yarra includes a high proportion of rental properties, with around 50% of homes rented, and a large proportion of dwellings (85%) being high to medium density. This creates barriers to the installation of solar or other energy related building upgrades.

The design and construction of a building has a major impact on its energy consumption, however there are a number of opportunities to reduce emissions from homes that are already built. This ranges from simple energy conservation actions such as turning off appliances, to installing rooftop solar and battery storage. Around 2,800 dwellings in the City of Yarra have rooftop solar already installed[15], which is around 11% of all detached or semi-detached dwellings (compared to the estimated average across Victoria of 22.5% of all detached or semi-detached dwellings). This means there is still significant opportunity remaining for household rooftop solar in Yarra.

Solar install rates across Australia have skyrocketed in recent years. This has in part been driven by the declining cost of solar, available rebates and the normalisation of solar energy, which means that it's now seen as a trusted technology. In Yarra, there is around 9,000 kW of installed capacity on residential rooftops, and this is increasing by around 5-10% per year.

Where there are limits on the ability to export surplus solar energy to the grid, household battery storage can encourage an increase in rooftop solar capacity by storing additional power during the day, releasing it at night and allowing additional solar capacity to be usefully deployed. The pricing of batteries is a significant hurdle to their uptake at the household level. A study released in 2018 stated that consumers would need to see a payback of 7 years or less on their investment, and a palatable price point was unlikely to be reached until 2023[16].

Similarly, there are barriers to energy efficiency retrofits and installation of renewables and batteries in apartment buildings, due to strata governance processes and building design constraints. However, there are several different technologies and models seeking to overcome these barriers. For example, from a technological perspective Allume solar sharing technology enables equitable sharing of a single solar

system throughout an apartment complex. Wattblock take a different approach, by engaging directly with the strata committees to overcome barriers.

Zero Carbon Actions for Households

Buy 100% renewable electricity

Any household or business can reduce emissions from electricity to zero by purchasing accredited GreenPower. GreenPower refers to electricity that is generated by 100% renewable sources accredited by the Australian Federal Government. Most energy retailers offer GreenPower products for purchase as part of an electricity contract.

GreenPower is an option that can be taken up by anyone but is particularly useful for households that cannot install rooftop solar or implement significant energy efficiency measures due to building tenure or type, or for any household to ensure they are using 100% renewable energy at any time of the day. This is a simple change that involves switching to a GreenPower product or contract through a new or existing energy retailer. It only needs to be done once, so there is no need for ongoing behaviour change or building upgrades. This is an accessible option for renters, apartment dwellers and heritage home-owners, and supports the growing renewable energy industry in Australia. The purchase of GreenPower does however incur a price premium, and in general GreenPower is not well understood by consumers. These are key barriers that need to be overcome to increase the take up of GreenPower.

Create an all-electric house by replacing gas appliances

Reaching zero-net emissions will be impossible whilst Yarra homes are still burning fossil fuels as an energy source. Gas appliances are typically for the purpose of space heating, cooking or hot-water systems, and are usually replaced either at failure or during renovations. This means they usually have an operating lifespan of between 10-25 years.

Many people do not make a considered and planned transition to new appliances, but rather make the upgrade at the point of failure. In the case of a hot water system, this may mean that residents are making a choice in an emergency situation, which can lead to a number of challenges. There may not be time, energy or money available to explore the range of products available and make an informed decision. By planning now to upgrade to an electric appliance when the time comes, this transition can happen smoothly. Eligible residents can take up the Victorian Government's financial support for efficient appliance upgrades via the Home Heating and Cooling Upgrades program.

Install rooftop solar and battery storage

There is still significant scope for further installation of rooftop solar on properties in the City of Yarra. Around 89% of freestanding or semi-detached dwellings do not have solar installed, and whilst many will be rented and/or in a heritage overlay, there are still many where solar could be readily installed. Council has already taken steps to reduce the barriers for properties in a heritage overlay by waiving planning application fees for solar panel installation and providing guidance on installing solar in heritage areas. As the cost of household batteries declines, there could also be opportunity for households to install this technology and it is likely that it would see a similar trend to solar as the technology becomes normalised. There are Solar Victoria loans and rebates available for solar and batteries that eligible residents can take advantage of to speed up this transition.

According to Google Environmental Insights Explorer, it's estimated that between 2021 and 2030, around 259MW of solar could be added to Yarra's rooftop solar, including around 13,000 additional household-scale systems. This estimation considers roof space, orientation, shading and obstructions, but does not consider heritage overlays or building tenure.

Reduce energy use and improve home energy efficiency

Households stand to save money and create more comfortable homes by implementing simple home energy conservation and efficiency measures. This includes things like upgrading lighting to LED, switching to energy efficient appliances, changing thermostat settings for heating, cooling and hot water systems, draft sealing and window shading, for example. There are more complex and expensive options also available, such as introducing smart home technology with energy conservation features or installing double-glazed windows.

For home-owners, renters and apartment dwellers there are options available to make improvements and there is financial support available, for example through the Victorian Energy Upgrades Program. The actual impact of this action will vary greatly between homes, depending on the building envelope and measures employed. However, it's anticipated that if households were to take up energy efficiency measures to their fullest extent, around 53,000 tCO_2e per year could be saved, based on 2018/19 emissions and not considering future decarbonisation of energy sources.

Offset remaining emissions

For households that want to achieve carbon neutrality, but still have residual emissions from gas consumption or transport, the purchase of carbon offsets is an option. Whilst there isn't widespread uptake of offsets at a household level, other indicators show that individuals are ready and willing to purchase offsets for particular behaviours. For example, recent data shows that around 11% of Qantas customers pay for carbon offsets when they purchase a flight[17].

How Yarra Council Can Enable Zero Carbon Households

Yarra Council has a long history of working together with the Yarra community on emissions reductions, energy security and social equity projects. Working at the household level is important for several reasons. Changing emissions from households will take time and Council only has certain levers of influence. However, Council is the closest level of government to the community, with regular interactions with residents and businesses that mean Council is able to support the transition to zero emissions at this level. Supporting the community to take part in climate solutions can also inspire future action and shift social norms.

There is scope to reduce household emissions by making changes to major appliances to make them more efficient, and to change from gas to electric. Many households can also install onsite solar, or purchase renewables through their energy retailer.

Different housing types and tenures have different needs and challenges. The action areas outlined here have been designed to focus on the main categories of housing in Yarra and their specific needs in reaching zero-net emissions. Whilst these areas of focus have been recommended for the next five years, they are all building on existing work by Council in the community.

Facilitate households to purchase renewable energy

Council provides education and related support to assist residents to take up Green Power, including through webinars, instructional videos, web content and online comparison tools. Through the ongoing 100% Renewable Yarra campaign Council could further promote the uptake of GreenPower by the community.

In partnership with the City of Melbourne and the Northern Alliance for Greenhouse Action (NAGA), Council is currently investigating the potential to partner with a vetted electricity retailer to supply residents with 100% renewable electricity, ideally at a price that is comparable to fossil fuel based electricity. Similar schemes underway include London Power in the UK, Indigo Power and Co Power.

Such a partnership has considerable potential to overcome the price, information and trust related barriers to GreenPower uptake.

It's expected that through this initiative around 400 households per year could switch from their existing energy retail product to GreenPower.

Facilitate all-electric energy solutions for homeowners

For owner-occupier, detached or semi-detached homes, there are limited barriers for energy efficiency retrofits and installation of solar PV, outside of upfront capital cost. Financing is readily available with low interest rates, a strong business case and knowledge about solutions. However, the next challenge is transitioning homes away from gas, typically used in homes for cooking and hot water, and towards renewable electricity.

Council currently partners with parties such as YEF, Metropolitan Community Power Hub and Renew to support residents to make changes at home to reduce emissions. This is primarily through the 100% Renewable Yarra campaign, assisting residents to switch to renewable energy, install solar, create an all-electric home and reduce energy consumption. Council and partners provide support in the form of the Yarra solar PV and batteries program, workshops, online resources, case studies, tailored advice and assistance to access government rebates and loans.

Partnering with the Metropolitan Community Power Hub, Council has begun supporting community members to access energy assessments and connect with reputable, vetted installers to install insulation, draft proofing and window treatments; to upgrade appliances to all-electric options, such as hot water, heating and cooling, lighting, and energy efficiency retrofits.

It's estimated that this type of initiative could influence around 700 households per year to implement energy efficiency measures and around 300 households per year to install rooftop solar.

Facilitate all-electric energy solutions for apartments

With around 85% of Yarra residents currently residing in medium or high-density dwellings, a dedicated effort to support this sector of the community is important. Currently, there are limited examples of successful programs that reduce emissions from apartment buildings at scale.

The proposed initiative could involve partnering with a select group of strata management companies, owners corporations or body corporate organisations to assist them in navigating installing solar PV,

building and lighting upgrades, and accessing rebates and finance. This would serve as a pilot, and from these initial pilots, Council could share the learnings, develop standardised processes and 'how-to' models for other apartment buildings to follow.

This work would seek to address the complexities of carrying out sustainable building upgrades and retrofits on apartments, such as navigating strata governance processes, the need for additional equipment and metering; building, roof and network constraints; and to access rebates and finance. It could include facilitating building audits and feasibility assessments to inform building upgrades, such as rooftop solar, batteries, EV charging, lighting upgrades and other energy efficiency improvements and installing all-electric plant and equipment.

Building managers could be assisted to engage the apartment community around behavioural changes and low-cost, low-intervention measures that all occupants could take up, regardless of whether they rent or own their apartment.

Facilitate all-electric energy solutions for rental properties

Due to split incentives between landlords and tenants, there is much lower uptake of renewables and energy efficiency by the rental sector than there is by owner-occupiers. To address this, Council could provide assistance to both rental property owners and tenants to overcome barriers to reducing energy related emissions in rental properties.

Council can work with other partners to actively engage property owners, managers and renters to make energy improvements. Council can also continue to provide education and promotions to encourage renters and rental property owners to take up government support, including solar PV rebates, loans and template agreements for sharing the benefits of rooftop solar. Real estate agencies and owners' corporations would be key partners to navigate landlord-tenant relationships.

As part of Council's focus on all-electric homes, renters and rental property owners could access education and advice on all-electric and energy efficient appliances, as well as government financial support available to upgrade from gas appliances. Renters can be enabled to carry out low-cost energy efficiency improvements and switch to GreenPower.

Because there is often a crossover between renters and low-income households, this would also have social-equity benefits. It would also improve resilience for rental homes, with increased thermal comfort during extreme heat events.

Facilitate home energy improvements for low income and vulnerable households

Council can continue to leverage its role as an age and disability service provider to support vulnerable and low-income households to improve thermal safety, save energy and reduce bill stress.

This would build on the existing Healthy Homes initiative that is upgrading the homes of 48 aged care clients to improve energy efficiency and thermal comfort, mainly through draft proofing. Information is also provided about energy concessions, rebates and other energy related financial support, such as loans and rebates to assist low income households to install solar PV and upgrade hot water, heating, cooling and cooking appliances.

Potentially this sort of initiative can be broadened to partner with external providers to provide support to low income and vulnerable residents who don't receive Council services.

Potential Impact of Council Action

Table 4: Impact associated with Council support for zero carbon households

	Impact in 2030 (% of BAU residential emissions)	Impact in 2030 (tCO_2e/year)	Cumulative Impact to 2030 (tCO_2e)	Cost for 5-year implementation
Council supporting Yarra households, including: • Facilitating renewable energy purchasing • Facilitating all electric energy solutions for homeowners, apartments and rental properties	7%	21,000	132,000	$900,000

Other Actions to Enable Zero Carbon Households

State and Federal Government

The suggested actions for other levels of government to accelerate the take up of renewable energy and electrification set out in the Zero Carbon Business section, will also contribute significantly to reducing emissions from the household sector. There are also other household-specific actions that governments should take to drive down emissions:

- Further scale up existing government home energy efficiency and solar programs to drive rapid and mass upgrades to existing buildings. There is potential for these initiatives to be modified to incentivise and speed-up a transition away from gas.
- Manage a smooth, equitable transition by providing financial support for affordable renewable energy and reduce the upfront cost of gas appliance changeovers for low income households.
- Ensure that minimum energy standards are met at point of sale and lease; and evolve the mandatory minimum standards for heating in rental properties to exclude the installation of gas space heaters.
- Work with electricity distributors, resident groups and councils to reduce impediments to installing solar PV on multi-unit developments.

Examples and inspiration

Solar for rentals - Australia-wide

There are regions in Australia where programs targeting the barrier of split incentives in the rental market are implemented effectively. For example, those being implemented by Starfish Initiatives in ZNet Towns, including

Hepburn and Uralla. Council can also look to municipalities such as Port Pirie and Eyre, who have worked with Cool or Cosy and Tindo Solar to deliver similar programs in this area.

Data driven behaviour change - MyHeat, Canada

In 2017, several partner organisations set out to investigate the impact of personalised and comparable information on home heat loss and consumption via a control trial implemented on utility bills. The objective was to measure if providing households with heat loss data and gas consumptions for their home in the form of a heat map would impact on how much gas they used. Customers given the heat map saved over two times more energy than customers in the comparison group. Providing heat loss data also increased uptake of building envelope improvements[18].

Opt Out GreenPower Retail Partnership - Evanston, USA

Evanston is a suburban community of 75,000 people north of Chicago. In 2012 Evanston held a referendum where 73% of the voters authorised the City Council to set up an opt-out Community Choice Electric Aggregation program. This means that the city aggregates residential and small business electric accounts to collectively seek bids for an energy supplier. Those who do not wish to participate need to actively opt out of the program. The aggregation program not only saved participating households money; by 2013 it also helped the city reach its goal of a 13% reduction of community-wide GHG emissions from a 2005 baseline. This program is still running eleven years later[19].

Data driven behaviour change - London Power

Founded by the Mayor of London, London Power was created to provide Londoners with energy that is fairly priced and sourced from 100% renewables. The Mayor of London partnered with the retailer Octopus Energy to source renewable energy, which is then sold to customers on a not-for profit basis. Energy poverty is big issue in London and supporting vulnerable consumers is at the core of London Power. London Power also offer carbon offsetting gas consumption, supporting Londoners to minimise their energy footprint further[20].

8. Zero Carbon New Developments

Potential Impact of Zero Carbon New Developments	Sectors Targeted
Cumulative impact to 2030: 360-500 $ktCO_2e$[1]	This pie chart highlights the emissions from the built environment in the City of Yarra in 2018/19. This section focuses on new emissions and therefore would mitigate the expansion of emissions from this sector.

Please note that a comparison chart has not been included here, as this area is focussed entirely on avoiding new emissions, rather than reducing existing sources.

Areas of Focus	
	Zero emissions buildings
	Zero use of gas

Co-benefits	
	Improved building performance and thermal comfort for occupants.
	Reduced energy bills through high energy efficiency standards.
	Greater resilience to climate change impacts through climate conscious building design.

Currently, energy consumed by the built environment is responsible for around 85% of emissions in the City of Yarra. This is largely from energy used to heat, cool and light, as well as major appliances such as hot water systems and those used for cleaning, refrigeration and entertainment. According to the Yarra housing strategy, dwellings are increasing at a rate of around 1,100 per year and approvals for apartment buildings doubled between the periods 2006-2010 and 2011-2015.

[1] *This figure has been modelled based on best available information, however a there is a high degree of uncertainty regarding future variables and actual outcomes may differ. This figure assumes a Zero Carbon Planning Scheme Amendment takes effect within two years.*

Decisions made at the design and construction phase for buildings directly influence emissions released over the life cycle of a building. Making better choices about design elements such as building orientation, thermal envelope and ventilation can influence the emissions trajectory for 50 to 100 years, or even longer into the future. Furthermore, ensuring that developments are "electric vehicle (EV)-ready" is an important part of ensuring that the built environment is future-proofed for zero emissions.

New homes are currently required to meet a 6-star energy rating under the Nationwide House Energy Rating Scheme (NatHERS). There are significant pushes from many parties, including Yarra Council, to see this raised to at least 7-stars in the upcoming review of the National Construction Code (NCC). In Yarra, local policy already dictates that a higher standard must be achieved.

Zero Carbon Actions for New Developments

Developers to design and build zero carbon homes and commercial buildings

There are few incentives for developers to design for low emissions homes. With a high portion on-sold or rented out, upfront capital costs are borne by the developers while long-term efficiency gains stay with the homeowner or business operator. Furthermore, there is significant pressure on minimising upfront construction costs.

The action for developers working in Yarra to construct new residential and commercial buildings, is to ensure those buildings, meet the highest standards of energy efficiency. At minimum, all buildings should include insulation, double glazing for windows and doors, electric appliances, draft proofing and on-site solar. Where possible, passive solar design should be considered. Furthermore, ensuring buildings are future proofed, ready for the installation of electric vehicle charging facilities.

Real estate sector to report on energy efficiency at the point of sale or lease

The design and energy efficiency of a building directly influences the long-term running costs of that building. However, many consumers do not have the understanding of sustainable design features to be able to consider this during their inspection for sale or lease, so unless it is clearly stated by the property agent or developer, the opportunity for this to influence purchasing decisions and property value is lost. By promoting new homes and commercial premises that achieve high standards of energy efficiency and are ready for a zero emissions future, purchasers will be able to factor this into their decision.

How Yarra Council Can Enable Zero Carbon Developments

The goal of this focus area is to ensure that all new developments are built to a zero-net emissions standard. As a planning authority, Council has a pivotal role to play in this space. There are a number of ways to influence improved building design, and as such the proposed actions within this focus area are multi-faceted. It looks at the "top-down" approach of driving improved regulation, through updated ESD standards through the planning system. It also looks at ways to ensure that these standards, once approved, are met. This could come through enforcement, or through providing support to developers to meet higher standards.

Raising ESD Standards

Yarra Council is currently taking a leading role with 31 councils and the Council Alliance for a Sustainable Built Environment (CASBE) in pursuing a joint amendment to the planning scheme, that would require all new commercial and multi-residential developments to achieve higher ESD standards. This includes meeting zero carbon requirements and ensuring developments are 'EV ready'. The amendment requires approval by the Minister for Planning.

In addition to changes at the state level, Council can leverage the Yarra LPP, the requirements of the Urban Design Framework (UDF) and strategic planning processes to encourage further improvements. This may take the form of place-based controls that tailor the design requirements of developments within a particular precinct rather than municipality-wide.

Educate, advise and negotiate with developers to achieve higher ESD outcomes

Even when written and approved, planning schemes are subject to interpretation and provide only a minimum requirement, which can be exceeded. Via the planning process, Council works with and negotiates with developers to achieve higher ESD outcomes for new developments. Council could continue to work with developers to ensure that they are supported, educated and encouraged to achieve the high standards set out by Council in the revised planning scheme.

Through on-going advice and education, Council can build the capacity of the development community to prepare planning applications that exceed the current ESD benchmarks.

Promoting leaders in zero carbon development

Council promotes leaders in sustainable development through case studies and other communications and could continue to build on this to encourage higher standards in the development sector. By educating potential purchasers and the wider community about zero carbon building Council can contribute to the broader demand for sustainable homes.

Ensure ESD requirements are met at construction

Council could also explore whether more needs to be done to ensure developments are built to plan and perform as predicted. As the sustainability management plan for a proposed development is endorsed as part of the planning permit, developers must build in accordance with the plan. In the usual way with suspected planning permit breaches, Council may investigate and may take compliance and enforcement action.

Determining that developments have been built in accordance with the approved sustainability management plans and perform as expected can be challenging. A de-regulated surveyor industry and limited access to external building surveyors means that buildings may not meet the performance standards specified at the design stage. At this stage, it's not clear as to whether this is an issue within the City of Yarra that requires additional resources from Council, so it is proposed that further exploration is done to confirm whether there is a discrepancy between plans and as-built performance. This could be conducted in collaboration with other councils. The outcome of this assessment will determine whether special attention on ESD compliance and enforcement is warranted.

Overall, it's estimated that on average 2,700 buildings would achieve higher standards, saving an average of 10tCO_2e per year. However, because this is blended across commercial and residential buildings, which also have different ratings schemes, it's likely that this number would vary.

Potential Impact of Council Action

Table 5: Impact associated with Council support for zero carbon new developments

	Cumulative Impact to 2030 (tCO_2e)	Cost for 5-year implementation
Zero carbon new developments, including: • Raising ESD Standards • Zero carbon precincts • Education, advice and negotiation with developers • Promoting leaders • Compliance and enforcement	360,000 – 500,000	Within existing resources

Other Actions to Enable Zero Carbon New Developments

State and Federal Governments

To help accelerate policy reforms by other levels of government that would aid the transition to zero emissions developments, it is recommended that Council continue to advocate to state and federal governments to take the following actions:

Victorian Government

- Support the joint Victorian councils planning scheme amendment to raise the ESD standards to achieve zero carbon developments.
- Through state legislation, require zero emissions infrastructure for new developments and precincts.
- Make changes to planning, building and plumbing regulations to normalise developments with no gas connections.
- Ensure regulations support alternative approaches to meeting grid connection requirements, such as on site or community scale storage rather than traditional network upgrades.
- Continue and expand programs to build capacity within the residential building sector to construct homes to meet high energy performance standards.

Federal Government

- Strengthen provisions in the National Construction Code (NCC) for new buildings to increase the required NatHERS rating from 6 to 7 stars, and require that all new apartment buildings are built to accommodate EV charger installation

Examples and Inspiration

Promotion of Zero Carbon Neighbourhoods - City of Malmo, Sweden

Vastra Hamnen is a district in the Swedish City of Malmo. Once a declining industrial area, it has been redesigned as a world leading sustainable neighbourhood. Beginning in 2001 the area has been a testing ground for innovative architectural and technological environmental solutions including renewable energy and energy efficiency and sustainable transport. With further development to 2035, innovation in low emissions and climate resilient urban design remains a driving force. Local government promotion of the area and the developments within has played a big role in its success by encouraging developers to push boundaries[21].

Precinct level planning controls - Fisherman's Bend, City of Port Philip

Fisherman's Bend in the City of Port Philip is Australia's largest urban renewal area and has committed to achieving zero-net emissions by 2050. The vision is to create "A thriving place that is a leading example for environmental sustainability, liveability, connectivity, diversity and innovation." This is to be achieved through the Fisherman's Bend Framework, a long-term strategic plan for the development of Fisherman's Bend to 2050.[22]

The Framework provides direction on how the transition of the area will be managed, creating certainty for the community, landowners, developers, businesses and investors. The Framework includes a guide to inform planning permit applications and strategic planning directions for public and private investment. It also requires new developments to meet 4-Star Green Star Design and As-built ratings and 5-Star Green Star Design and As-built for all buildings over 5000 square metres, and clearly indicates future increases to performance requirements. The success of the development will be monitored through the Green Star Communities tool which assesses projects against a set of social, environmental, and economic and innovation categories.

As the land is predominantly privately owned, collaboration has been a critical element of the development. The successful implementation will continue to involve ongoing conversations and collaboration with the community, industry, land-owners, businesses, all levels of government and the not-for-profit sector[23].

Incentives in the Planning Process - Moreland City Council

Moreland is piloting a Design Excellence Scorecard as a means of fast-tracking developments that meet high sstandards of sustainability performance and other urban design requirements. The voluntary tool establishes a benchmark for design excellence of medium and high-density development in Moreland. The standards are in addition to the requirements of the Moreland Planning Scheme. If developers can demonstrate all required compliance points within permit applications, the delegation of decision making on that permit goes to officer level, rather than to council meeting. Participants will also be eligible for additional support from planning officers throughout the process. The aim is to incentivise ambitious standards by speeding up the permit process for high performing developments[24].

9. Zero Carbon Transport

Potential Impact of Zero Carbon Transport	Sectors Targeted
Cumulative impact to 2030: 1.1Mt CO_2e Annual impact in 2030: 200 ktCO_2e Reduction from total BAU emissions in 2030: 9% Reduction from BAU transport emissions in 2030: 38%	This pie chart highlights the emissions from transport in the City of Yarra in 2018/19.

Figure 12: Impact of zero carbon transport compared to BAU

Areas of Focus	
	Zero carbon transport: active and shared

Co-benefits	
	Improved health and wellbeing of commuters through the benefits of active transport. Improved air quality within the city of Yarra through reduce internal combustion engine (ICE) vehicle use.

	Zero carbon transport: EVs

	Reduced congestion for other road users.
	Showing leadership on active and EV infrastructure is a visible signal to the Yarra community and its visitors that Council is committed to the low carbon transport transition.
	Greater social equity by creating walkable, cyclable neighbourhoods and making these the preferred choice for transport.

The City of Yarra is close to the CBD and includes multiple commercial precincts, meaning many residents could meet their daily needs within a short walk or cycle, meeting the "20 Minute Neighbourhood" principle included in Plan Melbourne and the Yarra Planning Scheme. According to Google Environmental Insights Explorer data, in 2018 and 2019 around 8% of all trips taken in Yarra are by walking or cycling and this was increased in 2020 to around 10%, likely due to reasons associated with the Covid-19 pandemic and lockdown restrictions[25]. Yarra is also a public transport hub for many people commuting from outer suburbs into the CBD, with well-connected bus, rail and tram lines in some areas.

Transport emissions account for around 12% of Yarra's total emissions profile (around 216 $ktCO_2e$), and two-thirds of these emissions are from petrol and diesel-powered automobiles. Despite long term and ongoing programs to shift travel to active transport options, significant population growth over the last 20 years has increased travel demand, and much of the increase in trips have been via private vehicles. Council has a clear and important role in supporting zero emissions transport, but this is not expected to be realistically achieved by 2030 in Yarra.

Transport emissions and vehicle use is increasing and if no action is taken, emissions from transport in Yarra could increase to around 500 $ktCO_2e$ by 2030. Shifting the travel modes people use is key to reducing emissions, noting however there will be an ongoing role for on-road vehicles.

Wherever possible, it is important that active travel, shared or public transport modes are prioritised over private vehicles. Yarra is well connected with cycling and public transport networks, and over the years Council has invested considerably in infrastructure and other improvements to enable people to take up these modes.

The City of Yarra has done a lot of work on mode shift to alternatives. In-part due to proactive support by Council, the uptake of car-sharing within Yarra is also relatively high compared to elsewhere in Australia. In 2019 Council adopted the Car Share Policy 2019-2024. This policy focuses on provision of dedicated parking for car share vehicles and the positive impacts of car sharing. Essentially, creating an enabling environment for car share companies to operate. There are currently 181 car share spaces provided by three commercial car share providers and Council is seeking to realise a network of 283 car share vehicles by 2023. This goal represents 1 car share space per 349 residents.

In addition, to manage transport that cannot legitimately be shifted to another mode, it's important that there is a supported transition away from fossil fuels and to electric vehicles (EVs).

A number of countries, such as the United Kingdom and Japan, have already introduced ambitious targets to phase out new car sales of internal combustion engine (ICE) vehicles[26]. Car manufacturers have also responded to the rise of EVs by setting timelines for phasing out the production of ICE vehicles, including Ford, General Motors, Volvo and Jaguar Land Rover[27]. This means that EVs will eventually replace ICE vehicles and some projections expect them to reach price parity as soon as 2024[28]. However, due to the large second-hand car market in Australia, the average age of cars is around ten years, so internal combustion engines purchased today will still be releasing emissions into the atmosphere ten years from now. Therefore, accelerating the infiltration of EVs into the market is very important to limiting future emissions.

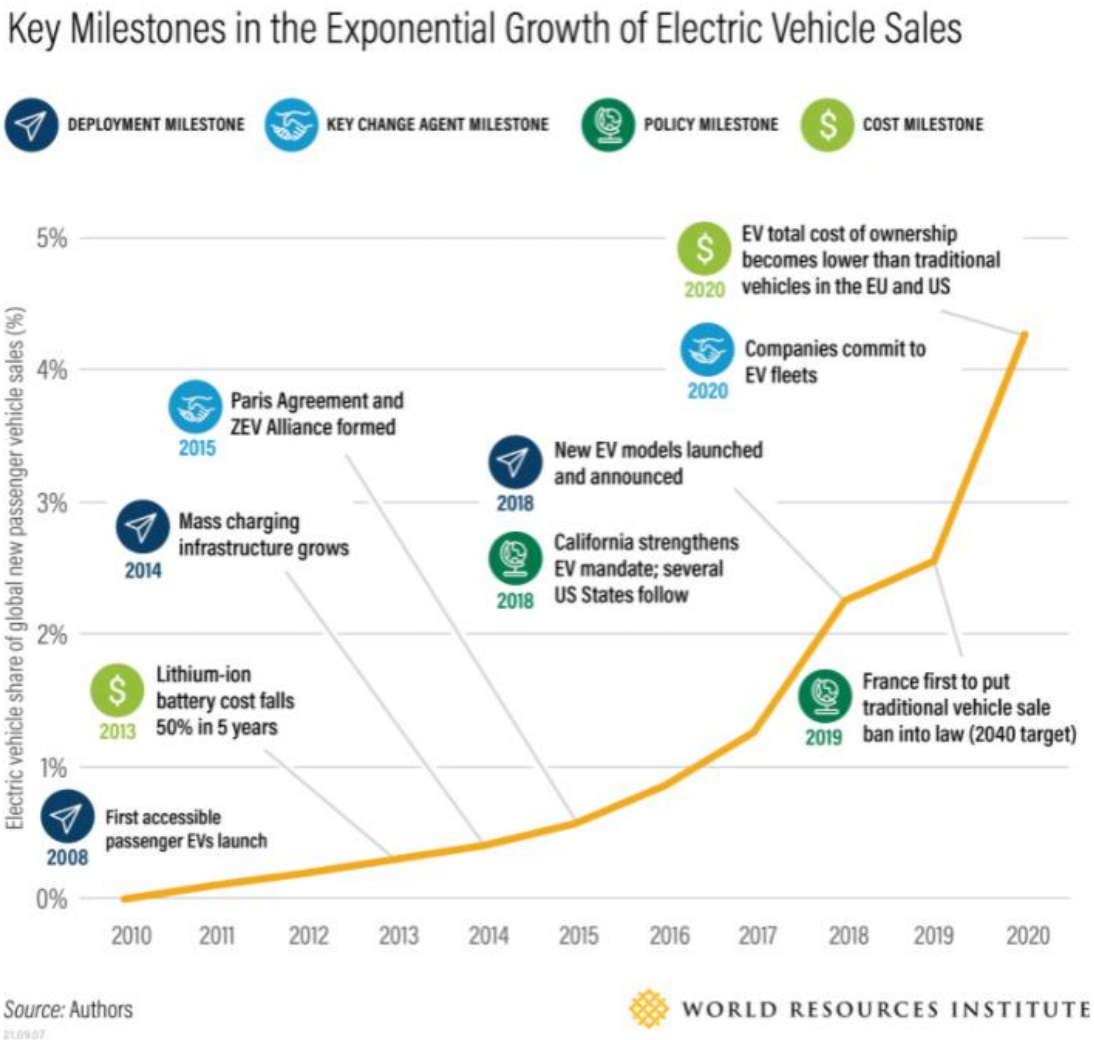


Figure 13: Graph charting the key milestones in global EV sales[29]

Data from the Australian Bureau of Statistics (ABS) has revealed that the Yarra suburbs of Burnley, Cremorne, and Richmond are within the top ten suburbs in Australia for electric vehicle (EV) ownership. Since EVs still only make up less than 1% of vehicle ownership in these suburbs there is still significant potential for EV uptake in the City of Yarra.

Zero Carbon Transport Actions for the Yarra Community

Take active or public transport wherever possible

Active transport, such as cycling and walking emits zero emissions and has numerous other benefits to public health, air quality and city liveability. By increasing travel choices available — through allocation of space and infrastructure for public transport, walking and cycling — people are more likely to take up these zero emissions options.

There are many local trips taken in Yarra every day that could be readily made via lower emissions transport options. Over 30,000 car trips occur within the city boundaries each day. The vast majority of these trips are under five kilometres and could be made by using alternatives such as bicycles, e-bikes or e-scooters, in similar or less time than it takes to travel by car.

For some potential riders, electric bikes and scooters can be more attractive than conventional bikes as they are better suited to a range of fitness levels and ability, avoid the need for clothing changes and can carry greater loads (for example, children or groceries).

To encourage people to walk, environments need to be conducive to pedestrians, addressing issues of safety, convenience and accessibility. Improving existing footpaths and how space for pedestrians is used are key, including reducing obstructions, and creating shade and pleasant spaces to spend time in.

Public transport is a highly desirable low emissions alternative to private ICE vehicles, with electric trains and trams emitting a fraction of the emissions of car travel. For more people to preference public transport over car travel they need genuine choices such that this mode is considered an attractive, safe, highly accessible and convenient way to travel.

In places where people can travel mostly by public or active transport, it can be more attractive for them to forgo private car ownership and take up car sharing services for the times they need a vehicle.

Electrify all vehicles

For any new or used car purchases, residents of Yarra can seek out electric options. For local businesses, a transition to electric fleet will not only lower emissions, it provides an opportunity to boost the second-hand market for residents, as fleets are usually on-sold after 3-5 years.

When it comes to freight and delivery, e-bikes also hold great potential as an alternative transport option. E-cargo cycles are currently experiencing a surge in use in European cities as a solution to congestion and emissions resulting from small parcel delivery in inner city areas. These vehicles are an important opportunity to support efforts to create car free, vibrant spaces within the City of Yarra.

Use car sharing services and other alternatives to car ownership

Car sharing services are a lower emissions option than private vehicle ownership. Independent research indicates that one car share vehicle in urban Melbourne can replace between 7-10 privately owned cars reducing congestion and parking demand[30]. The research further indicates that when car ownership is replaced by an immediate and convenient access car share service, that the local community cut their total vehicle use by 15-50% switching from car to active and public transport.

How Yarra Council Can Enable Zero Emissions Transport

Mode Shift to Active, Public and Shared Transport

There are several roles that Council could continue to play to further increase the uptake of active, public and shared transport. Yarra Council's transport related policies and strategies guide the action needed to drive greater take up of walking, cycling and public transport and reduce private vehicle use. Council could build on existing work to make policy and infrastructure changes to:

- Improve and invest in additional walking and cycling infrastructure to create safe routes and links, including through road space reallocation
- Reduce vehicle traffic speeds and volumes to improve safety for all road users
- Modify vehicle traffic turning movements and signals to improve safety for users higher up the road user hierarchy
- Raise the sustainable transport standards for new developments to improve cycling infrastructure and restrain the provision of off-street parking
- Manage car parking in ways that are consistent with objectives to reduce emissions from transport
- Support the use of subscription-based transport schemes (e.g. car, bike and scooter share) to enable reduced car use and ownership
- Facilitate and advocate for improvements to and greater investment in public transport infrastructure and services to improve frequency, reliability and accessibility

To further expand the reach of car share services, it's recommended that Council work in partnership with car share operators to understand and eliminate remaining barriers and to work towards all-EV fleets. Finally, to underpin any work on mode shift, Council could continue to implement community education that tackles issues of safety, convenience, route planning and social norms.

Expanding the EV Charging Network

A key area of focus for zero carbon transport is to expand the electric vehicle charging network through developing partnerships with relevant stakeholders and facilitating installations of new infrastructure.

One of the key barriers to the uptake of EVs is actual or perceived issues with charging range[31]. To ensure cities are EV-ready, the availability of accessible and convenient charge-points for vehicles will be required. The goal would be to streamline the roll out of an EV charging network within the City of Yarra to enable a greater number of fast chargers to be installed at strategic locations.

Council supports the roll-out of public EV chargers by seeking grant opportunities and working with private providers to enable them access to land and infrastructure to install and operate charging stations. It could also play a role in facilitating others to meet EV charging needs, such as via large private car parks.

By carrying out strategic work, Council could gain a stronger understanding of EV trends to plan for community charging requirements, identify suitable locations and providers and work through network infrastructure considerations.

Council has guidelines in place that are applied during the planning permit process to help ensure multi-residential and commercial developments have the necessary electrical infrastructure to enable the installation of EV chargers on-site. The intention is that these guidelines will be incorporated into a proposed joint council planning scheme amendment to raise ESD standards for new developments.

Council could continue its advocacy to other levels of government to actively incentivise and support the take up of EVs and charging infrastructure.

Provide incentives for the uptake of e-bikes and e-scooters

E-bikes hold great potential to reduce negative impacts associated with last kilometre freight delivery and other personal and work-related trips. E-cargo cycles are currently experiencing a surge in use in European cities as a solution to congestion and emissions resulting from small parcel delivery in inner city areas. These vehicles are an important opportunity as part of creating a healthier, less congested city.

Council is currently participating in a trial of e-scooters in collaboration with the Department of Transport and the Cities of Melbourne, Port Phillip and Ballarat. The trial will run for 12 months.

Council could work with the commercial delivery industry to create a better understanding of current delivery practices and explore the potential for undertaking last kilometre freight with e-cargo bicycles. This could be explored in collaboration with neighbouring inner urban municipalities who face similar congestion challenges.

Council could also run behaviour change initiatives and provide incentives to further drive the take up of e-bikes and e-scooters for commuters in partnership with equipment providers and large employers in Yarra. Being a large employer, Council could show leadership and run a trial encouraging commuting Council staff to take up e-bikes.

Potential Impact of Council Action

In addition to the projected emissions reductions related to electric vehicle charging below, there can be emissions saved from policies and projects that increase active and public transport and reduce private vehicle use. Inevitably there are a range of factors that influence the scale of take up of these measures (e.g. actions by state government, ability to roll out new infrastructure etc), so it is difficult to model the potential emissions reductions from active and public transport-related with sufficient confidence. Therefore, the figures in Table **6** below relate to the potential impact of expanding the EV charging network only, not active and public transport related projects.

Table 6**: Impact associated with Council support for zero carbon transport**

	Impact in 2030 (% of BAU transport emissions)	Impact in 2030 (tCO_2e/year)	Cumulative impact to 2030 (tCO_2e)	Cost
Expanding the EV charging network	3%	16,000	120,000	$140,000

Other Actions to Enable Zero Carbon Transport

State and Federal Governments

In Australia, policy setting including taxes and tariffs, and regulations on tailpipe emissions, is an important tool for State and Federal governments in accelerating the transition from petrol vehicles to EVs. The Federal government is supporting the uptake of EVs through funding for charging infrastructure, incentives for fleet transitions such as the Future Fuel Fund being provided through the Australian Renewable Energy Agency (ARENA), and other strategic initiatives[32], however more favorable policies and tax treatments for the EV market in Australia can still be implemented.

The Victorian Government has released a plan on transition to clean energy which includes a $100 million fund for electric vehicles. This includes a target for 50% of all new vehicles sold to be EV by 2030, supporting further reforms to the National Construction Code in 2022 to make new buildings Zero Emissions Vehicle ready, and subsidies of $3000 of each new EV purchased for vehicles that cost below $69,000. This is somewhat offset by a new tax on the travel of EV vehicles.

The Victorian Government plays a key role in public transport funding, planning, and infrastructure management and making low emissions travel accessible to the community. Ensuring high quality public transport options to the public that is frequent, convenient, connected, and accessible, encourages people to benefit from low-emissions travel. The Victorian Government and Transdev are currently investing $20 million in a trial to investigate technologies to transition Victoria's bus fleet to zero emissions vehicles. Victorian trams are currently powered by renewable energy under the Solar Trams Initiative.

Council continues to advocate for public transport and active transport improvements through its on-going transport advocacy agenda, separate from this advice. The actions below centre on measures that other levels of government should take to speed up the transition to electric vehicles.

Victorian Government

- Actively support the accelerated transition to electric vehicles by developing a state-wide vision, strategy and plans, coordinated with both Federal and Local Governments, to address the barriers to electric vehicle uptake including, but not limited to, vehicle costs and incentives, public charging infrastructure and planning provisions for new developments.
- Implement the transition plan which includes a target for 50% of all new vehicles sold to be EV by 2030.
- Progress the broader roll out of electric buses across the network based on results of the trial

Federal government

- Set strong targets to rapidly phase-out of fossil fuel vehicles leading to a ban on sales from 2030 or earlier.
- Raise national vehicle emissions standards.
- Increased and on-going funding for charging infrastructure and incentives for transition of corporate fleets to electric vehicles.
- Provide a range of policies and incentives, including subsidies and favourable tax treatments for private and corporate fleet EVs.

- Reforms to the National Construction Code in 2022 to make new buildings Zero Emissions Vehicle ready.

Examples and inspiration

Low traffic neighbourhoods, United Kingdom Low traffic neighbourhoods (LTNs) are groups of residential streets, bordered by main roads where through motor vehicle traffic is discouraged or removed. Strategic road closures (like bollards or planters) prevent through traffic and make it more attractive and safer to walk and cycle.
E-bike subsidies and related support – European Union There are almost 300 tax-incentive and purchase-premium schemes for cycling offered by national, regional and local authorities across Europe to make it attractive to cycle more and drive less, **reduce** emissions and provide important growth stimuli for the European bicycle industry. For example in some cities, a subsidy of 25% of the purchase price can be granted to private companies, freelance professionals and non-profit organisations.
Car Free Sundays - Bogota, Columbia Every Sunday, the city of Bogotá closes its streets for millions of cyclists and pedestrians. The initiative has improved liveability, reduces emissions and has significantly increased levels of physical activity. As city-dwellers, local people have limited space for recreational activities and face high rates of diseases linked to sedentary lifestyles.
E-bikes and E-scooters rental - Auckland, New Zealand Starting in 2020 Auckland have issued licences for three e-scooter, two e-bike and one standard bike operator to lease vehicles from Auckland's public places. In Auckland, operators of rental e-scooters, e-bikes or bikes that are parked in public places are licensed through the Trading and Events in Public Places bylaw 2015. Auckland Council and Auckland Transport have run a series of trials around the licensing and code of practice of rental e-scooters in Auckland under the bylaw. These trials would likely offer important learnings for Yarra in establishing such as scheme[33].
Travel Apps - Monteria, Columbia The city has launched a government funded app which links residents to public transport hubs using small vehicles. Yipi transports passengers for free between their homes and the bus station, providing an unprecedented level of market accessibility for a public transport system. The mopeds are called upon by a text message or telephone call and arrive within five minutes. They operate in zones and are controlled via geo-fencing (using GPS to define a geographical boundary) from a control centre with 24/7 surveillance. Fares are integrated and those that use the authorised mopeds receive discounts on the central bus system[34].
Ultra-Low Emissions Zone - London, UK A 24/7 Ultra Low Emission Zone (ULEZ) has been established in the centre of London. In order to drive through the zone all vehicles must meet strict emission standards or pay a daily fee. Financial assistance to help residents switch to lower emission vehicles is available. A 49% reduction of non-compliant vehicles in the centre of London was noted by the end of 2019; toxic and greenhouse gases also decreased by 35% and 6%, respectively. The ULEZ zone is set to expand in 2021[35].

10. Zero Carbon Innovations

In emissions mitigation there is a need for the rapid and widespread uptake of existing technologies that can reduce emissions, such a renewable energy and EVs. However, there are still areas of emissions that are not fully solved and technologies that show initial promise, but are not yet considered, "tried and tested". In order to achieve zero-net emissions, there needs to be continued research, innovation and testing to bring new technologies, processes and systems to proof of concept and scalability.

By its nature, a focus on innovation would be responsive to new technology and implementation solutions and could go in many directions. This area is exciting, demonstrates leadership and creates an environment where innovation by local governments, researchers, investors and technology is encouraged and supported.

An initial focus for zero carbon community innovations could be integrated energy systems. Integrated energy systems connect generation, transmission and distribution, storage, loads and behaviours in a coordinated way. There are innovative solutions and smart technology that can tap into various parts of that process to ensure that energy is used more efficiently and ultimately, saves emissions.

With surging solar uptake, the network will need to evolve with new types of infrastructure to cope with growth of households that both consume and produce electricity. The resultant strain on the existing networks is an issue for DNSPs. Community batteries have potential to alleviate this issue.

Barriers faced by solutions such as integrated energy systems include high cost, high engagement, low cost-effectiveness and they require high appetite for innovation from a number of relevant parties (homeowners, DNSPs, councils, and possibly others). For example, while the cost of batteries has come down over the last few years, any community battery project will still require significant upfront capital investment with an initial low rate of return. It also requires sufficient buy-in from community members, a suitable location and support from the relevant distribution business.

YEF, CitiPower, City of Yarra, and the Australian National University are pursuing one of Victoria's first community battery initiatives[36]. The initiative has received funding through the Victorian Government's Neighbourhood Battery Initiative to demonstrate the community support, operational, and technical viability of community batteries. This type of trial is occurring all over the country, with Western Power and Synergy in Western Australia now in the third phase of their PowerBank trial, and with 13 community batteries in operation[37]. AusGrid, United Energy and CitiPower (with the City of Melbourne) are all also undertaking trials within their jurisdictions. The Synergy and Western Power trial allowed customers to store around 6-8kWh of power for use after 3pm[38]. Ausgrid are running NSW trials in Bankstown and Lake Macquarie, and in Victoria United Energy are installing 40 30kW batteries, each with the capacity to service up to 75 homes.

A cost-benefit analysis of community batteries conducted by the Australian National University and funded by ARENA in 2020 found that ownership structures greatly impacted the viability of community batteries. Under DNSP-owned models, batteries can reduce energy imports/exports by around 15-20% and power by around 5%, whereas batteries owned by third-parties, such as community groups, councils or for-profit enterprises faced additional challenges and considerations to achieving viability and reducing overall grid energy consumption[39].

Zero Carbon Innovations: Priority Actions

Integrated energy systems are a whole building, precinct or neighbourhood approach which aims to enable participants to access locally generated renewable energy throughout the day. Integrated energy projects can be location-based such as an industrial area where all participants are in proximity. They can also be virtual, such as a virtual power plant (VPP) in which case participants do not need to be close to the renewable source or battery but are connected via an energy trading app or platform.

This action requires community members, from households to large energy users, to be willing to trial new technology, take risks and demonstrate leadership. Community groups across Australia have been able to do this, with probably the most famous example the Hepburn Community Wind Farm, which now provides power to around 2,000 local homes.

There will be upcoming opportunities for Yarra residents to participate in community projects. Yarra Energy Foundation (YEF) has partnered with local energy distributor CitiPower, Australian National University and Yarra Council on a community battery project, with funding support from the Victorian Government's Neighbourhood Battery Initiative.

How Yarra Council Can Enable Zero Carbon Innovations

Zero Carbon Innovations is an area where Council could develop and lead an overall vision for integrated energy systems in Yarra. This would involve gaining a Yarra-specific understanding of the local potential for various integrated energy systems and their costs and benefits. Council can provide value in the innovation space by identifying enablers, opportunities and barriers to these systems in Yarra, and can involve key technology providers, businesses and key players in the community. This work would need to be responsive to the latest technology trends and community needs.

Council's specific role and the actual potential of particular innovations would need to be determined; however, it may involve facilitation, community support, partnerships, funding research or implementing pilots.

As there are existing initiatives already in progress within Yarra and other municipalities, Council can look to establish and leverage partnerships. Council's role could then be shaped by the needs of these existing initiatives, the opportunity they present, and the gaps.

Integrated energy system projects are complex and involve collaboration and coordination of several stakeholders during the project initiation and the ongoing management. Establishing such a mechanism with consensus from all parties and the appropriate legal protections in place can be complex. Council could play a role in facilitating agreements or partnerships that enable this process to progress.

Council is already working closely with YEF and partners to roll out trial community batteries across the city. Other pilots that Council could explore include solar gardens or local energy trading models. Council can also work with precincts, business groups and apartment owners to facilitate other pilot projects not covered by existing initiatives. This may involve bringing together interested parties with innovative technology providers to scope out the potential for projects within Yarra. Once suitable projects have been identified Council can provide ongoing resources to support project management, storytelling and knowledge sharing.

Other Actions for Zero Carbon Innovations

State and Federal Government

To help accelerate policy reforms by other levels of government that would drive innovation to transition households to zero emissions, it is recommended that Council continue to advocate to state and federal governments to take the following actions:

Federal Government

- Provide major funding through ARENA for innovative projects including renewable energy, battery storage, demand response models, and distributed energy models.
- Develop mechanisms to apply small technology certificates or other subsidies or rebates to community solar models such as solar gardens.

Victorian Government

- Support the deployment of large and medium scale energy storage projects. In addition to grid scale storage, there are likely strong benefits in providing more support for mid-scale neighborhood or community batteries closer to consumers.
- Support innovative local energy systems such as through changes to energy market regulations to support peer-to-peer trading and distributed generation and storage.
- Work with electricity distributors and regulators to disclose electricity network constraints and capacity data to support solar PV and batteries, and better manage network constraints to maximise the ability to export excess solar.

Distribution Network Service Providers (DNSPs)

As network owners and managers, community batteries and integrated energy systems are an important solution to problems faced by DNSPs around network limitations. The DNSPs also currently hold much of the electricity network data as commercial in-confidence. This data, such as information about network constraints and capacity, is needed to work out the viability of alternative energy systems, such as community batteries or integrated energy systems.

DNSPs could take an active role in:

- Working with the community and other partners to co-fund and manage pilot projects.
- Making electricity network constraint data publicly available to enable industry and other parties to invest in the right technologies in the right locations.

Universities and research organisations

There is much interest in the potential of community batteries and integrated energy systems as a model for decentralising energy distribution and overcoming network issues. This presents an opportunity to leverage the expertise of university or research institutions in designing, monitoring and evaluating efforts.

Large-scale investors

Innovation requires design, research, testing and sometimes, failing a couple of times before its right. This costs money. By directing money away from fossil fuel companies and towards renewables and innovative energy solutions, large-scale investors can directly influence the shape of the future.

Examples and inspiration

Haystacks Co-operative Solar Garden, NSW

Haystacks is owned by a co-operative of members who own a "plot". It was created as a partnership between community renewables group Pingala, solar developer Komo Energy, Community Power Agency, a regional farmer and land owner, and the energy retailer.

The project was supported by a grant from the NSW Government's Regional Community Energy Fund. The project could enable 333 people who currently can't access solar to participate in the renewable energy transition. The collaborative structure of this model opens up opportunity for leveraging several co-benefits through choice of project partners[40].

Industry Microgrid - Byron Bay Arts & Industry Estate, NSW

In the industrial estate some businesses have excess to solar while others are unable to install solar due to lack of roof space or capital to buy panels. The microgrid connects all businesses in the industrial estate to a battery via a microgrid. This enables a business with solar to trade the excess energy it generates with its neighbours. When supply exceeds demand, excess could be stored in a centralised battery for reuse within the estate or sold externally.

Electricity consumers benefit from lower energy costs from the onsite renewables, and electricity producers receive a higher price for their energy than the feed in tariff. The industrial estate is part of an existing distribution network operated by Essential Energy and will remain connected to the main electricity grid to ensure continuity of energy supply[41].

Community Battery with Energy Trading - Beehive Project, NSW

Delivered by Enova Community Energy, the Beehive Project enables households to share and trade rooftop solar between themselves, and access energy from a community battery when it is needed. The battery is provided by the energy retailer with support from the DNSP.

This pilot enables up to 500 households to get more out of their solar as a community. The pilot will also test the value of batteries in helping small and mid-size electricity retailers better ride the impacts of days of very high electricity demand, by accessing the stored energy. A research team at the University of Newcastle tracks and monitors this pioneering project and learnings will be shared with the wider community and industry.

The project is managed through an online trading platform, Powertracer, developed by Enosi. It enables an energy sharing and trading. Energy usage from solar households is matched with non-solar households using the platform and customers can then conduct transactions with each other. Use of the trading app means that unlike traditional microgrids, participating households don't have to be geographically located close to the battery[42].

11. The Role of Carbon Offsets

Carbon offsets are expected to be a key part of the global solutions to the climate crisis. Even if all feasible emissions reduction actions could be deployed at speed in the coming years, in 2030 there will be residual community emissions in Yarra.

The purchase of carbon offsets may play a role in the City of Yarra's journey towards zero-net emissions. The focus of climate action however should always be on reducing emissions at the source.

Carbon offsets essentially compensate for emissions produced through the purchase of corresponding offset units. These carbon credits are generated by projects that reduce, remove or capture emissions from the atmosphere such as reforestation, renewable energy or savanna burning. Carbon offsets are sold as carbon credit units, either generated in Australia (ACCUs) or internationally (VCUs) and represent one tonne of carbon dioxide equivalent (1 tCO_2e) for one year.

While the priority should remain on reducing emissions at the source, carbon offsets play a very important role in offsetting emissions that are currently unavoidable while solutions for these harder-to-mitigate emissions are developed or require more time to reach full deployment, such as electrification of transport or cessation of gas consumption. Growing numbers of businesses and individuals choose to purchase offsets, with leading examples in the business community including transport and freight companies such as Qantas, DHL and Australia Post.

Due to the geography of Yarra, and the scale of projects required to offset carbon emissions, these are most likely to occur outside urban areas. There continues to be a range of accredited offset projects emerging that achieve multiple benefits, such as Indigenous-owned enterprises that deliver carbon projects, mainly through Indigenous land management practices.

As shown in Figure 14, spot prices for ACCUs increased over the 2020/21 financial year, finishing at $19.30. The average spot prices for ACCUs in 2020/21 was 5% higher than the average spot price in 2019/20[43].

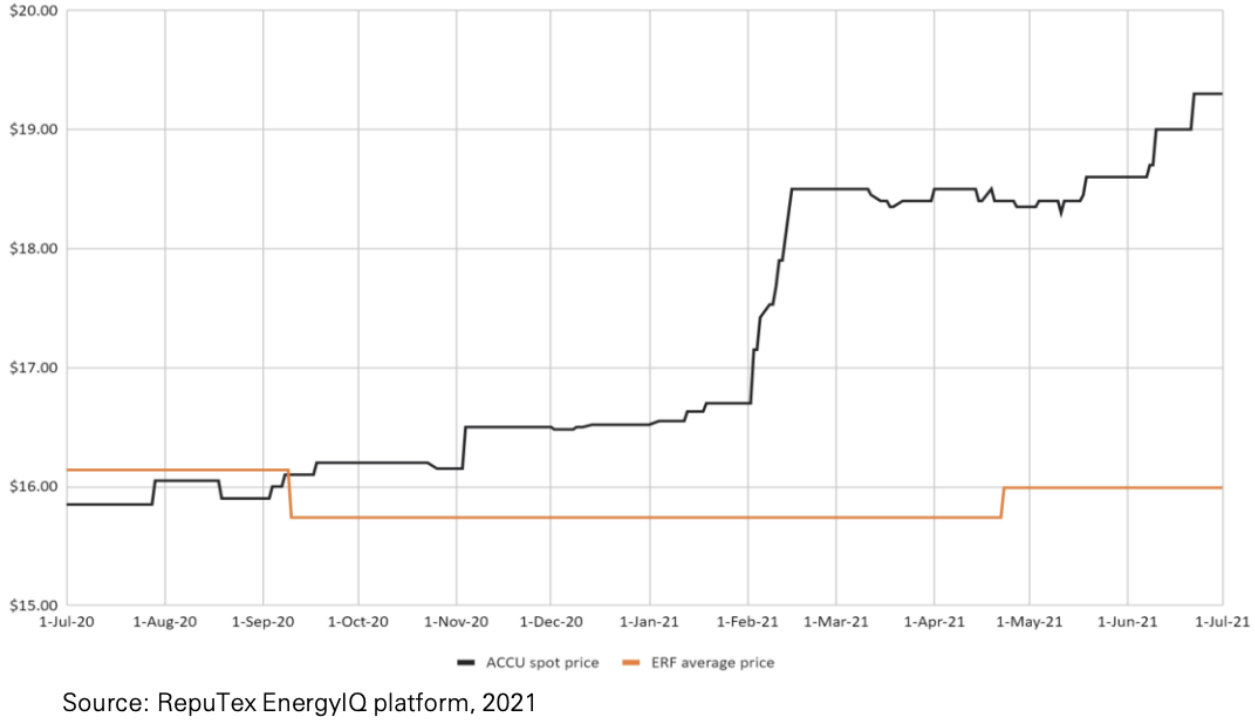


Figure 14: ACCU spot price trend for financial year 2020/21

How Yarra Council Can Enable Carbon Offset Purchasing

Educate and facilitate businesses and individuals to purchase carbon offsets

While Council's primary focus should remain on working to reduce community emissions, there is a useful role to play in helping residents and businesses purchase accredited carbon offsets. As part of engagement with businesses and households, Council could educate community members about offset schemes and purchasing.

Council could educate households and businesses about selecting and purchasing offsets and may also partner with not-for-profits to provide community members access to affordable, accredited GreenPower and carbon offsets.

In future, Council could explore opportunities to support or encourage the development of new Australian-based carbon offset projects. This could be delivered in collaboration with regional councils or partner organisations located in regions where effective and scalable carbon sequestration is possible. This would have co-benefits of regional partnerships, testing innovations in offset generation, and supporting new regional and Indigenous-led industries.

Council could also stay up to date with emerging approaches to drawdown and partner with others to advocate for effective and scalable drawdown methods.

Other Actions to Enable Carbon Offsets and Drawdown

Federal and Victorian Governments

- Invest in local offsets and develop Australia's primary industries and land management sectors to be global leaders in regenerative land management practices, to sequester carbon and contribute to regional economies.
- Support innovation in carbon drawdown technologies: Carbon drawdown technologies such as carbon sinks and changes in land management practices are still in the emergent phase and more investment in research and pilot projects is needed at the national level to drive progress in this area.

12. Monitoring, Evaluation, Review and Learning

As an integral part of the design of each program, Council should incorporate the collection of qualitative and quantitative data for program monitoring. This would require some investment in data collection and a close relationship with delivery partners to ensure they are also collecting valuable insights. With the impacts of some programs being generated over several years it is important that these channels of data collection remain open after Council is no longer directly involved.

Through regular data collection and data analyses, Council could be undertaking mid-project evaluations. Programs should be designed and delivered to allow them to be dynamic. It is important that program learnings feed into program delivery to ensure ongoing success.

Once a program is in full delivery, Council could conduct a review of program effectiveness. Using data collected through the implementation together with further research, Council could establish an understanding of the effectiveness of the program.

This is an incredibly important contribution to growing the knowledge base in the local government sector and ensuring emissions reduction programs are well targeted in future. With little data on community emissions reduction currently being generated, the development of this evidence base by Council also provides a unique and powerful opportunity.

13. Appendices

Appendix A: Assumptions Summary Table

Appendix B: Community Emissions Profile Report

Appendix C: Report Methodology

14. References

All references are included as endnotes. Documents accessed in the development of this Roadmap report, but not specifically referenced in text are listed here:

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