



Draft Climate Response Plan 2021-2031



Draft Climate Response Plan 2021-2031

(Version 2 – February 2021)

Contents

1. Introduction	3
2. Climate Response Planning.....	5
2.1 Sustainable Development Goals	5
3. Technical and Scientific Summary	7
3.1 Climatic Trends.....	7
3.2 Knox City Council Emissions.....	9
3.3 Knox Community Emissions	11
3.4 Carbon Emissions Reduction Goals	11
3.5 Knox’s Carbon Budget.....	12
4. The Economics of Climate Action.....	14
4.1 COVID-19 and Climate Action	14
4.2 Investment Appetite.....	14
5. Climate Risk Assessment	16
6. Our Community.....	18
6.1 Vulnerable and General Populations.....	18
7. Our Natural and Built Environment.....	22
7.1 Biodiversity	22
7.2 Green & Leafy Streets.....	23
7.3 Active Transport	25
8. Our Council	26
8.1 Energy	26
8.2 Buildings and Facilities.....	26
8.3 Infrastructure	27
8.4 Waste Management.....	29
9. Guiding Principles.....	31
10. Action Plan	33
11. Monitoring, Evaluation, Review and Learning	41
11.1 Progress Monitoring	41

11.2 Impact Monitoring.....	41
11.3 Evaluation Trigger.....	41
11.4 Evaluation, Review and Learning	42
12. References	43
Appendix A - Detail for Proposed Action Plan Interventions	45

Tables

Table 1: Council's Carbon Emissions from all scopes 2015 to 2020	10
Table 2: Knox Community Emissions 2017 – 2019 (Source: Snapshot Climate).....	11
Table 3: Scaled science-derived target for City of Knox	12
Table 4: Summary of proposed corporate and community actions.	33
Table 5: Summary of corporate mitigation actions	34
Table 6: Summary of community mitigation actions	36

Figures

Figure 1: The Sustainable Development Goals (Source: United Nations)	6
Figure 2: BOM 2019 and 2020 (respectively) annual mean temperatures compared to historical temperature observations.	7
Figure 3: DELWP Victoria's Climate Science Report 2019	8
Figure 4: DELWP Victorian Climate Projections 2019 Technical Report	9
Figure 5: Average annual temperatures for Knox, Scoresby Weather Station 1965 - 2019	9
Figure 6: Carbon Emissions from Council's buildings and fleet. Scope 1, 2 and 3.	10
Figure 7: Knox emissions vs EAGA average, tonnes per capita 2017.	11
Figure 8: Representation of City of Knox's municipal science-derived target if used linearly	13
Figure 9: Heat vulnerability map Knox.....	18
Figure 10: Number of households participating in Knox Gardens for Wildlife.....	23
Figure 11: Tree cover as a percentage of total area 2018.....	23
Figure 12: Percentage of change in tree canopy, 2014-2018.....	24
Figure 13: Urban Heat Island effects in Knox 2018	24
Figure 14: Residences within 400m of public open space, 2018	25
Figure 15: Bushfire prone assets Boronia/Basin and Bayswater (respectively)	28
Figure 16: Bushfire prone assets Rowville.....	29
Figure 17: Waste to landfill kilograms per household	30
Figure 18: Business-as-Usual GHG Emissions trajectory, including reductions from actions	34
Figure 19: GHG Emissions Pathway: Efficiency Actions and Renewable Energy	48
Figure 20: Estimated impact of interventions for low emissions buildings through design in Knox	51
Figure 21: Estimated impact of facilitation of industrial working groups intervention in Knox.....	54
Figure 22: Estimated impact of industrial education intervention in Knox.....	54
Figure 23: Estimated impact of solar installation intervention in Knox	57
Figure 24: Estimated impact of EV charging interventions in Knox	60
Figure 25: Estimated impact of mode shift to car share services interventions in Knox	62
Figure 26: Estimated impact of sustainable road building intervention in Knox.....	65

1. Introduction

In late 2019, Knox City Council reaffirmed its commitment to taking urgent action on climate change and committed to commence developing a new Climate Response Plan in 2020.

The Knox Climate Response Plan (CRP) delivers a pathway to an emissions neutral Knox City Council by 2030 and sets ambitious interim targets. It demonstrates how Knox will adapt and improve its resilience to the climate hazards that impact the city now and in future climate scenarios. The CRP outlines the social, environmental and economic benefits expected from implementing the Plan in line with the United Nations Sustainable Development Goals and details Council's governance, powers, and the partners who need to be engaged in order to accelerate the delivery of Knox's mitigation targets and resilience goals.

Public input was sought during the development of this Plan in order to ensure the thoughts and needs of our community were identified and included. This included communicating directly with the public at the Knox Festival prior to the COVID-19 lockdown, and thereafter through online engagement with each Council Advisory Committee to explain the approach to developing the CRP and to ask for input on what impacts and concerns each representative group has around climate change. Additionally, feedback was sought on what each Advisory Committee felt was important for Council to consider when developing an Action Plan. This feedback has been incorporated into all relevant sections of this Plan.

A concurrent step in the development of the CRP was the completion of a municipal-wide climate risk assessment to better understand, manage and respond to the changing frequency, severity, and scale of climate hazards and to develop a detailed assessment of priority risks based on levels of exposure, sensitivity, and vulnerability. This risk assessment enables Council to allocate resources and efforts to the areas that will be most affected. Eight key systems at risk were identified:

- Biodiversity;
- Business;
- Council operations;
- Emergency management;
- Infrastructure;
- Recreation;
- General population; and
- Vulnerable populations.

The systems at risk are discussed in sections 5, 6, 7 and 8.

It is important to note that the development of the CRP has also taken into account and has been aligned to a number of relevant strategic plans including (and not limited to) the following:

- Knox Council and Community Plan 2017-2021
- Emergency Management Plan
- Knox Liveable Streets Plan 2012-2022
- Knox Planning Scheme
- Capital Works Sustainability Initiatives
- Sustainable Building and Infrastructure Policy
- Knox Integrated Transport Plan
- Green Areas and Rural Strategy (currently being prepared)

The draft CRP sits within the Knox Integrated Strategic Framework (illustrated below), and like all other Knox plans and strategies, will be used to inform the development of the Knox Community and Council Plan. It is the Knox Community and Council Plan which drives the allocation of resources and requires regular reporting to State Government and the community.



2. Climate Response Planning

Climate response planning is increasingly mandated for local government (*Victorian Local Government Act 2020: S9,2c*) and the communities and partners with which they work. Governments are recognising the importance of municipal-level climate response planning for addressing climate change. At the same time, as local governments have responded to this challenge, they have begun to realise the additional benefits of taking climate change action. In addition to yielding climate benefits, mitigation and adaptation actions can enable Councils to: meet their development priorities; address social challenges and local environmental concerns; realise cost savings; and respond to other international agendas, such as those captured in the United Nations Sustainable Development Goals.

Local government is identified in the *Climate Change Act 2017* as a decision-maker that must consider climate change when preparing a municipal public health and wellbeing plan. Addressing climate change and its impacts on health is also a focus area of the *Victorian Public Health and Wellbeing Plan 2019-2021*. Under the *Public Health and Wellbeing Act 2008*, Councils are required to have regard to the State Plan when preparing a municipal public health and wellbeing plan.

At a regional level, Knox is part of the Eastern Alliance for Greenhouse Action, a formal collaboration of eight councils in Melbourne's east, working together on regional programs that reduce greenhouse gas emissions and facilitate regional adaptation.

2.1 Sustainable Development Goals

The United Nations Sustainable Development Goals (SDGs) set out a framework of 17 transformational goals to tackle our social, economic, and environmental challenges (see Figure 1 below). The SDGs have been adopted by all 193 member states of the United Nations, including Australia. As the level of government that works closest with their communities, local governments already play a large role in achieving the SDGs, which will result in a more sustainable, healthy, prosperous and just society.

At the SDG Summit in September 2015, Mayors from 40 countries met and declared their support and intention to drive the SDGs. As well as calling for the localisation of the 2030 agenda, the Mayors particularly welcomed the inclusion of SDG 11, Sustainable Cities and Communities as a '*powerful driver of transformation*'.

Local government plays an important part in achieving the SDGs. In the Australian Voluntary National Review (AVNR, 2018) the Federal Government stated that:

"many targets in the SDGs are in the purview of sub-national levels of government" and "The Australian Government has adopted an approach to the SDGs that is appropriate for our national circumstances, with government policy responsibilities and priorities devolved to the relevant agency and level."

Councils have an opportunity to use the SDGs to:

- Drive transformation that aligns with other local government authorities and levels of government;
- Achieve integration by using the SDGs as the integrated framework for plans, strategies and reporting;
- Align a diverse set of stakeholders in a universal agenda; and
- Engage their employees and communities to help achieve the SDGs, including co-benefits from achieving specific SDGs.

Co-benefits are defined as SDG goals and targets that are advanced through the achievement of other SDG targets. Plans to achieve a specific target can easily overlook important contributions from other targets. For example, strong

action on climate (SDG 13) can also benefit SDGs 7, 11, 12, 14, 15 etc. Understanding the co-benefits of achieving targets can help design integrated policy platforms to consider these important contributions. The Action Plan of the CRP will identify where actions align with the SDGs that will also benefit from robust climate action.



Figure 1: The Sustainable Development Goals (Source: United Nations)

3. Technical and Scientific Summary

3.1 Climatic Trends

Globally

Atmospheric carbon dioxide concentrations have risen from around 280 parts per million at the start of the industrial revolution, to above 400 parts per million today (Global Carbon Project, 2018). The increasing concentration of carbon dioxide, along with other greenhouse gases, are trapping heat in the Earth's atmosphere and warming the planet as a result of the enhanced greenhouse effect. In the recent geological history of the Earth, equivalent rates of change have taken thousands of years to occur. The *State of the Climate 2020* report released by the Bureau of Meteorology (BoM) and CSIRO notes that the Earth's climate system has not seen atmospheric carbon dioxide levels above 400 parts per million since around 2.3 million years ago (BoM and CSIRO, 2020).

According to the Intergovernmental Panel on Climate Change (IPCC), the global surface temperature has warmed by 1°C since the middle of the 19th Century (IPCC, 2018). The *State of the Climate 2020* report notes that every decade since the 1980s has been warmer than the last. Due to the emissions already in the atmosphere, climate scientists warn that a further warming of up to half a degree is already locked in. How much the climate changes will depend strongly on the greenhouse gas emissions pathway that the world follows. To this end, the Paris Climate Agreement is a global effort to limit the warming to below a 2°C increase (an increase of less than 2°C is below pre-industrial levels), but make efforts to contain the temperature increase to 1.5°C.

Australia

Australia's warmest year on record was in 2019, with the annual national mean temperature 1.52°C above average as well as being Australia's driest year on record (see **Error! Reference source not found.**). The 2020 BoM report shows the highest temperature ever recorded in the Sydney Basin, at 48.9°C, occurred in 2020, on January 4.

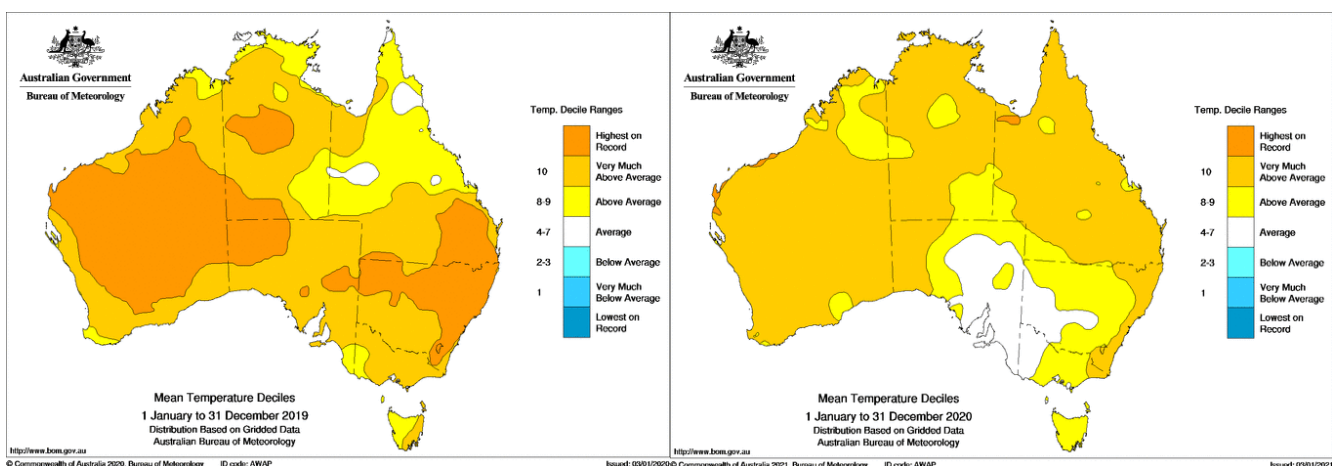


Figure 2: BOM 2019 and 2020 (respectively) annual mean temperatures compared to historical temperature observations.

More recently, the BoM has released information that shows that 2020 was Australia's fourth-warmest year on record. Notably:

- Australia's area-averaged mean temperature for 2020 was 1.15°C above the 1961–1990 average;
- Mean maximum temperatures were the eighth-warmest on record at 1.24°C above average;
- Mean minimum temperatures were the fourth-warmest on record at 1.05°C above average; and

- Annual mean temperatures for 2020 were above average for the majority of Australia, with close to average annual mean temperatures for parts of eastern South Australia, and the west of Victoria and New South Wales.

In addition, La Niña¹ was declared in September 2020, reaching moderate strength by the end of the year. During a La Niña phase, Australia's northern waters are warm with increased convection. This allows more moisture to be lifted into the air than normal, typically resulting in increased rain for eastern and northern Australia, which can lead to an increased flooding risk for some areas. That moisture can lead to cooler daytime temperatures however it is worth remembering that despite the La Niña effect, 2020 was still the fourth hottest year on record for Australia.

Victoria

Victoria's climate has changed in recent decades, becoming warmer and drier. These changes are expected to continue in the future. Understanding the drivers and impacts of these changes, as well as what can be expected in the future will help all levels of government to plan and adapt (DELWP, 2019). Annual rainfall is projected to decrease across the state, due to declines across autumn, winter and spring. When extreme rainfall events do occur, they are likely to be more intense.

The Victorian Climate Projections Report (DELWP, 2019) notes that by 2050, the climate in Melbourne is projected to be similar to the climate currently experienced in Wangaratta. Days above 35°C are expected to increase from around 8 per year to between 10 and 21 days, and nights over 20°C are expected to increase from nearly 6 nights a year to between 13 to 18 nights per year. Fire danger days are also expected to increase by 42%, and there is expected to be an overall reduction in rainfall totals, particularly in spring.

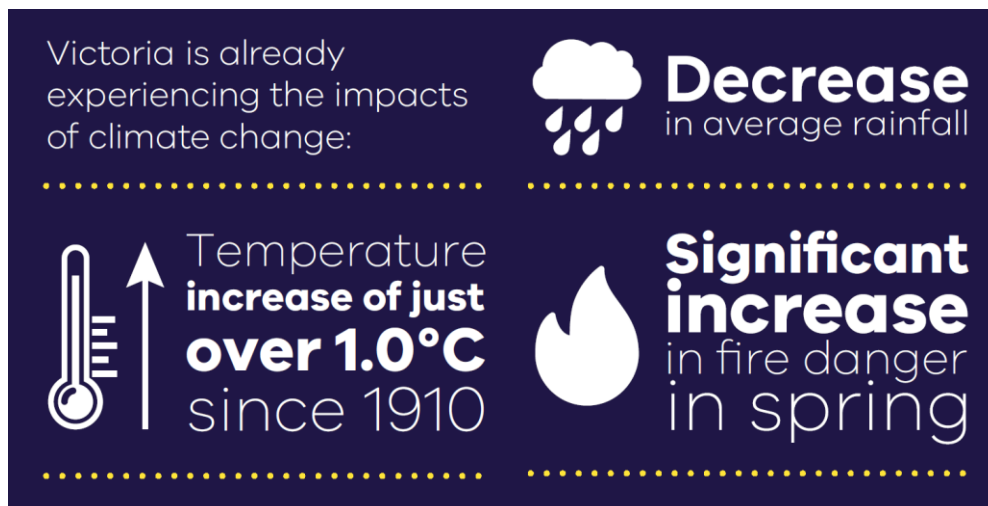


Figure 3: DELWP Victoria's Climate Science Report 2019

Figure 4 shows Victoria's 'climate stripes', where each stripe represents the temperature for a given year, compared to the 1961 to 1990 average, with red stripes indicating temperatures above average and blue stripes indicating temperatures below average. These 'climate stripes' illustrate that temperatures have been increasing over the recent decades.

¹ La Niña is a phase of the El Niño Southern Oscillation (ENSO), which describes ocean and atmospheric circulations over the Pacific Ocean.

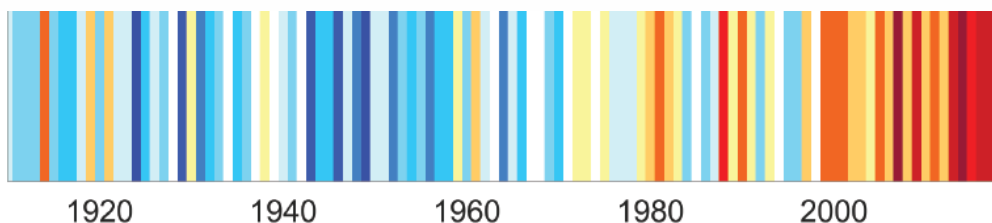


Figure 4: DELWP Victorian Climate Projections 2019 Technical Report

Knox

The 'climate stripes' for Knox (see Figure 5), show a warming trend for the average annual temperature (2.0°C increase between 1965 and 2019) and the number of hot days over 35°C is also increasing since 1965. Average temperatures were cooler in the 1960s (shown by white and blue stripes) and in recent years, there are more red stripes indicating warmer temperatures. In addition, nearly half of the hot days over 35°C in 2019, were extreme heat days, over 40°C. Data was not available from the Scoresby Weather Station between 1989-1996.

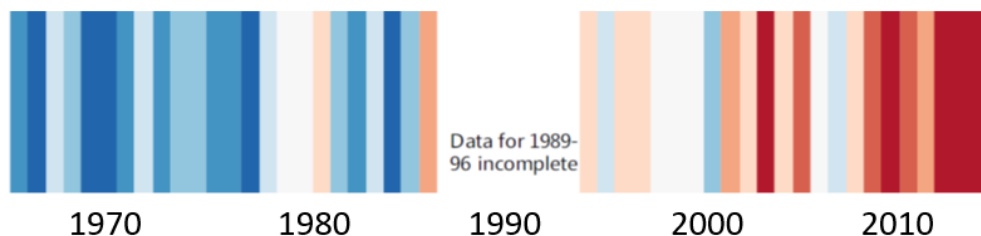


Figure 5: Average annual temperatures for Knox, Scoresby Weather Station 1965 - 2019

3.2 Knox City Council Emissions

Current carbon emissions from Council's services and operations as well as the community emissions have been documented, to better understand Knox's starting position. Council's corporate carbon emissions are determined using the National Greenhouse and Energy Reporting System (NGERS). This framework categorises the emissions as follows:

- **Scope 1:** Emissions from a facility or site under the direct control of the Council (examples include emissions from mains gas and fuel used in Council's Fleet);
- **Scope 2:** Indirect emissions created off-site for facilities under the direct control of the Council, mainly from metered electricity purchased for Council's facilities; and
- **Scope 3:** Emissions from off-site facilities or activities, not under operational control of Council (examples include unmetered electricity such as street lights, waste from Council operations, staff travel for work purposes, emissions from contractor vehicles, and emissions from leased buildings).
Note: Inclusion of Scope 3 is optional due to the difficulty in obtaining the required data from various sources such as suppliers, contractors and consultants.

The following Scope 3 emissions are included in Council's carbon footprint described in [Table 1](#) and [Figure 6](#) below:

- Energy used for streetlights; and
- Business related air travel emissions.

It is proposed that as additional data becomes available, that Scope 3 emissions are reviewed and revised in the future.

Table 1 below outlines the emissions from Council operations from 2015 to 2020. It shows that electricity consumption remains the largest contributor to our emissions at around 80%, followed by gas emissions at around 12%.

Table 1: Council's Carbon Emissions from all scopes 2015 to 2020

Financial Year	Electricity	Mains Gas	Fleet Emmissions			Flights	Total
	Emissions (t CO2-e)	Emissions (t CO2-e)	Petrol (t CO2-e)	Diesel (t CO2-e)	LPG (t CO2-e)	Emissions (t CO2-e)	Emissions - All Scopes (t CO2-e)
2015-2016	13,187	1,511	284	624	8	4	15,618
2016-2017	10,460	1,590	311	681	9	5	13,056
2017-2018	8,395	1,522	263	614	7	4	10,805
2018-2019	8,470	1,160	254	722	2	3	10,611
2019-2020	7,670	1,196	262	659	6	6	9,799

As illustrated in Figure 6, the bulk replacement of 10,600 Streetlights to LED has contributed to a significant reduction in Scope 3 emissions since 2015/16. The 2019/20 emissions have been partly impacted by the COVID-19 restrictions resulting in a reduction in energy and fuel use in a number of Council facilities in the final three months of the 2019/20 financial year.

In addition, the Sustainability Initiatives Capital Works program has seen a number of buildings reduce emissions due to energy efficiency upgrades and Solar PV installations. Rooftop solar has been installed in 28 Council buildings to date amounting to over 640kW of installed capacity, along with 378kWh of battery storage in four buildings. Improving energy and fuel efficiency standards, as well as an overall improvement to the Victorian emissions factors (Victoria's electricity emissions have improved as more renewable energy is added to the grid), have contributed to a 37% reduction in Knox City Council's greenhouse emissions since 2015/16.

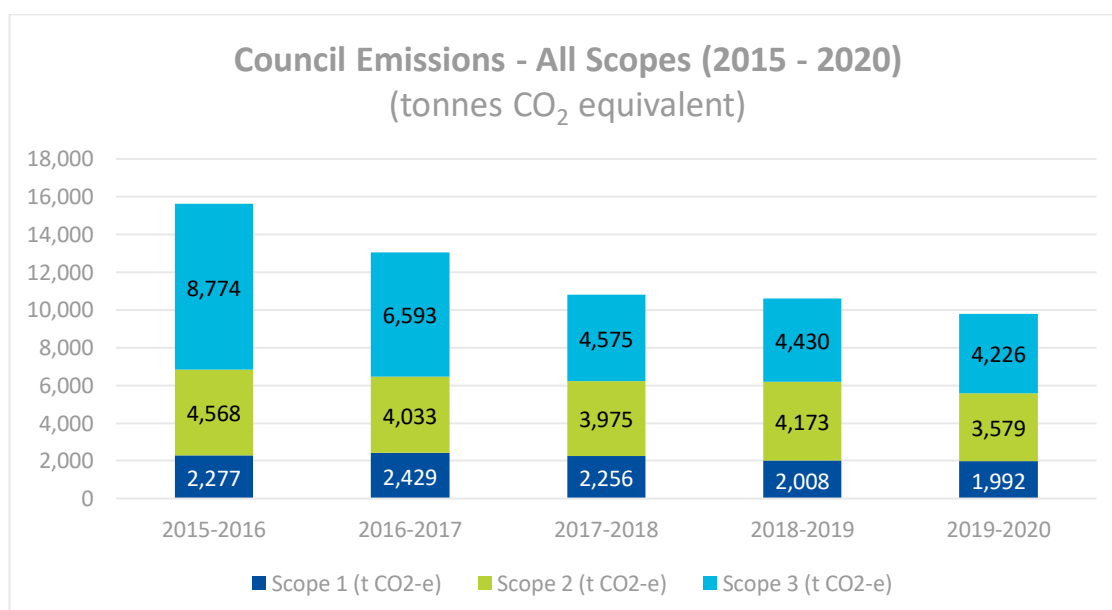


Figure 6: Carbon Emissions from Council's buildings and fleet. Scope 1, 2 and 3.

3.3 Knox Community Emissions

The 'Snapshot Community Climate Tool' which has been developed by Ironbark Sustainability and Beyond Zero Emissions, provides a national database of community emissions for all local governments in Australia. This tool has been used to obtain data on Knox community emissions between 2017 and 2019 (Table 2). The data shows that Electricity (56%), Gas (22%) and Transport (19%) accounts for 97% of the Knox community's emissions.

Table 2: Knox Community Emissions 2017 – 2019 (Source: Snapshot Climate)

Financial Year	Electricity Emissions			Gas Emissions			Transport	Waste	Agriculture	Total
	Residential (t CO ₂ -e)	Commercial (t CO ₂ -e)	Industrial (t CO ₂ -e)	Residential (t CO ₂ -e)	Commercial (t CO ₂ -e)	Industrial (t CO ₂ -e)	Emissions (t CO ₂ -e)	Emissions (t CO ₂ -e)	Emissions (t CO ₂ -e)	Emissions (t CO ₂ -e)
2017-2018	323,100	363,400	1,146,300	168,200	66,100	208,500	603,800	51,600	200	2,931,200
2018-2019	310,800	349,300	1,142,800	170,200	127,700	409,200	605,600	50,700	600	3,166,900

The total greenhouse gas emissions in Knox equates to nearly 15 tonnes per capita with household electricity and gas use accounting for around 3 tonnes of the per capita total (Figure 7). Emissions are higher in Knox than for the Eastern Alliance for Greenhouse Action Councils (EAGA) average which is 13 tonnes per capita in total, and just below 3 tonnes per capita in household emissions (State of Knox 2020).

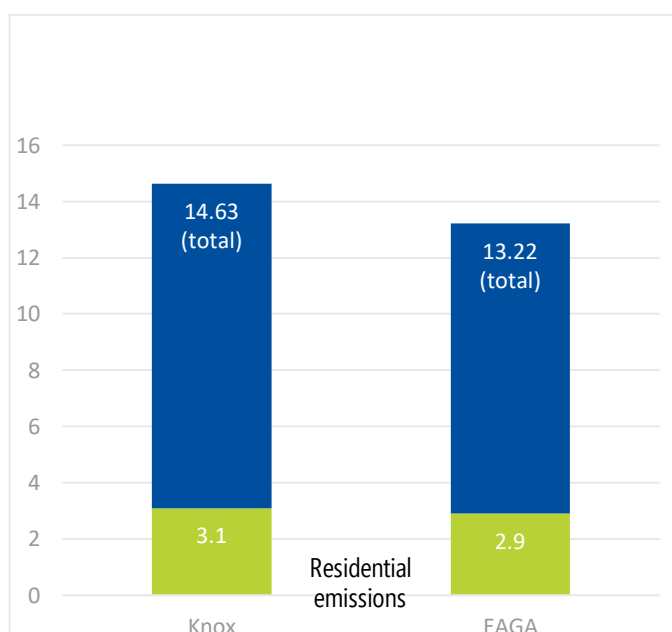


Figure 7: Knox emissions vs EAGA average, tonnes per capita 2017.

3.4 Carbon Emissions Reduction Goals

Reducing emissions is a shared responsibility between governments, business and the community. Setting targets enables efforts to be directed towards achieving that target, rather than letting emissions grow unchecked. As previously mentioned, close to 200 of the world's governments signed the landmark Paris Agreement. The Paris Agreement forms the basis of science-based targets to limit global temperature increase to below 2°C by 2050. However, to limit warming to below 2°C, let alone 1.5°C, current Paris pledges made by countries are not enough. Carbon emissions need to decline at a much steeper rate in the near future and reach net-zero by mid-century to have a 50% chance of keeping warming below 1.5°C.

Just as a financial budget guides and provides parameters for expenditure, a carbon budget provides parameters for how much carbon can be emitted into the atmosphere before warming will exceed certain temperature thresholds. The concept of a carbon budget emerged as a scientific concept from the IPCC's 2014 *Synthesis Report on Climate*

Change and relates to the *cumulative* amount of carbon emissions permitted over a period. Given that the carbon budget is not annual, but cumulative, it means that once it is spent, carbon emissions have to be held at net zero to avoid exceeding temperature targets.

To be consistent with the objectives of the Paris Agreement, and in light of the scientific information presented in section 3.1 of this Plan, it is proposed that Knox Council reach emissions neutrality by 2030 at the latest. The reduction will be based on Knox's corporate emissions inventory and modelling, outlining an accelerated reduction to total emissions neutrality through to 2030. An emissions neutral Knox City Council means:

- Net zero greenhouse gas (GHG) emissions from fuel use in buildings, transport and industry (scope 1);
- Net zero GHG emissions from use of grid-supplied energy (scope 2);
- Wherever possible, net zero GHG emissions related to indirect emissions (scope 3).

Furthermore, it is recommended that Council's role as a community leader support and help drive emissions reduction in the Knox community, towards zero net emissions by 2050. A net zero emissions target by 2050 has been adopted by every state and territory government in Australia to meet the obligations of the Paris Agreement.

Data from both the Council emissions and community emissions, together with the strategic direction outlined in the CRP enables recommendations on best practice actions to achieve Council's emission reduction goals. The Action Plan (Section 10) outlines the key measures that Council will need to take to achieve the net zero emissions target, and also the climate adaptation measures required to manage the impact of climate change.

However, irrespective of how quickly emissions are reduced, some climate changes are irreversible (DEWLP, 2020). The Climate Risk Assessment (Section 5) has identified that there are essential services and infrastructure which Knox Council provides to our community which are vulnerable to a range of climate hazards. Due to Knox Council's local knowledge and close connection to the community, Council is often best placed to help the local community reduce risks and adapt to climate change.

3.5 Knox's Carbon Budget

For our community, Council has established a target to be emissions neutral by 2050, in line with State Government targets. Using science-derived targets (SDTs) presents an effective and intuitive way to establish the boundaries of what this overall trajectory should be, and from there, to identify targets that are in-line with Council's and the community's aspirations. Importantly, the establishment of SDTs links our efforts to the international community through alignment with the Paris Agreement.

The calculated SDT for remaining within 2°C for City of Knox is provided in Table 3.

Table 3: Scaled science-derived target for City of Knox

Remaining budget (t CO ₂ -e)	23,020,889
"Runway" - Remaining years without change (years)	7.67
Required linear annual reduction 2021 – 2034 (t CO ₂ -e p.a.)	195,775
Required linear rate of reduction 2021 – 2034 (%)	6.52%

The Remaining Budget for the Knox community is the total amount of carbon that the municipality can emit if it is to make a fair contribution to limit the temperature increase to 2°C. The remaining budget for City of Knox is 23,020 kt CO₂-e from 2018/19.

The 'Runway' or Remaining years without change (7.6 years) calculates how long this carbon budget would last, based on the emissions released in 2018/19. If the municipality were to significantly reduce annual emissions this runway would extend as the region would not be 'spending' its carbon budget as rapidly.

The Required annual reduction and Required rate of reduction shows that City of Knox's emissions need to reduce by 195 kt CO₂-e (6.5% of 2018/19 levels) per year until 2034, if the carbon budget is to be used linearly over this time period.

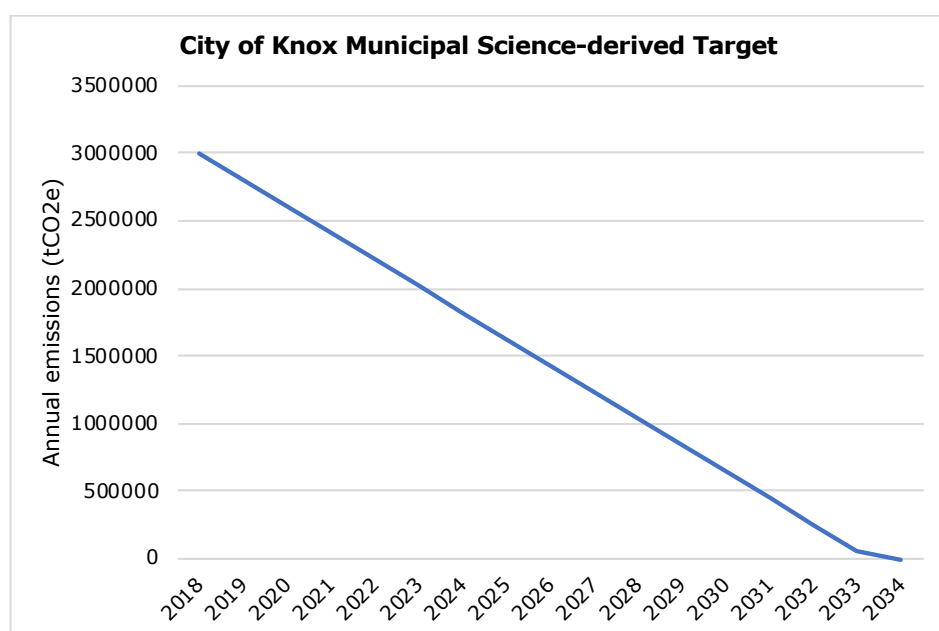


Figure 8: Representation of City of Knox's municipal science-derived target if used linearly

The SDT, which is developed in line with the recognised science of the Intergovernmental Panel on Climate Change (IPCC), connects our efforts to Australia's commitment to the Paris Agreement. This connection provides the yard stick against which to assess the effectiveness of different actions and interventions developed through an evidence-based action planning (EBAP) process. This EBAP process ensures that all interventions are considered through an evaluation of their effectiveness, cost and probability of success, based on the evidence of real projects, research and professional expertise.

Whilst understanding the necessity of meeting this target, it is also important to understand Council's level of accountability. Reducing municipal greenhouse gas emissions must be a whole of community effort and actions taken by State and Federal governments and emissions intensive industries will be key in ensuring Australia stays within its national carbon budget. Council may advocate for and support these actions or engage in collaborative planning with key stakeholders, but ultimately is not solely responsible for meeting the full municipal emissions target.

4. The Economics of Climate Action

Deloitte Access Economics' report *A New Choice: Australia's Climate for Growth* states that net zero is an economic necessity (Deloitte Access Economics, 2020). The cost to Australia of a global failure to deliver a new growth recovery is -6% of GDP and over 880,000 jobs would be lost by 2070. Compared to this future, Deloitte Access Economics estimates a new growth recovery would grow Australia's economy by \$680 billion (present value terms) and increase GDP by 2.6% by 2070. This new growth path adds over 250,000 jobs by 2070. It also claims that "there is no free ride for Australia – while doing nothing is a choice, it is not costless." A 'no policy action' scenario does not result in uninterrupted economic growth. A 'no policy action' pathway as the economy recovers from the COVID-19 crisis– one that does not deliberately and rapidly mitigate climate change – will result in significant economic losses. This is true in Australia, and the rest of the world.

4.1 COVID-19 and Climate Action

It is important to discuss Australia's economic outlook and climate action in the context of the unprecedented global health crisis of COVID-19 and its subsequent economic impacts. Economies globally are all facing the same challenge: how to shift from an economic baseline that was already changing, and recover to a 'new' resilient economic path post-COVID-19. Both government and private sector investment is needed to fill the chasm COVID-19 has left in the economy. This investment will present an opportunity to accelerate Australia's inevitable shift to a low emission economic structure.

The economic costs of the locked-in warming that is occurring, and moving to net zero by 2050, is a 0.1% loss in GDP growth, on average, over the 30 years to 2050 (Deloitte Access Economics, 2020). This 0.1% loss in Australia's GDP by 2050 is estimated to be \$90 billion, in present value terms. Of this \$90 billion cost of moving to net zero, \$23 billion, or 26% is due to the locked-in impacts of climate change. The remaining \$67 billion, by 2050, represents the cost to the economy of reducing emissions to reach net zero in a new growth recovery.

A \$67 billion cost to transform the economy by 2050 is a small price to pay, relative to the size of the Australian economy. In dollar terms, for comparison, the JobKeeper program cost the Federal budget just over \$65 billion in 2020 alone – and this is the necessary price Australia is paying to minimise the worst economic consequences of COVID-19.

The economy impacts the climate, and the climate impacts the economy. Very few forces can impact the Australian economy like the damages associated with climate change – not when considering the scale, persistence and systemic nature of the impacts, as we have seen in 2020. Climate change, if left unmitigated, can erode the productive capacity of the economy. It can change how people work, what is produced and where it is produced, and shift the preferences of what people buy. Industries that rely on people power, such as construction and manufacturing, which make up large elements of the Knox community's industry, will experience hotter working environments that not only disrupt comfort levels, but as temperatures continue to rise, hotter conditions become a concern for workers health and safety and their ability to perform tasks.

4.2 Investment Appetite

Over 150 global corporations have signed a public statement calling for a net-zero economic recovery (World Resources Institute, 2020). Global consulting firm McKinsey has pointed out this would create more jobs and growth than a high-carbon recovery (McKinsey & Company, 2020). Further, government investment on renewable energy has been shown to create five times more employment than spending on fossil fuels (Beyond Zero Emissions, 2020).

Institutional investors such as superfunds, banks and corporate investors have a large and growing appetite to fund projects that reduce emissions. The Investor Group on Climate Change reports that Australia's financial services sector has come together in an unprecedented coalition to promote a transformation of the Australian financial system to support the transition of the economy to net zero emissions by 2050, consistent with the Paris Agreement and the UN Sustainable Development Goals (Investor Group on Climate Change, 2020).

5. Climate Risk Assessment

Local governments provide a wide range of community-based services and infrastructure exposed to the impacts of climate change. Council is the first line of response for many risks facing the community, and their risk profile is likely to shift with projected changes in the frequency, severity, and scale of climate hazards.

These challenges will be encountered against background socio-economic trends such as population growth, housing affordability, water and energy demand, and technology changes. Climate change will exacerbate existing socio-economic issues, disproportionately impacting those most vulnerable in the community, widening the social inequality gap, and disrupting jobs and employment patterns (Australian Academy of Science, 2015).

Knox Council undertook a Climate Change Risk Assessment, with the objective of assessing the vulnerability of key 'systems at risk' across the municipality to develop a detailed assessment of priority risks based on levels of exposure, sensitivity, and vulnerability.

The Risk Assessment identified eight key 'systems at risk':

- Biodiversity;
- Businesses;
- Council operations;
- Emergency management;
- General population;
- Infrastructure;
- Recreation; and,
- Vulnerable populations.

Within each 'system at risk', several 'sub-systems' were defined and their vulnerability to various physical climate risks was assessed based on their exposure, sensitivity, adaptive capacity, relative significance, and the level of control exercised by Council. Based on the vulnerability assessment, Council identified four focus areas for further assessment, including:

- **Vulnerable populations:** Older persons and people with disabilities;
- **Biodiversity:** Council reserves, flora, and fauna;
- **Buildings:** Council owned buildings and recreation facilities, and;
- **Infrastructure:** Stormwater, roads, footpaths, and bike paths.

These areas and their risk profiles are discussed further in sections 6, 7 and 8 below. Whilst Council operations and role as planning authority were also identified as key areas of vulnerability, the complexity associated with these two areas warranted a deeper level of assessment than could be achieved within the scope of the Climate Risk Assessment, and therefore the exploration of these systems is deferred to a later phase of work.

Vulnerable populations

Older persons are considered one of the most significant areas of risk for Council due to Council's direct responsibility in assisting older persons, as well as due to older persons' high level of vulnerability to acute climate stressors, in particular heatwaves. This segment of vulnerable people was considered to be at extreme risk.

People with a disability were expected to have more extensive support networks, therefore were considered a slightly lower risk. Council also play a less direct role in supporting this segment of the population.

Biodiversity

Council's bushland reserves and other open spaces are an important part of the broader network of vital habitat spaces that connect a highly fragmented environment, all of which support a diverse range of flora and fauna. These environments are considered at high risk to both acute and extreme weather events, and longer-term shifts in the climate. A crucial role for Council is to support ongoing collaboration with community and government agencies to reconnect habitats and reduce the impact of fragmentation through a biodiversity plan and urban forest strategy.

Buildings

Bushfires, storms, heatwaves, and floods pose a 'high' risk to Council facilities due to the potential impact to users and assets. This was also identified as a key liability risk, flagged for further investigation as part of Council's next steps. It was also identified that there is a gap in procedures to govern the safe operating conditions of facilities during extreme weather events.

Infrastructure

Stormwater infrastructure, roads, and pathways were considered at high risk from flood and storm events, due the potential for disruption of essential services and impact to residential properties. Council is taking active measures to improve stormwater management and the preparedness of the community for high rainfall events, however these systems are considered to be an area of potentially high liability risk and further work is recommended to explore its magnitude.

These subsystems are elaborated on in sections 6, 7 and 8 below.

6. Our Community

6.1 Vulnerable and General Populations

Cumulative sensitivity is of particular relevance among vulnerable populations. Cumulative sensitivity is when two or more of the sub-systems intersect, for example in Knox there is a high prevalence of chronic health conditions and disabilities in the older persons segment of their population. As Knox's population is ageing (15% and projected to increase), and due to the direct role Council plays in supporting older persons, this sub-system was identified as a key area for further assessment. Whilst children also received relatively high scores in assessment, they were deemed to have strong support networks through families, childcare and education systems, and therefore not considered for further assessment.

Across the key climate stressors, heatwaves were associated with consistently high levels of vulnerability across most sub-systems. This is due to the regional nature of heatwaves (e.g. impacting the whole municipality rather than specific areas), and therefore individuals are unable to simply move away from the event. They are required to seek shelter with appropriate cooling and water, but the danger is less obvious than for more obvious and localised events, such as floods and bushfires.

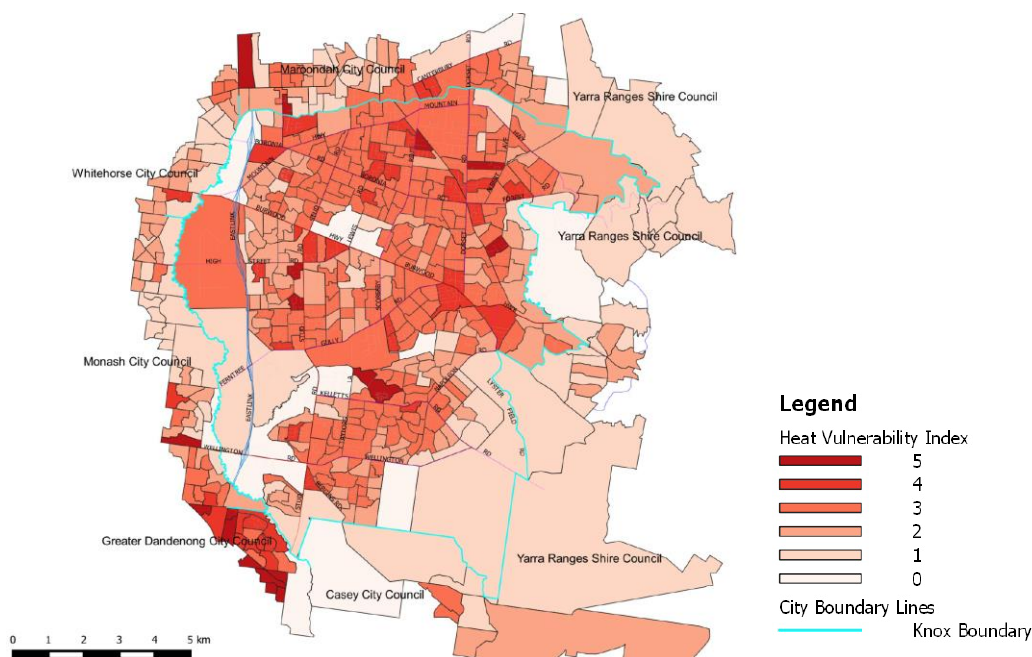


Figure 9: Heat vulnerability map Knox

The Heat Vulnerability Index rating of Figure 9 is determined by three components: heat exposure, sensitivity to heat (due to land cover, population density, and age), and adaptive capacity (e.g. socioeconomic advantage or disadvantage) where 1 equals low vulnerability and 5 equals high vulnerability. Equal weighting (one third each) is given to heat exposure, sensitivity to heat, and adaptive capacity. This demonstrates that in Knox there are areas where residents may be exposed to significant heat stress at times and who may lack the adaptive capacity to cope. The Climate Risk Assessment identified the most at risk as:

- **Older persons:** For the purpose of this assessment, older persons are defined as individuals aged 65 years or older. This segment of the community makes up approximately 15% of the municipality's population.
- **People with a disability:** People with a disability were determined based on the Census of Population and Housing definition, which defines the profound or severe disability population as:

'Those people needing help or assistance in one or more of the three core activity areas of self-care, mobility, and communication, because of a long-term health condition (lasting six months or more), a disability (lasting six months or more), or old age' (ABS, 2016).

This segment makes up approximately 5% of the municipality's population.

There is a significant intersection between these two sub-systems, with over half of the individuals deemed as 'needing assistance' also being over 65 years old.

Older persons

The impacts of climate change and the costs of action and adaptation are unevenly distributed, with low income earners and disadvantaged groups, including substantial proportions of older people, likely to be affected first and most severely. The effects of climate change on older people on low or fixed incomes, who are disadvantaged socially, or who have health issues, will be significant because they have less capacity to adapt to the effects of extreme weather conditions including:

- higher temperatures and longer, more significant heat waves,
- increased costs for essential goods and services, and
- damage to housing and the built environment (COTA, 2019).

While climate change affects everyone, there is a growing body of evidence that it poses specific risks for older people. They are more vulnerable to the effects of temperature extremes and have a significantly higher mortality risk in extreme weather. The combination of chronic health problems and social isolation, in addition to more limited access to services, can reduce their capacity to cope with climate-related stresses. Minor conditions can quickly become major challenges that overwhelm an older person's ability to cope.

The risk to older people is enhanced by a multitude of underlying factors such as housing affordability, housing quality, income levels and cost of utilities. ABS 2016 Census data shows that 550 Knox households aged 65+ years were in housing stress, with many located in bushfire prone areas. These individuals are less likely to have capacity or disposable income to spend on home improvements or garden maintenance, which can be key mitigation measures for extreme weather events. The greatest risk however comes from heatwaves causing more deaths than any other emergency in Knox combined.

Knox's Community Access and Support team maintains a register of older persons who are vulnerable during an emergency event and provide them with advance notice when extreme weather is forecast. However, this register doesn't capture all vulnerable members within the community. In addition to the Community Access and Support team's register, the Emergency Management Team maintains a broader vulnerable people register, providing an additional check point during extreme weather events.

Complementary to the above contact registers, Knox runs a 'Ready to Go' volunteer program to support older persons in planning for emergency events, such as heatwaves and bushfires.

Council also provides a range of services for older persons, including domestic assistance, personal care, flexible respite, escorted shopping, food services, occupational therapy, home modifications, home maintenance, social support (individuals and groups), community transport, housing support, and specialised access support. However, following national reform across the aged care sector, Council, from 1 July 2021, will transition out of in-home services. Moving forward Council will work even more closely with vulnerable populations and continue to provide the remaining range of services.

People with a disability

The inherent risk of acute climate events for people with a disability can be impacted by their mobility and/ or communication abilities. It was assumed that people with a disability are likely to have a broader support network through family or service providers, therefore isolation was expected to be less of an acute issue compared to older persons, therefore slightly reducing the likelihood.

Council's role in relation to people with a disability has changed significantly with the roll out of the National Disability Insurance Scheme (NDIS). Council no longer provides any direct services to people with a disability, and has a role limited to provision of accessible public facilities and services, information, education, and capacity building. However, it is recognised that the NDIS does not support all people with a disability and support networks might be lacking or failing some of the people in this category.

General Population Health

The World Health Organisation describes climate change as the defining issue for public health in the 21st century. Our health is dependent on the health of our environment. However, our changing climate has significant consequences for the environment and for public health, wellbeing and safety, the consequences of which are already being felt. The direct and indirect impacts of climate change are likely to exacerbate existing public health risks and represent an unacceptably high and potentially catastrophic risk to human health. Direct impacts, including hypo- and hyperthermia, heat stress, injury, trauma and death, are caused by exposure to more frequent and intense extreme weather events such as bushfires, droughts, floods and heatwaves. Indirect impacts, mediated through natural and human systems affected by climate change include:

- Vector-borne diseases (those transmitted from vectors such as mosquitos to humans)
- Zoonotic diseases (those transmitted from animals to humans)
- Water-borne diseases (resulting from exposure to harmful algae and pathogenic microorganisms affecting drinking water, recreational water, including aquatic facilities, and water supplied for domestic use)
- Food-borne diseases (such as salmonellosis)
- Exposure to contaminants such as mycotoxins in food
- Impacts on the micro and macro nutritional quality of food
- Exacerbation of existing chronic diseases such as cardiovascular and respiratory diseases as a result of higher temperatures, poorer air quality and airborne pollen. (Victorian Government, 2020)

Aside from its effects on physical health, climate change can also adversely affect mental health. Extreme weather events such as floods, droughts and bushfires can lead to psychological distress due to trauma, illness, loss of loved ones, destruction of property and displacement, and disruption of communities, goods and services. The incremental change to our environment and fear of what the future may bring can also have negative impacts on mental wellbeing. According to a recent survey, depression or severe anxiety related to climate change was noted by half of Victorian healthcare professionals (Sustainability Victoria, 2020).

Conversely, there are many benefits from taking strong action on climate change with respect to public health. The Climate and Health Alliance notes that the health benefits from climate mitigation policies reducing air pollution can offset the cost of public health implementation tenfold (CAHA, 2017).

Children

Doctors for the Environment have released research that outlines how climate change is threatening the underlying social, economic and environmental determinants of child health (DEA, 2015). Reduced availability of food, water and sanitation and disruption to education and social stability are already occurring in developing countries. Australia is not immune to such effects in the future.

Children have a longer life expectancy, and are therefore more at risk from the effects of repeated or prolonged exposures. On a broader scale, early effects of climate change on a generation's physical or mental health could leave lasting consequences on human capital as children reach adult life, and eventually on subsequent generations.

Children are particularly vulnerable to a changing climate because:

- They require more food, liquids and oxygen for their body weight compared to adults, which increases their risk from hazards such as air pollution, water shortage and contamination, and malnutrition.
- They have difficulty coping with stresses from increasing average and extreme temperatures because of their immaturity of physiology and metabolism.
- Their developing immune systems make them more vulnerable to many infections.
- Their rapid growth and development in utero and childhood means exposure to harmful situations such as maternal and/or childhood malnutrition, or exposure to air pollutants leading to chronic asthma, can have ongoing, severe and long-term effects into adult life.
- Psychological trauma exposure in childhood can lead to alterations in a developing brain's function and longer term cognitive and mental health impacts.
- Their behaviour is different and they lack many self-protection mechanisms. As an example, they tend to spend more time outdoors thereby exposing themselves to hazards such as dehydration and sunburn.
- They rely on primary care givers to protect and provide for them and will suffer more if their responsible adult is impaired.

Sport

Climate change and extreme weather events threaten the viability of Australian sport as it's currently played, either in the back yard, at local grounds, or in professional tournaments. Heatwaves, changed rain patterns, floods, and drought are impacting grounds and facilities around the country. Climate change will continue to have direct impacts on all sports. Heat directly affects athletic performance and welfare. Drought and changed rainfall patterns affect ground surfaces, player safety and increase management costs. These range from increased water and energy use to insurance premiums to cover the increased injury risks of harder grounds. Extreme rainfall threatens short-term ground washouts, and more extensive damage to grounds surfaces, which also impact maintenance and insurance costs.

Extreme heat (i.e. the frequency of days over 35 degrees) is just one of the impacts from climate change that affects athletes and poses risks to spectators and event staff. Athletes of all levels are discovering that record-breaking hot temperatures make it harder to play and perform. The challenges of extreme heat on indoor facilities could also include cost of efficiently cooling large spaces to provide a safe and comfortable venue for patrons and participants. The heat impact is greatest where significant protective equipment is required such as cricket (Cricket Australia, 2019) or those sports played on synthetic surfaces such as tennis (Tennis Australia, 2019) where the surface temperature could be much higher than natural surfaces.

Smoke and air pollution can also have a major impact on people's ability to safely participate in sport. In Australia, particularly during heat waves, smoke from bush fires can become a significant risk and may exacerbate other heat related conditions. In December 2019, in response to unprecedented levels of smoke pollution from bush fires across the country, the Australian Institute of Sport (AIS) developed a position statement on Smoke Pollution and Exercise (AIS, 2020) to provide guidance and advice to decision makers.

The most immediate impact of extended periods of low rainfall and high heat, or insufficient water supply, is the deterioration of playing surfaces. Poor ground conditions also increase the risk of injuries, alter playing conditions and diminish the appeal of playing.

7. Our Natural and Built Environment

7.1 Biodiversity

The City of Knox is bounded by the Dandenong Ranges National Park to the east, by Churchill National Park and Lysterfield National Park to the south, and by the Dandenong Creek Valley Parklands to the west, however, the natural environment within the municipality is extremely fragmented due to both residential and commercial development. Knox managed bushland reserves are an important part of the remaining network of natural habitat and provide important food and shelter for a wide variety of wildlife, including many bird species, bats, frogs, reptiles, and insects. There are over 40 threatened species within the municipality, and extreme weather events have the potential to lead to local extinctions. Some of the impacts of climate events on biodiversity include direct fauna casualties, habitat loss, reduced 'functional biodiversity' (ability for fauna to move for food, breeding and protection), reduced long-term survival and resilience of species, and the amplification of these impacts as a result of new diseases.

Whilst a large number of threatened species currently reside outside Council managed reserves, Council plays an important role in working with community, state and national agencies in revegetation efforts within the municipality and more recently has been involved in the hand pollination of orchards, to compensate for a decline in pollinating species. Council reserves may become important safe havens in the event of fires and may act as seed banks for the region, ensuring there is a capacity for recovery following events.

Climate impacts on biodiversity are considered major and likely (the consequence will probably occur) with no controls in place, translating to a 'high' risk rating.

As the frequency and severity of extreme weather events increases, recovery time between events is likely to be insufficient for many species. Over time, it is likely that this will impact the diversity of flora and fauna at these parks, with species declining, thus reducing the overall amenity of the sites. Impacts will vary between events, however, if more significant and mature vegetation is impacted, such as canopy trees, the loss may be definitive or the recovery time could stretch over decades, assuming that no further disruption occurs in the interval.

The risks to these segments is driven by the extent of the impact. For example, floods and bushfires can be localised events, whilst heatwaves and storms are regional stressors. Sensitivity of each segment will vary from species to species depending on the availability of preferred habitat, current population levels, adaptive capacity, and their ability to recover from extreme weather events.

Whilst Council is unable to eliminate the impacts of these acute and chronic events, a number of controls exist to manage projected increases in the severity of consequences. Council undertakes revegetation works throughout reserves and seeks to create buffer zones around important areas of vegetation, helping to lessen the impacts of human activity and other disturbances.

Given the large degree of fragmentation, it is essential for Knox to work collaboratively with community groups, residents, state, and national parks agencies to ensure:

- A consistent approach to the management of pest plants and animals; and
- Continuous improvement of the quality and connectedness of natural environments within the municipality.

Community Action

The Knox Revegetation Program and Knox Gardens for Wildlife Programs are practical local actions to increase local biodiversity. Since 2009 a total of 18.5 hectares of land in Knox have been revegetated. This accelerated in the last five years with 93% of the total (17.3 hectares) revegetated since 2014. The number of households participating in the Gardens for Wildlife program have also increased steadily since its inception in 2007. The program has recently been expanded to metropolitan Melbourne. The Revegetation and the Gardens for Wildlife Programs are proactive steps to protect and enhance vegetation and tree cover in Knox. Both increase and promote the creation of connected vegetation corridors that are important for the quality and ongoing health of local biodiversity.

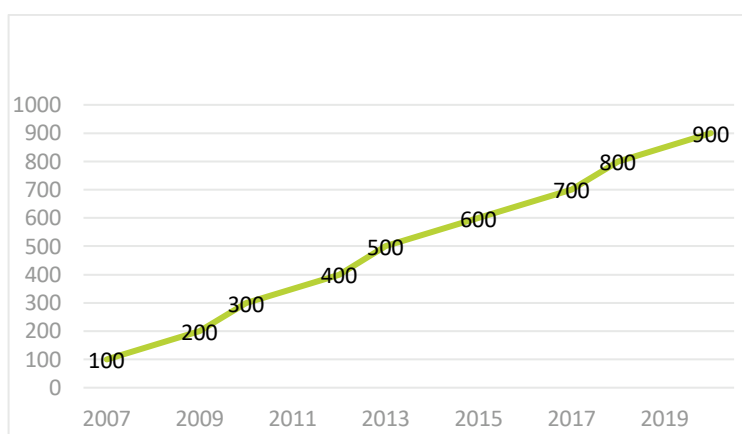


Figure 10: Number of households participating in Knox Gardens for Wildlife

Planting nature strips with indigenous vegetation is another opportunity to increase connectivity and reinstate tree canopy cover in Knox.

7.2 Green & Leafy Streets

Increasing urban tree cover improves the landscape, attractiveness, and local sense of place. A 'Green, leafy Knox' is highly valued by the community. Eastern Melbourne has the highest tree canopy cover of Melbourne's metropolitan regions. In 2018, nearly 27% of the region's urban and non-urban area was under tree cover. This compares with 18% of total land area in Knox which is one of the lowest levels of tree canopy of all municipalities in the eastern region (Yarra Ranges, Manningham, Maroondah, Whitehorse, Knox and Monash). Knox's tree canopy cover is closer to the metropolitan average than the level that characterises the Eastern Region (State of Knox, 2020).

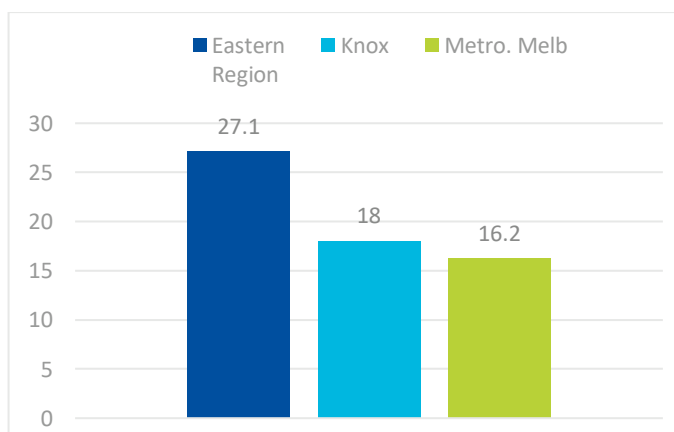


Figure 11: Tree cover as a percentage of total area 2018

Tree canopy coverage is shrinking in the Eastern Region, and also in Knox, faster than the metropolitan average. The Eastern Region lost 2.3 percentage points (1,200 hectares) of cover between 2014 and 2018. Knox lost approximately

1.2 percentage points over the same period mainly in the north of the municipality. The biggest loss of tree canopy has been in the north of Knox (State of Knox, 2020).

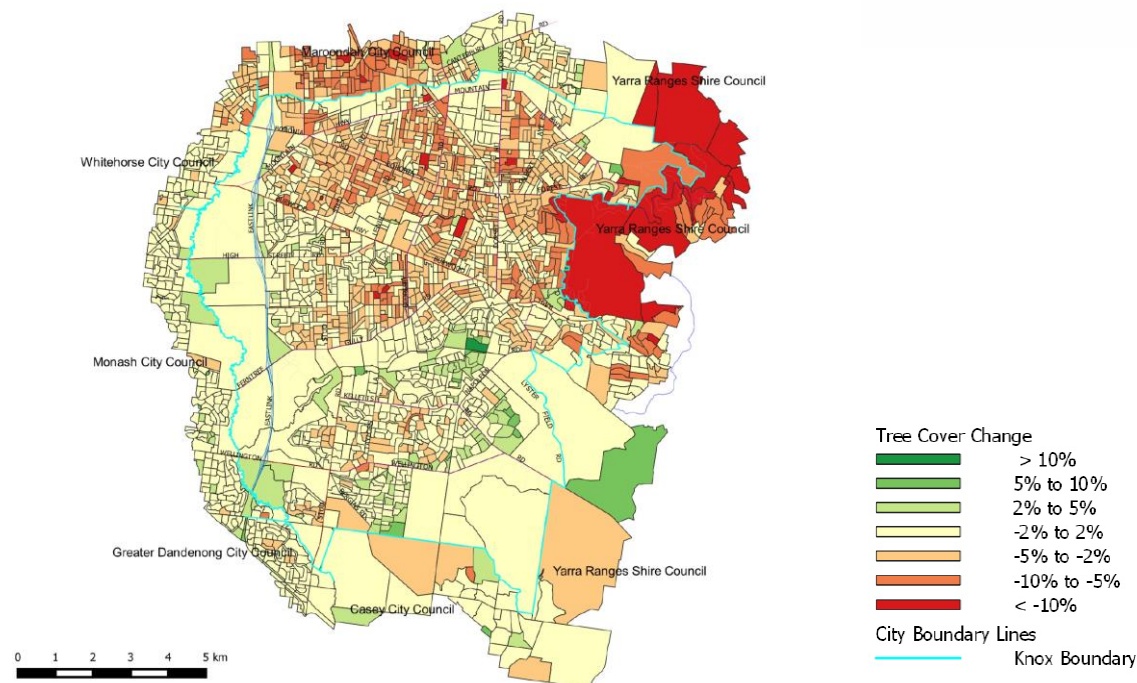


Figure 12: Percentage of change in tree canopy, 2014-2018

Urban Heat Island effects

The Urban Heat Island is a measure of the deviation of urban temperatures above a non-urban baseline temperature. Temperatures in many urban areas are warmer than their rural surroundings. This phenomenon is known as the 'Urban Heat Island' which refers to temperature differences attributable to urbanisation. Urban heat Islands can have multiple impacts on health, resource use, and air quality. Figure 13 shows that in some areas of Knox, the Urban Heat Island effect can be greater than 9°C from a non-urban area. Tree canopy cover was found to have the strongest relationship with reducing heat in urban areas. By comparison, there was less evidence to suggest that grass and shrub cover has a large influence on reducing urban heat (DELWP, 2020).

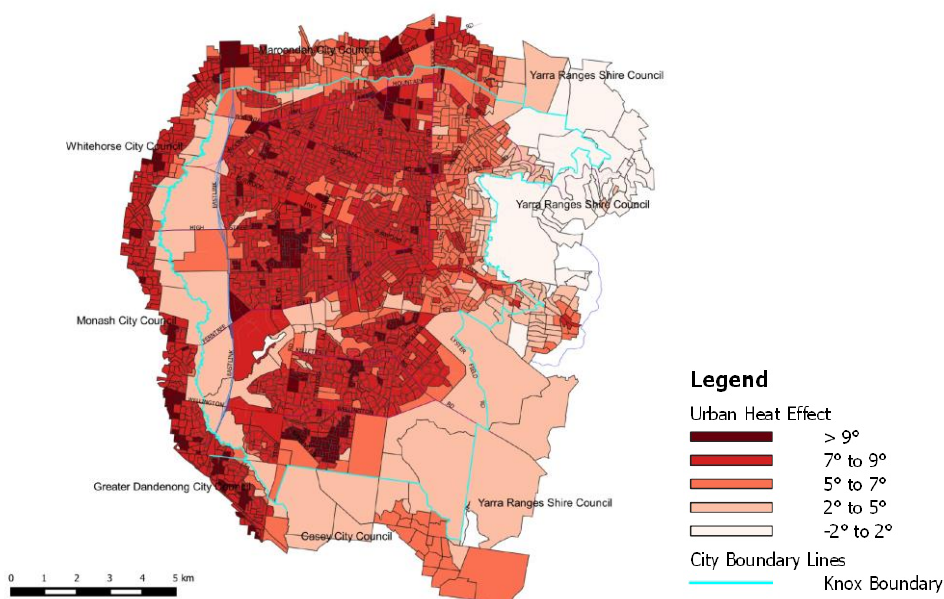


Figure 13: Urban Heat Island effects in Knox 2018

Liveability

With respect to walkable access to open space, 69% of residences are within 400m of a public open space of any size, and 42% are within 400m of a public open space of 1.5 hectares or larger, both of which are lower than the metropolitan average (82% and 49% respectively). This ranks Knox at the lower end of Melbourne LGAs when ranked according to level of access to open space (State of Knox, 2020).

Access to public open space is an important measure of liveability. Open space expands people's sense of home to include the wider local area and shared communal spaces and facilities. Access to high quality open space is becoming increasingly important as higher housing density and more compact housing types increase.

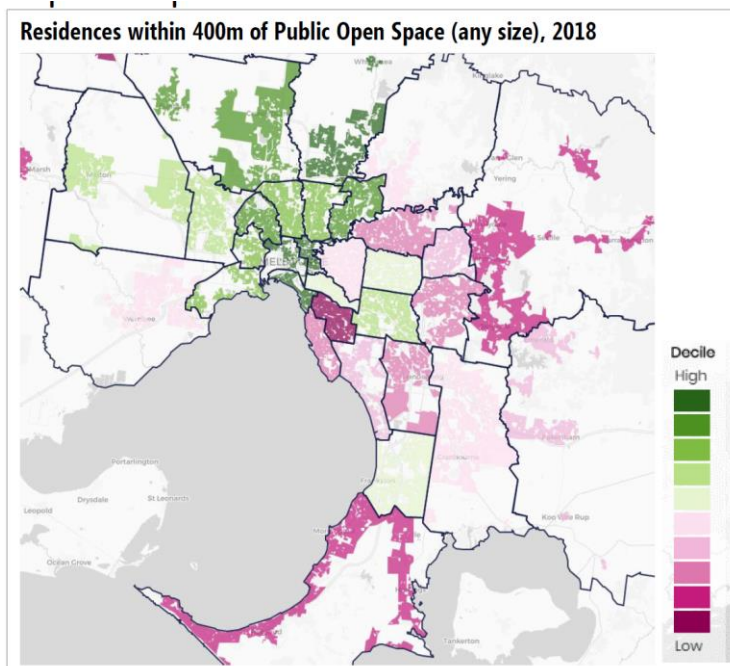


Figure 14: Residences within 400m of public open space, 2018

7.3 Active Transport

Improving walking and cycling infrastructure in cities is key to mitigating against climate change impacts. Council has the responsibility to plan, develop and organise urban spaces that strive for zero carbon and are resilient to changing climate impacts. Collaboration between transport planners and climate adaptation or resilience teams in each city is important to ensure that walking and cycling infrastructure is resilient during extreme weather events.

With rising global temperatures, walking and cycling infrastructure also needs to be adapted to changing local climatic conditions. Creating comfortable outdoor environments for pedestrians and cyclists - for example with increased shading and greenery - is crucial in order to avoid increased uptake and use of air-conditioned private vehicles.

8. Our Council

8.1 Energy

Local governments are large consumers of energy through our operation of public infrastructure and facilities like council offices, street lighting and community centres. With over 90% of the Scope 1 and 2 emissions resulting from electricity and gas emissions, we can harness opportunities to reduce costs and carbon emissions through energy efficiency measures, decarbonising our energy supply by switching gas appliances to electric alternatives and continuing to install rooftop solar where possible.

In April 2020, Knox Council entered into a long term Renewable Energy Power Purchase Agreement (PPA) for the electricity from streetlights. In a PPA, a customer enters into a long term 'off-take' agreement to purchase power from renewable energy sources such as solar and wind farms. The streetlight PPA will supply energy from Victorian based windfarms until 2030.

8.2 Buildings and Facilities

Council owns a total of 281 buildings and 53 structures (i.e. small shelters and BBQs). Council owned building stock is made up of a variety of facilities, including sporting pavilions, multipurpose facilities, community halls, and storage facilities. Some facilities are managed directly by Council (e.g. Knox Civic Centre, Children and Family Centres), whilst others are managed by third parties (e.g. Knox Leisureworks, local sporting clubs). Council has direct responsibility for owned and managed facilities, whilst responsibilities are shared for facilities managed by a third party.

The exposure of Council facilities to climate extremes is dependent on their proximity to high risk areas, such as bushfire prone areas or land subject to inundation, whilst sensitivity is driven by the quality of the building stock and supporting infrastructure (e.g. drainage).

The construction date of Council facilities ranges from 1880 through to 2020, with the majority of Council facilities constructed in the 60s, 70s and 80s. Overall, Council's building stock is relatively old and considered in moderate condition.

The Risk Assessment considered Council's most vulnerable assets – those that are located in highly exposed areas and with the least capacity to adapt. A number of Council facilities are in less desirable areas, including facilities located in bushfire or flood prone areas, leading to greater exposure to those acute climatic events.

The main driver for mitigating risk across Council's building stock is a proactive maintenance schedule, including tasks such as gutter and pit cleaning which mitigate the impacts of storm and flood events, and vegetation management for mitigating the impacts of bushfires.

The inherent risk of long-term chronic climate events is largely driven by the potential for deepening droughts impacting key sporting grounds, as observed during the millennium drought when all ovals without stormwater harvesting were closed, which in turn led to the inability of the asset to perform its function. The ability for significant sporting facilities to continue operating through a period of drought is dependent on their ability to access recycled water. Whilst Council has been working on water harvesting opportunities across a number of sites, there is ultimately a trade-off between the capital and operational costs. As a result, a number of facilities remain reliant on mains water for irrigation and are susceptible to the risk of deepening droughts over the longer term.

8.3 Infrastructure

Knox's landscape is made up of a significant number of hard, impervious surfaces, therefore most of the rain ends up being managed through the stormwater infrastructure. Council is responsible for the provision and maintenance of local and precinct stormwater infrastructure, providing flood protection for 5-year ARI (Average Recurrence Interval) storm events in residential areas and 10-year ARI storm events in industrial and commercial areas. Some local stormwater infrastructure is managed by Melbourne Water; however, the majority is managed by Council.

Appropriately managed stormwater infrastructure is essential for limiting issues such as erosion, pollution of waterways and flooding (causing potential damage to private property and hazard to health and safety) in the municipality. In addition to pipes and pits, Council manages several retarding basins, treatment wetlands, raingarden systems, rainwater tanks, stormwater harvesting schemes and overland flow networks to assist with the management of stormwater.

Regarding roads and pathways, Council manages 704km of sealed roads, 20km of unsealed roads, over 1,200km of footpaths and more than 100km of shared paths.

Given the long-lived nature of these assets, much of the existing stormwater, road and pathway infrastructure are likely to have been designed to outdated specifications. Having regard to current and future climate patterns, these specifications may now be inadequate. This may result in increasing levels of degradation across assets and prevent them from operating effectively under an increasing intensity and severity of extreme weather events.

Given that infrastructure is widely distributed throughout the municipality, climate risk is driven by the extent of the impact. For example floods and bushfires are localised events, whilst heatwaves and storms are regional stressors. Sensitivity of infrastructure is largely driven by the condition and design of infrastructure.

Council is currently developing updated flood mapping for Knox. This information will contribute to our understanding of future stormwater flood risks.

Stormwater

This risk is driven by the impact of flood and storm events, which are localised in nature. They are felt most in areas located near waterways, such as Dandenong and Ferny Creeks. Knox has experienced two major flood events in 2011 and 2016, when water rose to above waist height in some residential areas and habitable structures were damaged by the flood extent. Whilst controls are put in place by Council, infrastructure will continue to be placed under increasing pressure from climate change, as much of the stormwater infrastructure was designed to now outdated specifications.

An important mechanism guided by Council is the Knox Planning Scheme, with high risk flooding areas demarcated by planning overlays, including the Land Subject to Inundation Overlay, Floodway Overlay, and more recently the Special Building Overlay developed in partnership with Melbourne Water. These controls raise the building standards within the overlays and ensure best practice stormwater measures are implemented in new developments. In addition to planning controls, Council reduces risk by implementing regular cleaning regimes for pits and pipes in high risk areas, increasing the capacity of drainage systems at their end of life, and educating residents on measures they can take to mitigate flood risks on their property.

Roads

Damage to roads or impacts on their ability to operate was found to be caused mainly by storm and flood events, and directly related to the capacity of the stormwater infrastructure. Impacts include the temporary inundation of roads, runoff impacts on neighbouring properties, and longer-term degradation from ongoing events causing issues such as 'crocodile cracking'.

Paths

Whilst there are some impacts from heat to footpaths and bike path users, flooding was again considered to have the most significant impact on pathways. Many of the existing bike paths are located along waterways and experience flooding at least once per year. In some instances, paths are constructed of granitic sand, and when flooding occurs, this path treatment is easily impacted. Council provides some temporary signage to alert users of impacts to pathways, however no further control is implemented.

Bushfire

Like the rest of Victoria, Knox is prone to bushfires, particularly whenever grassland vegetation and forest litter become very dry. The Fire Danger Period in Victoria has become longer over time, indicating a trend towards extended fire seasons. In 2019-2020, fire restriction dates for Victoria extended from as early as 23 September 2019 to 23 March 2020 (FFMV, 2020) and Melbourne's 'fire days' are projected to increase by 42% per year by 2050 (CSIRO, 2019).

Smoke from fires, including from planned burns, can also be a hazard within the Knox region. Those most at risk from smoke exposure include young children, adults over 65 years of age, people with asthma or existing heart or lung conditions, pregnant women, outdoor workers and smokers. In January 2020, smoke from bushfires across Victoria (and from New South Wales) rendered Melbourne's air quality the worst in the world with the smoke haze estimated to cost the cities of Melbourne, Sydney and Canberra over \$500 million (City of Melbourne, 2020).

The Victorian Government states that Knox has a Bushfire Prone Area (BPA) of 43.6km² which is 38% of the City of Knox (Justice & Community Safety, 2020).

Below are some indications of identified bushfire prone assets for Knox.



Figure 15: Bushfire prone assets Boronia/Basin and Bayswater (respectively)

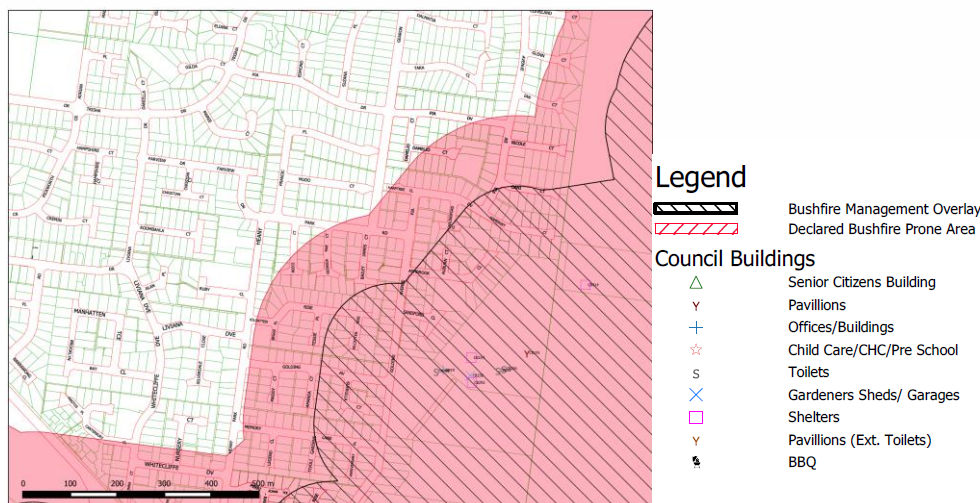


Figure 16: Bushfire prone assets Rowville

Transport

Nearly 20% of the Knox community emissions are estimated to be from the transport sector, as such, switching to low or zero emissions vehicles is invariably a significant step required. A growing number of international jurisdictions are setting ambitious targets to rapidly switch passenger vehicles to fully electric options. For heavy vehicles, Hydrogen fuel is likely to play an important role in this transition. Due to the changes in major international automotive markets, the change in Australia maybe occur by default.

There are multiple roles for local governments in this transition, including to progressively convert passenger fleet vehicles to low and zero emissions vehicles to not only reduce Council's carbon emissions, but also to contribute to a market for affordable second-hand electric and hybrid vehicles. Another key role is in the provision of charging infrastructure in community facilities to help encourage a faster uptake of this technology in the community.

Promoting and providing active transport options will remain a key role for local councils, as described in Section 7 above. Ensuring active transport infrastructure and provision of services can cope with extreme weather events is paramount to building reliability and confidence in the community.

8.4 Waste Management

Whilst waste in Knox only contributes around 3% of our emissions, it is a key function of Council and many significant improvements have been made. Waste to landfill in Knox is declining –reducing by 9.6% from 489kg per household in 2012 to 442kg per household five years later (Figure 17). This brings the waste to landfill level back to below the State average after some years running above average (State of Knox 2020).

Waste management is one of the key services local government provides, and climate change can impact waste facilities both directly and indirectly. At the same time, improper waste management, e.g. litter blocking drainage systems exacerbating flooding during rainfall events, can reduce the ability of a city to cope with extreme climate events. All new and existing waste management systems therefore need to be designed to be resilient to climate change.

There are significant environmental benefits from reducing the amount of waste going to landfill. Reducing, reusing and recycling conserves the energy needed to produce goods, significantly reducing carbon emissions and climate impact. Over half (54%) of the total kerbside pickup in Knox in 2017 was recyclable or green waste and after excluding contamination, 49% was diverted from landfill. This conserves landfill space, reducing the need to build more landfills which take up valuable space and are a source of air and water pollution.

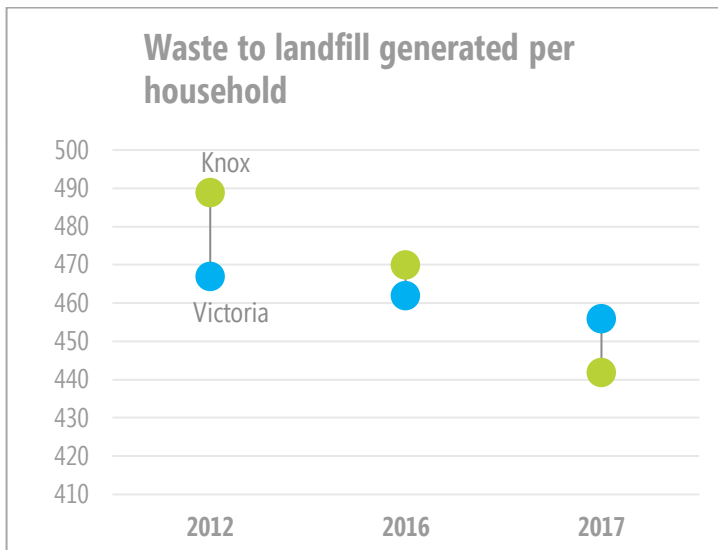


Figure 17: Waste to landfill kilograms per household

The Climate Council’s Clean Jobs Plan found improving organic waste management with better collection and processing can create 10,000 jobs nationally (The Climate Council, 2020). Organic waste is a major contributor of greenhouse gas emission from landfills and falls under local government jurisdiction.

9. Guiding Principles

These Guiding Principles help to provide the context for how Council has decided on actions to minimise climate impacts, build a resilient community, and protect the ecosystems that sustain us. These principles will help Council address the important social, economic, and environmental challenges and develop the solutions that are required in order to meet the climate challenge. The Action Plan needs to be:

- **Ambitious:** Set goals and implement actions that evolve towards an ambitious vision.
- **Inclusive:** Involve community, business and other stakeholders in finding solutions.
- **Fair:** Seek solutions that equitably address the risks of climate change and share the costs and benefits of action across the community.
- **Relevant:** Deliver local benefits and support local development priorities.
- **Actionable:** Propose cost-effective actions that are realistic.
- **Evidence-based:** Reflect best practice scientific knowledge and local understanding.
- **Transparent and verifiable:** Set goals that can be measured, reported and evaluated.

Effective climate action planning inclusively engages multiple agencies, economic actors and community stakeholders. Such processes encompass a broad array of perspectives and interests, both within local government and the larger community. This helps to ensure that the Plan is **relevant**, meeting a range of community goals with broad-based support for implementation.

Building internal capacity and support

Addressing climate change is a complex challenge that will require involvement from multiple departments within Council. It also requires building political support for action. Neither adaptation nor mitigation fit neatly into the traditional silos that structure local government. To be effective, climate change planning requires a comprehensive and integrated cross-sectoral approach, with staff working across administrative boundaries.

Involving our community

Public participation is a vital part of **inclusive** climate action planning. It engages and empowers various sections of our community, including those that are most affected by climate change impacts, as well as those well placed to contribute to climate actions. Meaningful participation is inclusive of broad community perspectives and interests, including accounting for difference in terms of gender, age, and income, and including those members of the community that can be hard to reach, in order to ensure **fair** decision-making.

By providing co-ordination, Council can help community-led initiatives, vital to **ambitious** and effective climate action. Similar forms of support can build capacity within local businesses (particularly those high in emissions such as manufacturing, transport and construction) to improve energy efficiency and otherwise update their practices. Council can also support market transformation and help open up new areas of economic activity. By recognising the achievements of leaders and innovators in the community, Council can help publicise and mainstream the adaptation and mitigation measures they have pioneered.

Baseline inventory and risk assessment

Effective mitigation and adaptation needs to be **evidence-based**, grounded in a scientific understanding of climate change and informed by local data. Council has undertaken both an emissions inventory (Section 3) and a climate risk assessment (Section 5) in order to be able to engage in effective climate action planning. This data allows differing strategies to be assessed in a **transparent** manner to enable robust climate action planning.

Another kind of assessment, focused on local capacity for action, can also provide critical input to climate action planning. This assessment involves identifying existing public policies, initiatives and actors involved in addressing climate change. This exercise may identify initiatives that formally target climate change, such as State government grants, but may also turn up additional actions and policies that were not designed to specifically respond to climate change but nonetheless exert an impact on mitigation or adaptation, such as programs for household energy efficiency to bring down energy bills for disadvantaged people. Understanding what works and where barriers have been encountered is critical in designing a climate action plan that is **comprehensive, relevant, and actionable**.

A multi-criteria assessment framework also demonstrates, in a **transparent and verifiable** way, that certain actions may contribute to the realisation of more than one goal. For example, a number of actions may both reduce greenhouse gas emissions and improve local air quality. Conversely, such an exercise may also help decision-makers realise that certain actions may have other consequences, i.e. while they may help Council advance towards one goal, they may slow or even thwart efforts to achieve another. An example of this may be an adaptive measure such as air conditioning without the use of renewable energy, which would result in high levels of greenhouse gas emissions. Careful analysis has assisted Council to review actions that may lock the community in to unsustainable pathways.

Regularly monitoring of progress, and periodically updating and improving plans, will help Council to reflect the latest climate science, technological developments, financial situations, and development capacities. It will also enable on-going engagement with stakeholders and the community ensuring that on-going climate action planning continues to meet the evolving needs of the community.

Demonstrating that Council's own emissions can be reduced in-line with the requirements under the Paris Agreement sends a message to all that achieving this change is possible and Council is willing to lead by example. Council will also focus attention on supporting the community to reduce emissions in a way that creates systemic change towards a low-emissions future. Increasing City of Knox's adaptivity to climate change as an organisation will send a clear message to the Knox community about the resilience of their Council, and that making meaningful changes can result in a more connected and resilient community.

10. Action Plan

Climate action planning is integrated with and directly linked to other socio-economic, spatial, disaster risk reduction, and environmental planning processes, at the municipality level, as well as at other levels of government. Integrating climate action planning increases the effectiveness of responses to the climate challenge and will enable the zero net carbon emissions target to be met. Importantly, the achievement of integrated climate action planning will involve the sharing information and knowledge across different departments and stakeholders, and the inclusion of climate mitigation and adaptation goals, policies and initiatives into other relevant plans and policies.

The following table provides a summary of the proposed mitigation and adaptation actions contained within this Action Plan. A detailed explanation for each proposed action and associated interventions is provided in Appendix A.

Table 4: Summary of proposed corporate and community actions.

Action Category	Estimated Cost (To 2031)	Anticipated Timeframe	Total Impact GhG Savings (t CO ₂ e)	Sustainable Development Goal link
Corporate Mitigation Opportunities				
10.1 Expansion of Electric Vehicle Fleet	\$1.13m	2021-27	1,930	13, 11,
10.2 Energy efficient Council Buildings	\$14m	2021-31	32,380	13, 11, 7
10.3 Public lighting changed to LED lights	\$1.7m	2021-22	9,830	13, 11,
10.4 Landfill Solar Farm	\$8.5m	2023-31	>100,000	13, 11, 7
Corporate Mitigation Total	\$25.3m		144,140	
Community Mitigation Opportunities				
10.5 Low Emissions Buildings Through Design	\$1.3m	2022-26	1.9m	13, 11, 7, 3
10.6 Future Proofing Businesses and Industry	\$1.0m	2021-23	1.77m	13, 11, 7, 17, 8, 9, 12
10.7 Solar for Rentals	\$0.2m	2022-26	0.45m	13, 11, 7, 1, 3,
10.8 Expanding the EV Charging Network	\$0.63	2021-24	0.56m	13, 11, 7
10.9 Changing the Future of Transport	\$0.25m	2022-25	0.07m	13, 11, 3
10.10 Sustainable Roads and Infrastructure	\$0.01m	2023-26	0.03m	13, 11
Community Mitigation Total	\$3.39m		4.78m	
Adaptation Opportunities				
10.11 Vulnerable Populations	\$0.35m	2021-31	N/A	13, 3, 11
10.12 Biodiversity	\$0.6m	2021-31	N/A	13, 3, 14, 15
10.13 Buildings	\$0.9m	2021-31	N/A	13, 11
10.14 Infrastructure	\$2.35m	2021-31	N/A	13, 6, 7, 11
Adaptation Actions Total	\$4.2m			

Mitigation

Corporate Mitigation Opportunities

Knox City Council has established a goal of being a net zero emissions Council by 2030. In doing so, Council has made a firm commitment to action by mitigating the impacts of climate change from corporate operations. The establishment of the zero net emissions target also demonstrates strong leadership within the community. This Plan has assessed opportunities within but not limited to the following key areas of Council’s operations: energy efficiency improvements in buildings, low emissions technology upgrades in buildings and fleet, and renewable energy generation (such as small scale solar PV and landfill solar farm).

By implementing the activities outlined in this Plan for corporate operations, Council will reduce overall emissions by 85% on 2019/20 levels by the year 2030/31 (see **Error! Reference source not found.**).

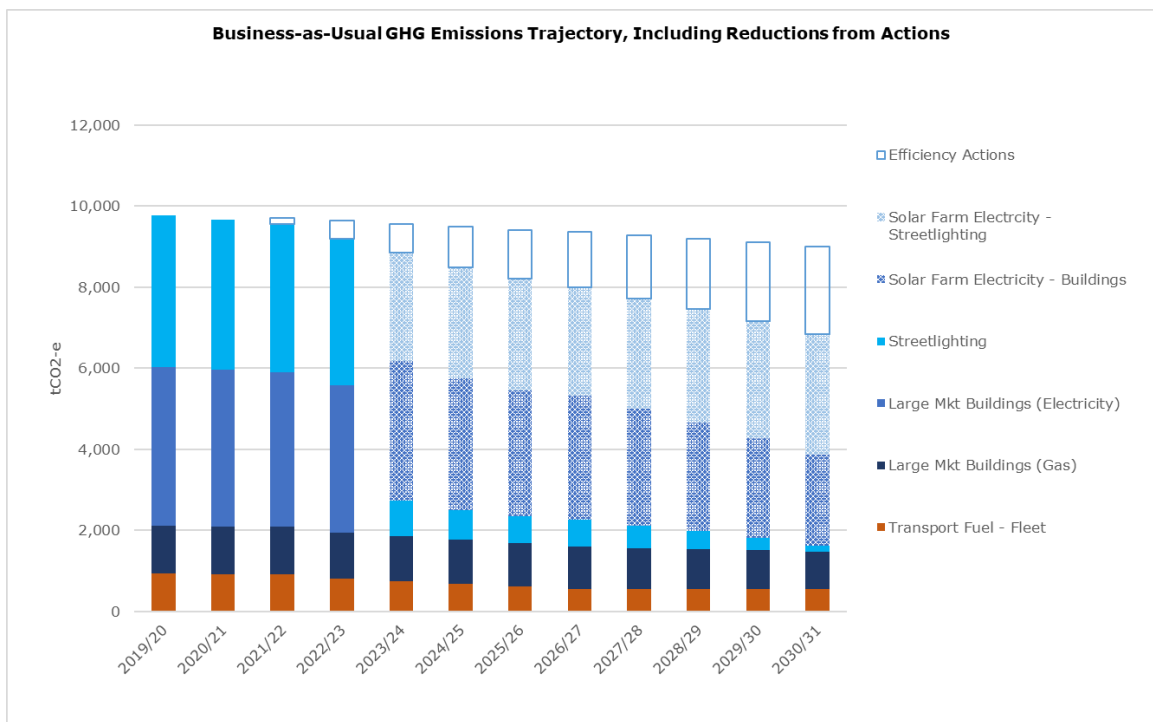


Figure 18: Business-as-Usual GHG Emissions trajectory, including reductions from actions

Below is a summary of the proposed corporate mitigation actions and interventions that Council will take. A detailed explanation on each action is provided in Appendix A - Sections 10.1 to 10.4.

Table 5: Summary of corporate mitigation actions

Action	Interventions	Program Budget (\$)	Program Years Active	Total Impact to 2030/31 (t CO ₂ e)	Simple Net Savings
10.1 Expansion of Electric Vehicle Fleet	Develop sustainable fleet policy, including driver training	\$40,000	10	280	\$390,000
	Replace all passenger vehicles with EV by 2025	\$450,000	4	1,000	\$850,000
	Install EV charging stations	\$480,000	3	-	\$0

Action	Interventions	Program Budget (\$)	Program Years Active	Total Impact to 2030/31 (t CO ₂ e)	Simple Net Savings
	Replace utility vehicles with greener alternatives	\$0	7	390	\$192,900
	Install telematics	\$165,000	9	260	\$144,569
10.2 Energy Efficient Council Buildings	Implementation of Sustainable Design and Infrastructure Policy	\$11.7 million (to 2030/31)	10	17,390	\$1.5 million (to 2030/31)
	Knox City Council EPC	\$1.85 million	1	11,034	\$210,000 p.a.
	Remaining energy efficiency opportunities for Council buildings	\$300,000	2	3,256	
	Install solar PV across remaining viable sites.	\$150,000	4	700	\$395,000
10.3 Public lighting changes to LED	Replace major road lighting with LED	\$1.7 million NPV savings over lifetime - \$4.3 million	1	9,830	\$6.3 million
10.4 Landfill Solar Farm	Construction of a Landfill Solar Farm	\$8.5 million	8	>100,000	\$0.55m p.a
TOTAL		\$25.3m		144,140	\$17.1m

Community Emissions Reduction Opportunities

This section outlines the priority community emissions reduction programs that have been identified. The programs for the Knox community focus on the following key areas:

- Industrial energy;
- Transport;
- Buildings and construction;
- Renewable energy generation; and
- Road building.

These programs can be implemented incrementally and scaled up in line with Council's resourcing allocations. The greatest opportunities for Council are in focusing on planning requirements for new buildings in the residential and commercial sector, supporting mid-tier industrial businesses and expanding the electric vehicle charging network.

Below is a summary of the proposed community actions and interventions that Council will take. A detailed explanation on each action, including background, identified barriers, enablers and impacts, is provided in Appendix A - Sections 10.5 to 10.10.

Table 6: Summary of community mitigation actions

Action	Interventions	Program Budget (\$)	Program Years Active	Total Impact to 2030/31 (t CO ₂ e)
10.5 Low Emissions Buildings Through Design	New implementation of existing regulations or policies - Work within approvals process for new buildings to establish a common understanding of what constitutes acceptable Environmentally Sustainable Design (ESD) and encourage all new buildings to achieve net-zero energy or net-zero energy ready.	\$1,300,000	3	1,900,000
	New Regulation - Encourage phasing in requirements for all existing commercial buildings to achieve net-zero energy or net-zero energy ready. This could be applied at a trigger point in the building's life, for example at point of sale or renovation.			
	Facilitate - Work with developers to pioneer zero net emission buildings and zero-net emission housing.			
	Incentivise - Planning scheme and rates incentives for positive outcomes. There are a variety of ways that this could work, for example faster processing of planning permits that meet specific requirements, or discounted rates.			
	Reporting and Communication - Build on existing public reporting requirements to implement a communications program that will actively apply pressure to developers to raise the energy efficiency performance through greater public awareness of the emissions footprint of new buildings.			
	Enforcement - Deploy resources to increase the enforcement of National Construction Code (NCC) and planning requirements. This may take the form of increased capacity of an ESD officer working in conjunction with surveyors.			
10.6 Future Proofing Business and Industry	Facilitate - Implement working groups to focus on a specific set of interventions to address the challenges discussed by key stakeholders around alternative technologies, Power Purchase Agreements (PPAs), energy efficiency and degasification.	\$840,000	2	1,600,000

Action	Interventions	Program Budget (\$)	Program Years Active	Total Impact to 2030/31 (t CO ₂ e)
	Educate - Deliver 1 on 1 workshops on renewable energy Power Purchase Agreements (PPAs) for industrial organisations with large electricity demand (more than 40Gwh p.a.).	\$210,000	3	170,000
10.7 Solar for Rentals	Facilitate - Work with solar installation companies and real estate agents to devise schemes that provide financial mechanisms for landlords to install solar on rental properties. Some schemes, such as residential Environmental Upgrade Agreements (EUAs) and the Special Charges Scheme, are already in operation.	\$210,000	3	450,000
10.8 Expanding the Electric Vehicle Charging Network	Strategic Planning - Identify and set aside land available for Electric Vehicle (EV) charging points, including select parking spaces, or it may be through requiring EV charging points in new developments in certain zones.	\$630,000	3	560,000
	Facilitate - Engage with owners or potential owners of charging infrastructure and work together with the relevant stakeholders to facilitate discussions that result in the removal of identified barriers.			
10.9 Changing the Future of Transport	Regulation - Adoption of a policy that promotes car share programs. This policy can focus on provision of dedicated parking for car share vehicles and the positive impacts of car sharing.	\$250,000	3	70,000
	Facilitate - Facilitate the establishment of practical and easily available car and bike share schemes which are mutually beneficial to the service providers and residents.			
10.10 Sustainable Roads and Infrastructure Building	Regulation - Update infrastructure guidelines and processes.	\$10,000	3	30,000
Total:		3,450,000		4,780,000

Adaptation

An assessment of the future impact of climate change on Council assets, services and functions was undertaken using a risk assessment and vulnerability assessment approach (see Section 5). This resulted in four priority areas to focus on for adaptation actions. These were expanded on to define the following key areas of decision making:

- How to meet Council's objective to improve the physical health of its community given the health risks to vulnerable populations from the increased frequency of heatwaves and storms, which may exacerbate existing health sensitivities, accommodation stress, and isolation.
- How to maintain the amenity of Council reserves and achieve Council's target to protect and enhance the natural environment given the increased likelihood and severity of acute and chronic climate stressors affecting vegetation and biodiversity.
- How to ensure the continued operation of council facilities, quality and effectiveness of associated services and safety of users, given the increased frequency and intensity of extreme weather events, including floods, bushfires, and storms, which may lead to increased maintenance or operational requirements and costs.
- How to ensure the continued provision of public infrastructure, quality and effectiveness of associated services and safety of users, given the increased frequency and intensity of extreme weather events, including floods, bushfires, extreme temperatures, and storms, which may lead to increased maintenance or operational requirements and costs.

Adaptation actions have been identified that are either part of existing Council programs or that are new and require consideration as part of future budgeting and planning processes. Below is a summary of the proposed adaptation actions and interventions that Council will take. A detailed explanation on each action is provided in Appendix A - Sections 10.11 to 10.14.

Table 7: Summary of adaptation actions

Action	Interventions	Program Budget – Low/Medium/High/Within existing resources
10.11 Vulnerable Populations	Undertake upfront planning and define responsibilities to better coordinate service providers involved in delivering assistance to older persons during emergency events.	Within existing resources
	Identify areas where urban heat islands intersect with vulnerable populations.	Within existing resources
	Undertake a prioritisation process for investment in urban cooling measures.	Low
	Develop a register of vulnerable persons and prioritised based on areas of urban heat islands.	Within existing resources
10.12 Biodiversity	Investigate the preparation and inclusion of additional planning provisions to minimise development from occurring in high bushfire risk areas.	Low
	Develop a fire management plan that allows for vegetation to adapt to future changes in climate patterns.	Low
	Develop street tree plantings for maximum urban heat island mitigation.	Low
	Obtain advice on liability issues relating to tree maintenance and pest management due to climate impacts.	Medium
	Develop an Urban Forest Strategy.	Low
	Establish more climate resilient plant species in Council plantings.	Low
	Improve Council wide tree planting diversity that incorporates both native species for biodiversity benefits and introduced species for improved cooling benefits.	Low
	Develop a lower impact approach to vegetation management through collaborating with power network managers.	Low
	Revise streetscape models to minimise damage to existing infrastructure assets resulting from poor street tree selection.	Low
	Investigate the preparation and inclusion of additional planning provisions that can retain tree canopy cover, and encourage or increase additional tree canopy cover.	Low
10.13 Buildings	Engage with the facility operators (Council and third party) to establish safe operating levels for facilities that are at risk of being impacted by climate stressors.	Low

Table 7: Summary of adaptation actions

Action	Interventions	Program Budget – Low/Medium/High/Within existing resources
	Incorporate climate variables and future climate risk into building condition assessments to ensure that climate stressors, such as storms, bushfires, floods and heatwaves are considered.	Within existing resources
	Develop a site-specific strategy for the ongoing provision of sporting facilities during extreme droughts.	Low
	Ensure in future planning and design criterion that critical facilities and emergency services are located in accessible and resilient locations.	Low
	Review and update climate hazard mapping to ensure that planning decisions account for areas of future and current risk.	Low
10.14 Infrastructure	Seek legal advice on the liability associated with climatic events that have the potential to impact users of Council infrastructure.	Low
	Engage with public sector service providers, such as water authorities, to signal the importance of being prepared for future climate risks, learn from their practices, identify potential points of intersection with Council services and areas where collaboration might be mutually beneficial.	Low
	Develop detailed financial impact analysis studies in order to access future external capital to support risk mitigation works linked to climate change.	Low
	Identify infrastructure that may be required as a retreat, as a long-term adaptation measure due to flood or fire risk.	Low

11. Monitoring, Evaluation, Review and Learning

Monitoring, evaluation, review and learning (MERL) is often considered an optional addition to programs and is regularly overlooked due to resource and timing constraints. Knox City Council understands the opportunities presented by MERL and incorporates it as a component to any climate change mitigation and adaptation program.

By subjecting emissions reductions programs to monitoring, Council can learn whether specific interventions are effective and redirect the course if necessary. This not only allows Council to address the risk associated with program failures, it provides confidence that resources are being used effectively to achieve the planned outcome. Without undertaking MERL activities, inefficiencies or misdirection may not be realised until the end of the program or project, if at all.

Where programs or projects are highly successful and don't need to redirect course, MERL provides a great opportunity for Council to demonstrate their leadership to the sector and celebrate success. Lessons learnt, both positive and negative, can be shared with other Councils to allow for replication and scaling of interventions.

The following components will be incorporated into the Climate Response Plan implementation program.

11.1 Progress Monitoring

Progress monitoring refers to internal monitoring on the implementation of a plan. This confirms that the action plan has been implemented as intended, however it does not measure the success of the plan in tCO₂-e abated.

11.2 Impact Monitoring

Impact monitoring measures the success of the plan in tCO₂-e abated or risk rating. It is used to understand whether an intervention is effective and to what degree. Impact monitoring must be conducted at regular periods during the implementation of the intervention. If this monitoring demonstrates that an intervention is not having the anticipated effect (by meeting a certain trigger point), a more detailed analysis should be conducted into the effectiveness of the intervention. Council can then use this information to decide whether to change or remove the intervention from the program.

Please note that the implementation period of an intervention refers to the time that the intervention is expected to be active in reducing emissions. For example, any planning requirement changes will not be measured from when Council staff begin engaging with the Department of Environment, Land, Water and Planning, but when planning requirements are amended.

Monitoring the impact of programs in the community is much more complex because Council does not have access to accurate, real time data. Instead, Council will be required to collect and assess data from particular sources and compare it to a cohort municipality – that is, another Australian municipality with similar characteristics that is not implementing the program. By comparing the data, it will be evident whether there is a change in Knox City Council that is occurring beyond business-as-usual.

11.3 Evaluation Trigger

When an evaluation trigger is reached for an action or intervention, this means that the intervention is not having the anticipated impact in reducing emissions. Evaluation triggers will highlight one of three scenarios:

- Intervention is having a lower-than-anticipated impact. This may result in significantly lower emissions reductions, meaning the intervention may not be effective. If so, Council should explore whether it is valuable to continue directing effort to this intervention.
- Intervention is having higher-than-anticipated impact. In this case, an increase in scope of this intervention may be considered. Or, this may mean that there are external factors at play.
- The business-as-usual trajectory for the action is considerably different to anticipated. In this case, Council should re-evaluate how it interacts with this action.

In any case, when an evaluation trigger is reached, it is a sign that more detailed analysis must be undertaken to determine the future of the intervention.

11.4 Evaluation, Review and Learning

Through regularly collecting and doing short data analyses, minor evaluations will essentially be undertaken. Initially, this evaluation will be a simple assessment of whether the program outcomes are within the acceptable threshold or whether a trigger point has been reached. If a trigger point is reached, understanding why the project has deviated from what is expected can be investigated. Based on this information, it can be determined whether to continue with revised expectations, adjust the program itself, or abort the program and focus resources on a different area.

At the conclusion of the implementation of each intervention, monitoring data will be compiled and a full evaluation of program effectiveness will be conducted. Using data collected throughout the implementation, together with further research and review of information from other local government areas, an understanding of the relative effectiveness of the program can be established. This is an incredibly important contribution to growing the knowledge base in the local government sector and enabling others to learn from Knox's programs and ensure activities are well targeted in the future.

Finally, learning. The information gathered through the monitoring and evaluation process for this program must be shared so that it can contribute to continuous learning and improvement, both internally within Council teams and externally, for other local governments, community members and a range of other stakeholders. Not only is this important to the continued growth and improvement of the sector, it provides an opportunity for the Knox City Council to share their successes in effective emission mitigation and adaptation.

12. References

- .idCommunity, 2020. *City of Knox: Housing Tenure*. [Online]
Available at: <https://profile.id.com.au/knox/tenure>
[Accessed 2021].
- AASB/IASB, 2019. *Climate-related and other emerging risks disclosures: assessing financial statement materiality using AASB/IASB Practice Statement 2*, Canberra: Australian Accounting Standards Board & Auditing and Assurance Standard Board, Australian Government.
- ABS, 2016. *Census of Population and Housing: Census Dictionary*, Canberra: Australian Bureau of Statistics.
- AIS, 2020. *Evidence based position on smoke pollution and exercise*. [Online]
Available at: https://www.ais.gov.au/position_statements#smoke_pollution_and_exercise
[Accessed 3 August 2020].
- ARENA, 2021. *Future Fuels Fund*. [Online]
Available at: <https://arena.gov.au/funding/future-fuels-fund/>
[Accessed 2 February 2021].
- Australian Academy of Science, 2015. *Climate Change Challenges to Health*, Canberra ACT: Australian Academy of Science.
- AVNR, 2018. *Australian Voluntary National Review*. [Online]
Available at: <https://www.sdgdata.gov.au/about/voluntary-national-review>
[Accessed 18 September 2020].
- Beyond Zero Emissions, 2018. *Electrifying Industry*, Melbourne: BZE.
- Beyond Zero Emissions, 2020. *The Million Jobs Plan: A unique opportunity to demonstrate the growth and employment potential of investing in a low-carbon economy*, Melbourne: Beyond Zero Emissions Inc.
- BoM and CSIRO, 2020. *State of the Climate*. [Online]
Available at: <http://www.bom.gov.au/state-of-the-climate/index.shtml>
[Accessed 20 September 2020].
- CAHA, 2017. *Submission to the Review of Australia's Climate Change Policies*, Canberra: Climate and Health Alliance.
- ChargeTogether, 2020. *Leading the Charge: Accelerate your transition to electric vehicle fleets*. [Online]
Available at: <https://fleets.chargetogether.org/>
[Accessed February 2021].
- City of Melbourne, 2020. *Climate Change Impacts on Melbourne*. [Online]
Available at: <https://www.melbourne.vic.gov.au/about-council/vision-goals/eco-city/Pages/adapting-to-climate-change.aspx>
[Accessed 19 November 2020].
- COAG Energy Council, 2015. *National Energy Productivity Plan: Boosting competitiveness, managing costs and reducing emissions*, Canberra: Commonwealth of Australia.
- Commonwealth of Australia, 2020. *Business Energy Advice Program*. [Online]
Available at: <https://www.energy.gov.au/government-priorities/energy-programs/business-energy-advice-program>
[Accessed 2020].
- COTA, 2019. *Climate Change*. [Online]
Available at: <https://www.cota.org.au/policy/climate-change/>
[Accessed 15 August 2020].
- Cricket Australia, 2019. *Heat Policy*. [Online]
Available at: <https://www.cricketaustralia.com.au/cricket/-/media/22C206296A1F4D848C0750C2FCEECD6C6.ashx>
[Accessed 3 August 2020].
- CSIRO, 2019. *Greater Melbourne Climate Projections*, Melbourne: CSIRO.
- DEA, 2015. *No Time for Play. Childrens Health & Climate Change*, College Park, SA: Doctors for the Environment.

Deloitte Access Economics, 2020. *A New Choice: Australia's Climate for Growth*, Brisbane: Deloitte Access Economics.

DELWP, 2019. *Electrification Opportunities in Victoria's Industrial Sector*, Melbourne: Victorian Government.

DELWP, 2019. *Victoria's Climate Science Report*, Melbourne: Victorian Government.

DELWP, 2020. *Budget 2020/21*. [Online]
Available at: <https://www.delwp.vic.gov.au/our-department/budget-2020-21>
[Accessed 25 November 2020].

DELWP, 2020. *Cooling and Greening Melbourne*, Melbourne: Department of Environment, Land, Water, and Planning.

DEWLP, 2020. *Climate Change Risks to Local Government*. Melbourne: Department of Environment, Water, Land, & Planning, Victorian Government.

Federal Reserve Bank of San Francisco, 2019. Healthy Aging: A Conceptual Model of Community-based Solutions in the Face of Climate Change and Global Demographic Changes. *Community Development Innovation Review*, 17 October.

FFMV, 2020. *Forest Fire Management Victoria - Fire Restriction Dates*. [Online]
Available at: <https://www.ffm.vic.gov.au/permits-and-regulations/fire-restriction-dates>
[Accessed 20 November 2020].

Global Carbon Project, 2018. *Carbon budget and trends*. [Online]
Available at: www.globalcarbonproject.org/carbonbudget
[Accessed 15 September 2020].

Google, 2020. *Environmental Insights Explorer*. [Online]
Available at: <https://insights.sustainability.google/>
[Accessed 2021].

International Energy Agency, 2020. *Global EV Outlook 2020: Entering the decade of electric drive?*. [Online]
Available at: <https://www.iea.org/reports/global-ev-outlook-2020>
[Accessed 15 June 2020].

Investor Group on Climate Change, 2020. *Australian Sustainable Finance Initiative: Bold plan launched to reshape Australia's financial system*. [Online]
Available at: <https://igcc.org.au/asfi-roadmap-launch/>

IPCC, 2018. *Global Warming of 1. °C. above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty.*, s.l.: Intergovernmental Panel on Climate Change.

Justice & Community Safety, 2020. *Environmental Scan Report - Eastern Metropolitan Region*, Melbourne: Victorian Government.

McKinsey & Company, 2020. *How a post-pandemic stimulus can both create jobs and help the climate*. [Online]
Available at: <https://www.mckinsey.com/business-functions/sustainability/our-insights/how-a-post-pandemic-stimulus-can-both-create-jobs-and-help-the-climate#>

Sustainability Victoria, 2020. *Linking Climate Change and Health Impacts*, Melbourne: Sustainability Victoria.

Tennis Australia, 2019. *Extreme Weather Policy*. [Online]
Available at: <https://www.tennis.com.au/wp-content/uploads/2019/11/Extreme-Weather-Policy-Effective-25-November-2019-1.pdf>
[Accessed 3 August 2020].

The Climate Council, 2020. *Clean Jobs Plan*, Melbourne: The Climate Council.

Victorian Government, 2020. *Tacking climate change and its impacts on health through municipal public health and wellbeing planning. Guidance for local government 2020*, Melbourne: Department of Health and Human Services.

World Resources Institute, 2020. *Over 150 global corporations urge world leaders for net-zero recovery from COVID-19*. [Online]
Available at: <https://www.wri.org/news/2020/05/release-over-150-global-corporationsurge-world-leaders-net-zero-recovery-covid-19>

Appendix A - Detail for Proposed Action Plan Interventions

The following sections provide detail on the rationale for each of the proposed mitigation and adaptation interventions proposed in the CRP Action Plan.

10.1 Expansion of Electric Vehicle Fleet

Currently, transport fuels are responsible for nine percent of Knox City Council's corporate emissions and this is expected to increase over time as emissions from electricity become less significant. Replacing an internal combustion engine (ICE) vehicle with an electric vehicle (EV) can dramatically reduce greenhouse gas emissions and overall operational cost over the course of the vehicle's lifetime. Moreover, EVs have no exhaust emissions, which brings health and other environmental benefits to the broader community.

There has been significant advancement in the Australian EV market over the past few years with a number of state and industry trials taking place, a more evident network of recharge stations being established and the release of electric vehicle standards.

As of June 2020, more than 14 countries have proposed banning the sale of ICE passenger vehicles and over 20 cities around the world have proposed banning ICE passenger vehicles within their city centres (International Energy Agency, 2020). Timelines range from 2025 to 2040 but the direction of change is clear. While Australia has not yet set any targets for banning the sale of ICE vehicles, both national and international pressure is mounting, and it is likely that similar targets will come into effect within the next decade. Regardless of whether such targets are adopted in Australia, there will nonetheless be a shift in international markets with car manufacturing moving away from ICE and towards EV.

Knox City Council manages a large vehicle fleet. It is therefore critical that Council acknowledges the implications of these trends and incorporates them into a Sustainable Fleet Policy. As well as demonstrating leadership within the region, taking a proactive approach to transitioning away from ICE vehicles will mitigate the real risk to Council of locking in an obsolete fleet. It will also enable Council to manage the transition strategically, allowing for the costs of vehicles and charging infrastructure to be spread over a number of years.

Sustainable Fleet Policy

The Sustainable Fleet Policy will set a trajectory for Council to significantly reduce fleet emissions. This will be achieved through:

- A gradual upgrade of all passenger vehicles to EV by 2025;
- Upgrade of all utility vehicles to the most efficient/low emissions alternative;
- More efficient management of the heavy vehicle fleet through installation of telematics²;
- Incorporation of EVs into the heavy vehicle fleet where feasible;
- Optimising the life-cycle of vehicles; and
- Regular driver training for all employees to ensure safe and efficient driving.

² Fleet telematics gather a range of data using Global Positioning System (GPS) technology, sensors and vehicle engine data. This will provide operators with the information they need to efficiently manage their fleet.

The Sustainable Fleet Policy will establish a framework to guide Council staff when purchasing new vehicles and designing fleet infrastructure such as parking bays and recharging stations. This will ensure that Council's fleet remains current and demonstrates environmental leadership within the community, as well as ensuring that investments in fleet and fleet infrastructure are future proofed for the EV transition. The policy will also provide a framework for the management of the fleet to ensure safe and efficient driving patterns are adopted by all employees.

10.2 Energy Efficient Council Buildings

Knox City Council has been able to reduce emissions through the implementation of the Sustainable Buildings and Infrastructure Policy, and Energy Performance Contract (EPC). Council's Revolving Energy Fund (REF) can be used to partially fund the remaining opportunities for energy efficiency in Council Buildings.

At around 40% of emissions in 2018/19, energy consumed by Council buildings is a significant source of emissions for Council's corporate operations. Addressing these emissions is straightforward and falls into the following key categories:

- Improvements to building operational efficiency through behaviour change;
- Improvements to the energy efficiency of existing buildings;
- Improvements to the energy efficiency of new buildings in the design stage; and
- Installation of solar photovoltaics (PV) on council buildings.

Environmentally Sustainable Design (ESD)

Ensuring that energy efficiency is considered at the design stage of any new Council building or major renovation is crucial. This is achieved through the implementation of Council's Sustainable Building and Infrastructure Policy.

Features of this Policy include:

- Projects > \$10 million: to achieve Green Star 4 Star Design standard; and
- Projects > \$20 million: to achieve Green Star 5 Star Design standard.

The Policy is already being used to guide the delivery of capital works projects since 2020. Potential emissions savings achieved through the implementation of the Policy have been modelled from 2020/21 to 2030/31 and are likely to total 1,955 tonnes of carbon dioxide equivalent (tCO₂e).

Energy Performance Contract

Knox Council adopted an Energy Performance Contract (EPC) in 2019 in order to reduce energy use across larger Council facilities. With \$1.85 million invested into energy efficiency upgrades at Knox Leisureworks, Rowville Community Centre, Ferntree Community Arts Centre and Library, Knox Community Arts Centre, and Knox Regional Netball Centre, Council can expect to see emissions reduced by approximately 45% or 1,226 tCO₂e. The energy efficiency upgrades include LED lighting, solar panels, building management systems and upgrades to cooling/heating systems.

Low Energy Behaviour Change

There are multiple ways in which the occupants of a building can participate in reducing emissions. This may be through thermal comfort policies, changes to room usage, or operational use of passive building features (like opening and closing of windows and blinds). These passive measures are often overlooked however can present excellent outcomes for many facilities. An additional benefit of these types of measures is that there is evidence showing that building occupants record higher levels of satisfaction with indoor environments (including metrics like temperature, humidity, and air quality) when they are active participants in controlling their environment, even if there is not a quantitative change in ambient measurements.

Energy Efficiency in Council Buildings

It is expected that by making simple upgrades such as gap sealing and lighting upgrades at some of Council's highest consuming sites, there is the potential to save 6,104 tCO₂e over the lifetime of the investment. If the proposed landfill solar farm is built, the emissions savings would be 204 tCO₂e over the lifetime.

Potential savings from energy efficiency measures at small market sites are lower, however, there are still notable cost and GHG savings to be made alongside the co-benefits of improved comfort for users.

It should be noted that for very low energy consuming sites (those with an annual consumption of less than 10,000 kWh), the costs of implementation can outweigh the benefits of any cost and emission savings generated. A brief cost-benefit analysis should be carried out before making any significant investments in these sites. Improvements to energy efficiency at these sites can continue to be pursued through ongoing maintenance and sustainability considerations within Council's Procurement Policy (for example, purchasing the most energy efficient appliances and lighting as applicable), and Sustainable Building and Infrastructure Policy.

On-site Solar for Council Buildings

Installing solar photovoltaics (PV) at the point of use, for example on the rooftop of a building, presents a simple opportunity for reducing emissions and generating clean, cheap energy. Due to the costs savings resulting from reduced grid-purchased energy, these projects typically have favourable payback periods.

This plan models the installation of a further 75kWp across feasible sites in beginning in 2022/23. Feasibility studies will need to be carried at potential sites to ensure investments are only made where the business case is favourable. As part of the solar PV assessments Council may wish to assess the feasibility of solar hot water.

Whilst Council has limited remaining roof space for solar on buildings that will provide a favourable business case, opportunities remain on community buildings that are Council-owned. Around \$500,000 has identified for installing solar on Council buildings over the next five years through the capital works program, with most of that being spent on buildings where Council does not pay the bills. Once funding for the proposed 75kWp has been set aside, it's estimated that approximately 200-300kWp of solar could be installed on community buildings. Not only will this provide renewable energy directly to the community, it will also reduce energy bills for these groups.

10.3 Public Lighting Changed to LED

Major Roads Street Lighting Upgrades

Knox City Council has already undertaken a bulk changeover of around 10,600 Category-P (residential) lights to LED, reducing energy use by over 75% and resulting in significant savings to operating and maintenance costs and GHG emissions. In addition, within Knox, streetlights will be powered through a Power Purchasing Agreement (PPA) for nine years, from July 2021.

Council has planned and budgeted for the upgrading of Knox's major road lights. This project is currently in the design phase, with the installation works planned to start in 2021/22 (subject to Council budget allocation). This will include replacing approximately 3,300 lights with LEDs, as well as conducting a Smart Lighting analysis for some lights to see if there is potential for significant energy savings by integrating smart lighting technology into the major light upgrade project. The project could see savings of 19,663 tCO₂e over 20 years if purchasing grid electricity.

10.4 Landfill Solar Farm

The preliminary findings of a recent feasibility study show that that Knox has a suitable site for a 4.99MW solar farm. If constructed, this solar farm would generate energy equivalent to 2.5 times Council’s energy demand³. The feasibility for a large-scale battery storage system to be co-located on the site is also currently being explored. Another study is investigating how the potential revenue from the proposed solar farm and battery could be re-invested into community climate projects.

The modelling assumes that a 4.99MW solar farm is installed. As this is not on-site solar, the electricity generated by the solar farm will not be directly consumed by Council’s operations but will instead be fed into the grid and used to offset the energy use in Council’s buildings.

The emissions impact is therefore illustrated in this proposed Action Plan and Figure 18 as net zero electricity for buildings and street lighting rather than as an emissions reduction.

Figure 18 illustrates that the solar farm would generate the energy equivalent of the majority of Council’s total annual electricity consumption by 2030/31 (including buildings and street lighting). This does assume that the electricity efficiency actions are implemented and significant reductions in annual consumption have been achieved. With the solar farm in operation Council will have reduced emissions against the business as usual trajectory by around 83% by 2030/31. This leaves Council with only around 1,800 tCO₂e remaining to offset through purchased offsets or other methods in order to be zero net emissions from corporate operations.

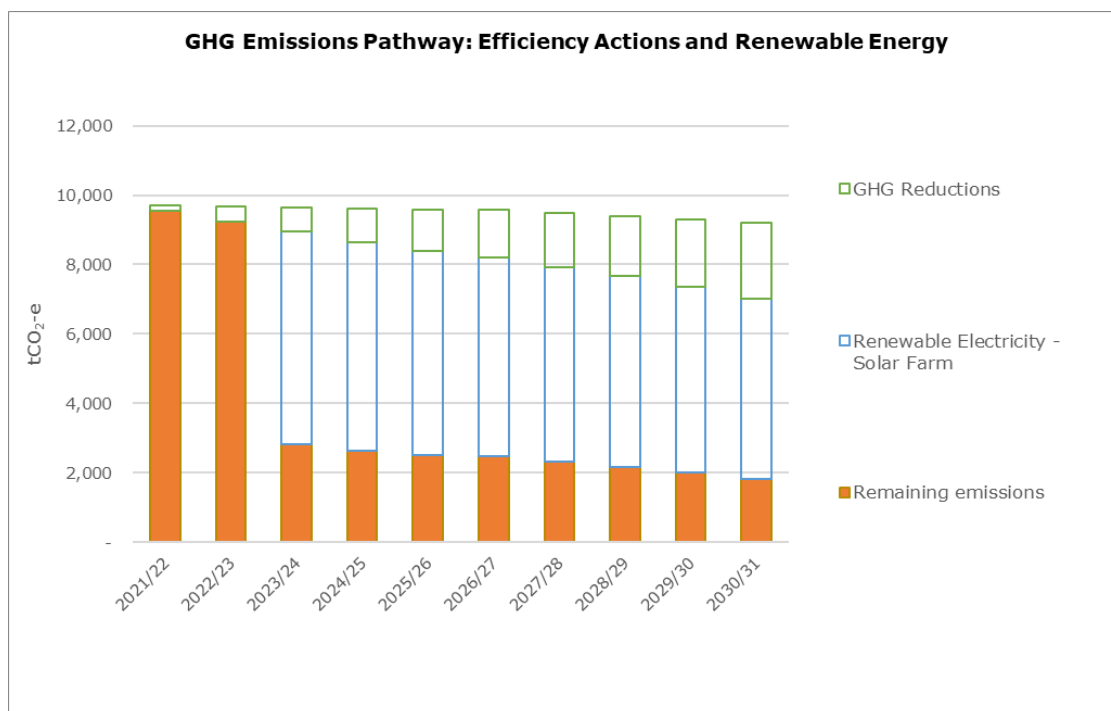


Figure 19: GHG Emissions Pathway: Efficiency Actions and Renewable Energy

³ Knox Landfill Solar Feasibility Study – Final Report, Enhar

10.5 Low Emissions Building through Design

Knox City Council will work with developers to ensure that the highest standard of environmentally sustainable design (ESD) is implemented. At first, this will involve developing consistent interpretations of Local Planning Policies (LPPs) and the National Construction Code (NCC) amongst planning teams and ensuring that developers are supported to meet these high standards. Beyond this, Council will work on developing updated planning provisions and advocate for their inclusion in the Knox Planning Scheme by the State Government. Additionally, Council will investigate incentives to developers to encourage them to design high-performing buildings. This may include incentives such as faster processing times for planning applications, discounted rates, or others.

Background

In the Knox municipality, 24% of emissions come from residential and commercial stationary energy, which largely refers to the use of electricity. The building envelope and design of space, particularly at the planning stage, can impact a building's emissions through changing the energy required to heat, cool or light the space.

This program aims to address the energy efficiency of buildings as they are being designed and built. The outcome would be buildings that are well insulated, well oriented, more comfortable and resilient to increasing temperature and designed for low-energy use. Additionally, the program seeks to ensure consistent interpretation and application of the planning scheme, working with developers to encourage them to meet a higher ESD standard and also developing new provisions.

Barriers

The identified barriers to low emissions building design currently are:

- Council cannot regulate higher standards but can only encourage them. Energy efficiency requirements for residential buildings are outlined in the National Construction Code (NCC) and for commercial buildings are prescribed in the Building Code of Australia (contained within the NCC).
- Inconsistent interpretation and application of existing planning regulations.
- Lack of incentives for developers to design for appropriate energy efficiency solutions. The upfront capital costs are borne by the developers while long-term efficiency gains stay with the homeowner or tenant.
- Developers face competing priorities, such as the provision of affordable housing, which can stifle ambition to achieve higher than minimum standards.

Interventions

One of the greatest tools available to Council in reducing GHG emissions is the Victoria Planning Provisions that form the framework for all of Victoria's planning schemes. Interventions through planning provisions and municipal planning schemes, could enable Council to interact with, and influence, major building upgrades and new buildings that require a development application within the region. Perhaps the greatest reason for using the application of planning regulation as an intervention for emissions reduction, is that planning is already a core role for Council. Thus, this program is truly about creating structural change and embedding a low emissions future within Council operations.

The efficiency of buildings in Australia is measured by the National Home Energy Rating Scheme (NatHERS). The National Construction Code prescribes the minimum requirements for new buildings with the objective to reduce GHG emissions in all new buildings through energy efficiency and sustainable design.

This program seeks to influence the existing implementation of the NCC and Knox Planning Scheme by local planning teams to a consistent and high standard. It also looks to: work with developers to ensure they understand the new interpretations of the Knox Planning Scheme and are preparing applications that meet the new standard; and offer incentives to motivate developers to build to a higher standard.

Work within Existing Regulations

This intervention seeks to address improvements to new buildings in multiple ways. Firstly, it seeks to work within the approvals process for new buildings to establish a common understanding of what constitutes acceptable ESD. In addition to working directly with developers, this intervention will also involve working with Council planning teams to determine a consistent interpretation of the existing regulations and train relevant staff to be consistent in the assessment of ESD requirements.

Challenges in achieving low emissions design in buildings are currently embedded in the planning process and in the lack of incentives for developers. Developers, faced by pressures to provide low-cost housing and buildings, consistently build to minimum standards. In addition, there is limited motivation to achieve higher standards because the financial benefits of doing so will be borne by the end-users. An additional way that this intervention addresses improvements to new buildings is through planning scheme or rates incentives which cover a range of possible mechanisms. Essentially, this is something that will further encourage developers to submit planning applications that meet a high standard of ESD. Incentives may be discounted rates, or other incentives.

Develop New Regulations

There is a limit to what can be achieved when working within existing planning schemes. As such, there are two interventions that seek to increase the ambition of these schemes. Firstly, the advocacy and preparation of new regulation (which would need to be approved by Victorian State Government) that phases in requirements for all new buildings to achieve net zero emissions or be net zero emissions-ready. This could also expand to consider transport emissions through the requirement for installation (or readiness for installation) of private charging infrastructure. Knox already undertakes advocacy aligned with the Council Alliance for a Sustainable Built Environment (CASBE), for changes to the Victoria Planning Provisions.

Enforcement

Council can deploy resources to increase the enforcement of NCC and planning requirements. This may take the form of increased capacity of an ESD officer working in conjunction with surveyors, to ensure ESD compliance of developments, throughout construction. This could be seen as a kind of incentive for developers, as Council would be covering the costs of ESD compliance and certification, instead of developers.

Reporting and Communication

A communications program can be implemented by building on existing public reporting requirements. By raising greater public awareness of the emissions footprints of new buildings, Council can actively apply pressure to developers to raise the energy efficiency performance of new developments.

Enablers

There are enablers that can help activities in this area be more successful or form the basis for intervention design themselves. These include:

- **Victorian State Government.** State government has recently released a plan for getting to zero emissions, building on their focus for a zero emissions future. In this plan, there is “\$5.9 million to establish a new 7-star energy efficiency standard for new homes to improve energy performance and reduce running costs” (DELWP, 2020).
- **CASBE.** Knox City Council is a member of CASBE, an alliance operating under the Municipal Association of Victoria (MAV). CASBE provides a forum for the exchange of ideas and methods on best practice for ESD. This Alliance also a leading advocacy group for driving change in Victoria Planning Provisions and planning schemes and for the NCC.
- **NCC.** Just as the NCC inhibits initiatives for higher standards, it can also be used as a vector for change. The recently released 2019 version of the NCC will reportedly achieve 30% more energy efficiency, and 40% more greenhouse gas emission savings compared to the 2016 version. The NCC is planning to have a standard that allows for zero net emission residential detached buildings within the next 10-15 years. This standard plans

for stepped improvements to 2030 every three years, through a combination of improved design and energy efficiency and the use of renewables and batteries to supply the supplemental energy required for the homes.

Impact

Through pursuing interventions that both increase the minimum compliance expectation, while providing facilitation towards better practice, there should be a good response to increased standards. This program will achieve structural change that will continue to increase well beyond the life of the program, making it very high impact (see Figure 20).

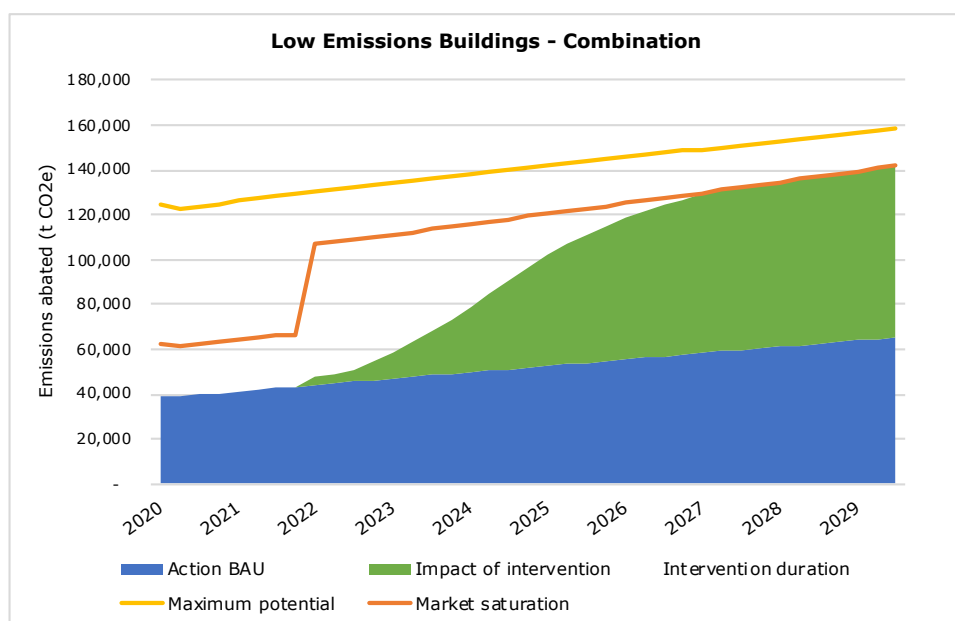


Figure 20: Estimated impact of interventions for low emissions buildings through design in Knox

There are large opportunities for reducing emissions within the municipality through targeting planning. An ambitious drive to raise construction standards can see large scale emissions reduction being embedded into the built environment, securing long term savings.

Looking Forward

This program is highly cost effective, which is to say that it achieves a high level of impact relative to Council's expenditure. Whilst these interventions are implemented, Council will be actively supporting change that will last for the duration of the program, but will also be creating a structural change that will last beyond the life of the program.

This program can build on Knox's existing Environmentally Sustainable Design (ESD) Policy, and look to improve the overall design of new developments. Council's Planning team will play a significant role in this program.

This program would also present an opportunity to support the Building 4.0 Cooperative Research Centre initiative. This is a Federal Government funded, collaborative initiative between industry partners that seeks to transform how buildings are designed and manufactured in Australia. Council can look to collaborate with organisations such as Civil Contractors Federation, Housing Industry Association Victoria and Master Builders Association Victoria.

10.6 Future Proofing Businesses and Industry

Council will address small-medium sized businesses in the industrial sector and support them to achieve emissions reductions through energy efficient technology, degasification and renewable energy. This support will be delivered through working groups with businesses, industry bodies such as South East Melbourne (SEM) and South East Melbourne Manufacturers Alliance (SEMMA) and where relevant, experts such as CSIRO and research bodies.

Background

The industrial sector accounts for 45% of the total emissions in Knox. This sector is largely comprised of small to medium sized manufacturing businesses, with some larger businesses also present. In comparison to other Organisation for Economic Cooperation and Development countries, Australia performs poorly in terms of energy efficiency in this sector (COAG Energy Council, 2015). This is an indication that there are viable solutions to reducing industrial energy use.

This program will strive to address emissions from industrial energy use in three key ways:

- **Transitioning towards more energy efficient technology.** Specific technology solutions include simple changes, such as transitioning lighting at industrial sites away from high-pressure sodium and metal halide to LEDs. It also includes more complex changes to air compressor systems, refrigeration systems and other pieces of industrial plant. Even simple changes to maintenance schedules, upgrade cycles and usage of plant can be effective in reducing emissions.
- **Transitioning away from gas as an energy source.** The most common application of gas in this sector is for industrial heating. This action involves a move away from the use of gas by industrial facilities through replacing gas-powered machinery with viable alternatives. There are a number of clean energies that are appropriate for use by industrial sites as an alternative to gas. These include systems powered by renewable electricity, electromagnetic technology, bioenergy, solar thermal, geothermal and hydrogen.
- **Sourcing all electricity from renewable sources,** including onsite solar PV systems and purchased grid renewables. Within the City of Knox, numerous businesses operate out of large warehouses, many with an ideal amount of roof space that could be used for renewable energy capture.

Barriers

The identified market barriers for this action are:

- **Lack of knowledge:** Not all businesses will have the in-house knowledge required to research and implement energy reduction or clean energy purchasing measures. This may include gaps in technological, financial, legal and energy market expertise.
- **Lack of availability of suitable alternative technologies:** Industrial processes can be very bespoke in their requirements and there may not be suitable alternatives for some processes. This will be particularly applicable to a transition away from gas.
- **Lack of confidence in new technologies:** While numerous solutions have been piloted, because they are innovative there will not have been widespread or long-term application of many alternative technologies.
- **Potential lack of capacity to operate alternative technologies:** The operation and maintenance of new technologies may require different skill sets to those currently in the sector.
- **High implementation costs for businesses:** Some energy efficiency and degasification technologies will entail significant upfront capital costs.
- **Potentially poor business case for solutions:** Some energy efficiency and degasification technologies do not offer a favourable business case as upfront costs are significantly higher than the savings generated.

Interventions

Working Groups

The proposed mode of engagement with industrial stakeholders will initially be through the development of a working group or groups. These working groups may also draw in expertise from the research or sustainability sectors for advice and support. The focus will be on teasing out the specific challenges and opportunities faced by this sector and tailoring effective and lasting solutions.

Education

This intervention will focus on educating industrial stakeholders about Power Purchase Agreements (PPAs) or other similar arrangements to purchase renewable power, increasing sector awareness and building capacity. Energy intensive industrial businesses can invest in PPAs to take advantage of renewable energy generation and reduce their overall carbon footprint and emissions.

It is possible that this education intervention can be more than just education on PPAs. There is an opportunity to include information on other funding mechanisms such as Environmental Upgrade Agreements (EUA) and Energy Performance Contracts (EPC) to create a deeper understanding of these aspects for industrial stakeholders. There is opportunity for further reach of this intervention through building on exiting partnerships with South East Melbourne Manufacturing Alliance (SEMMA) and the Eastern Alliance for Greenhouse Action (EAGA).

Enablers

Across Australia there have been many successful pilot programs run to improve industrial sites and there are a range of technological solutions available to improve energy efficiency. Climate change and energy efficiency are emerging as strong themes amongst business networks such as SEM and this can be leveraged. In addition, there is funding available to businesses for energy upgrade projects, for example through programs like Environmental Upgrade Finance (EUF).

Other enablers include:

- **The business sector** is feeling international pressure to keep up with sustainable supply chain demands and there is an important opportunity for Council to support this.
- **The Victorian State Government** has investigated opportunities for emissions reduction within the industrial sector and identified relevant sectors such as food and beverage as being appropriate sub sectors for efficiency and degasification in the short term. Council can work closely with State Government on appropriate interventions and seek funding and support from the State Government for program delivery that aligns with the State's targets of zero emissions.
- **The Australian Government** has sponsored resources for small businesses to reduce energy costs and usage. Council can partner with the Federal Government in program deployment within Knox. One example of an existing federal government program is the Business Energy Advice Program (Commonwealth of Australia, 2020), delivered by Business Australia, that targets small business with between 6 and 20 staff and supports them to reduce energy costs and emissions.

Impact

The opportunity for change will initially be modest as this is a slow-moving sector. However, through the interventions described, Knox City Council would be initiating a structural change to the industrial sector. This would lead to industry stakeholders choosing better options over time (see Figure 21 and 22). The estimated cost for these interventions is listed in Table 6.

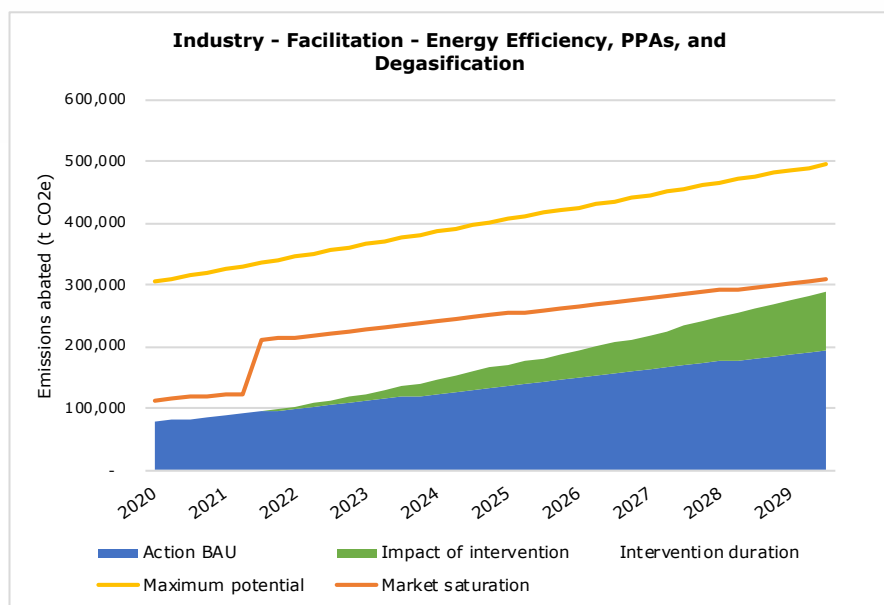


Figure 21: Estimated impact of facilitation of industrial working groups intervention in Knox

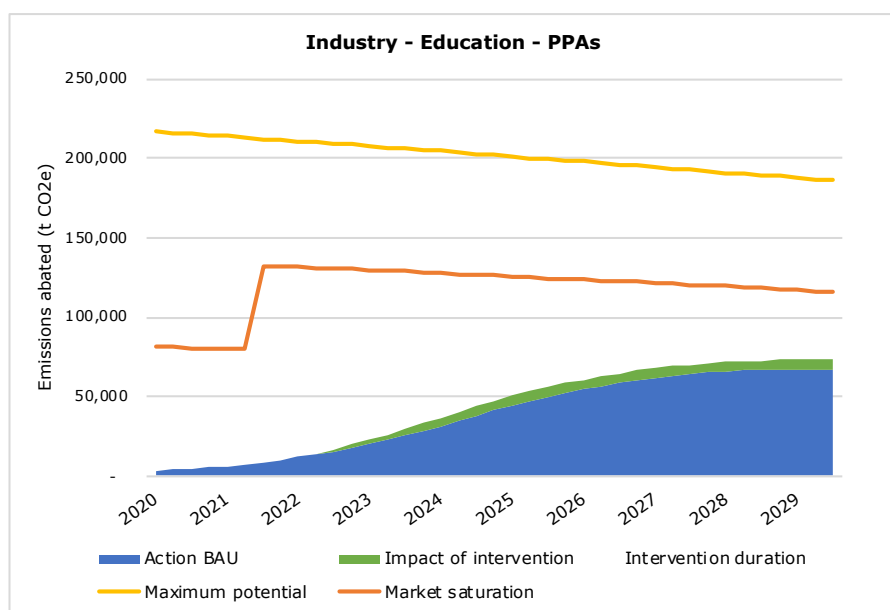


Figure 22: Estimated impact of industrial education intervention in Knox

Looking Forward

Industrial interventions require stakeholder engagement as the fundamental first step. Engagement in the design of an intervention and the monitoring of outcomes will be crucial to the success of this program. Industry associations operating at a local level such as SEMMA and SEM will be key partners in the design and implementation of these interventions. In addition, Council will also leverage the expertise within its Economic Development team to understand if there are other businesses operating within its municipality that may be high impact but are not currently covered by the associations noted above.

Initially, resources such as the Beyond Zero Emissions *Electrifying Industry* (2018) or DELWP's *Electrification Opportunities in Victoria's Industrial Sector* (2019) reports, which include specific examples of alternative technologies based on industrial subsectors, can be used to kick off discussions with industrial stakeholders around energy efficiency and degasification. Technology specific service providers or research institutions can then be brought on board to provide more in-depth information and feasibility studies.

For procurement of renewables such as a PPA, after initial discussions with relevant industry associations and key energy consumers, Council will bring energy market experts to the table to further explore the opportunity. A useful resource is the Business Renewables Centre Australia (BRC-A). This member-based platform streamlines and accelerates corporate purchasing of large-scale wind and solar energy and storage. It may also be valuable to learn from other councils that have already rolled out similar schemes. The City of Melbourne for example has facilitated two group power purchase agreements for organisations across Melbourne.

An important part of Council's role to support industry in reducing emissions will be in supporting awareness of and access to finance mechanisms. One example is the Victorian Government's Environmental Upgrade Finance (EUF) loans for businesses. The EUF provides funding for businesses wanting to make sustainability (e.g. energy efficiency) building upgrades.

The opportunity for businesses to participate in this program is both an environmental benefit and an economic development prospect. The program will benefit from the input and support of Council's Economic Development team in developing a persuasive and consistent message to industry across the municipality. There are several larger industrial stakeholders located in Knox that Council can engage with to help support emissions reductions and energy transitions in this sector. This may be achieved through the investigation of the feasibility of a Virtual Power Plant (VPP) or similar model.

VPPs are considered to be an important element of the future electricity grid. Their main role is as an alternative to grid infrastructure augmentation, which in principle will lower electricity costs to end-consumers in addition to increasing resilience. A beneficial further benefit is the encouragement of additional embedded renewable energy. Although there is no specific requirement that VPPs need to use renewable energy, and hence be 'green' energy, or indeed operate from any embedded generation source, it is manifesting as the most common solution.

The main solution for VPPs has been in residential and commercial properties so far. This is for several reasons. The residential and small to medium sized enterprise (SME) markets have conventionally faced the highest retail costs of electricity, in addition to having been the beneficiaries of Federal and State level initiatives on promoting embedded generation. Additionally, they are in general subject to fairly standard terms of electricity sale, and will only infrequently have tariffing arrangements such as demand or capacity charges. Critically, VPPs require the installation of batteries or other dispatchable energy storage devices. The business case for such technologies have only very recently established viable business cases, and, as for embedded renewables, this has favoured the residential and, more recently, SMEs.

10.7 Solar for Rentals

The barrier of split incentives between tenants and landlords keeps rental properties largely excluded from the solar PV market. Split incentives occur when those making the capital investment decisions (the landlord) are not the same entity as those responsible for paying energy bills (the tenant). By facilitating a scheme that addresses these split incentives, Knox City Council will open up this sector to the market. This may include, for example, financial mechanisms such as agreed rental increases proportionate to energy bill changes that will enable tenants cheaper energy whilst landlords have a payback on the asset. This program will make solar accessible to a new subsector of residents, many of whom are of lower incomes.

Background

The aim of this action is to install solar photovoltaics (PV) on rental properties. The relationship between installing rooftop solar PV systems on residential dwellings and savings in cost and emissions is well known and documented. For municipal solar installations on owner-occupier buildings, there is currently a good business-as-usual trajectory for implementation and a number of market mechanisms that are supporting the continued growth of this action.

Council currently participates in the Solar Savers program, which supports residents of Knox to install rooftop solar by providing advice and streamlining decision making about products and services. Council also partners with the Australian Energy Foundation to provide energy savings advice to residents. In late 2020, the Victorian State Government announced funding for a program that would support low-income households and social housing with improved energy efficiency and comfort. This announcement also included further funding for households to install solar panels. Overall, these programs represent and support a large proportion of the Knox community.

With all of this in mind, there is still an opportunity presented by focusing on actors that are not currently represented in the market, in particular rental properties and multi-unit dwellings. Therefore, the action outlined here will include a targeted focus on rental properties in Knox which make up approximately 16.9% of the housing tenure (.idCommunity, 2020), whilst also aiming to address the broader residential solar market.

Barriers

The identified barriers to uptake of the installation of solar PV on rental properties are:

- **Split-incentives between landlords and renters:** The positive business case for solar is dependent on payback through reduced electricity bills, which does not occur if the property owner is not responsible for bill payments.
- **Access to suitable roof space:** Generally, this refers to residents of higher density developments.
- **Lack of consumer confidence:** A multitude of installers and technology options can result in uncertainty.

Interventions

Facilitate a Rental Solar Scheme

This program is focused on facilitating a scheme or program that addresses the issue of split incentives. By facilitating specific landlord-renter loan schemes, for example that enable landlords to increase rent to a proportion of the value of the savings that renters receive on energy bills, the barrier of split-incentives will be addressed. This provides a win-win situation for renters, who will have savings on their energy bills that are greater than the increase on their rent, and landlords, who will have a payback period for the installation of the solar panels and long-term financial gain from the program. The mechanics of this program would be determined in consultation with key stakeholders. Once a solution has been designed, Council may then work to engage with property managers or real estate groups.

Enablers

In Victoria, there are State Government programs through Solar Victoria that currently provide incentives to landlords for installing solar on rental properties and provide support to tenants to request solar or participate in payback of the asset. Council can build directly onto this program by amplifying and promoting it directly to relevant local groups.

There are several programs that target rental properties already operating in Australia with varied degrees of success. An example is the Solar Analytics program, which includes a calculator that facilitates an agreement between landlord and tenant on a modest rental increase that is offset by energy savings. There are also programs such as the Cool or Cosy scheme in South Australia that offer payment plans to landlords and tenants wishing to see solar installed at their residence.

As a first step, Knox will research existing programs that target this action. Successful elements of these programs could be incorporated into the program design, whilst lessons learned can also be considered.

Impact

As rental properties are a relatively underserved market segment, there is good opportunity for making an impact at scale across the municipality through interventions that remove barriers to participation (see Figure 23).

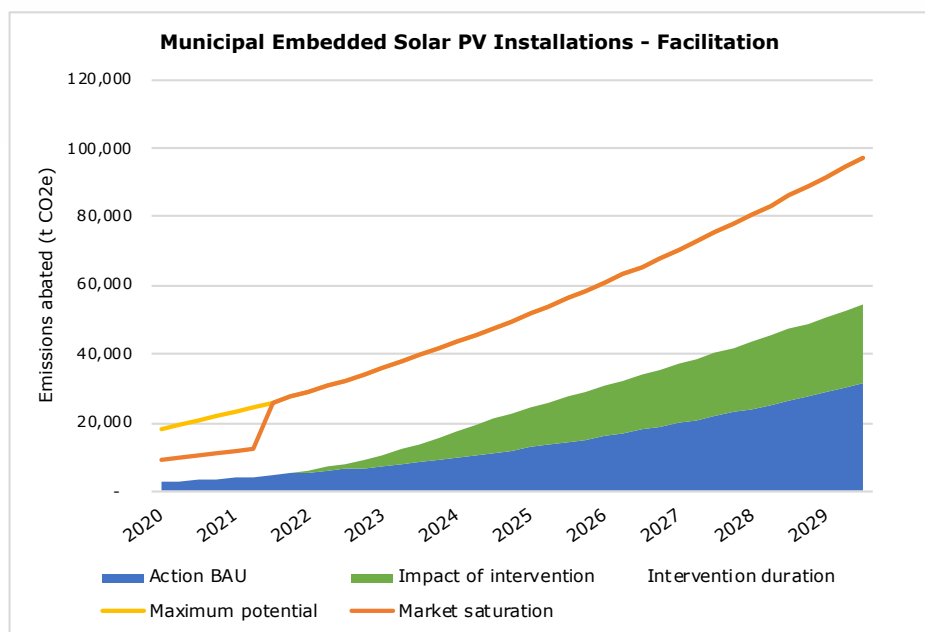


Figure 23: Estimated impact of solar installation intervention in Knox

Because of the low take up of solar within rental properties to date, there is very high potential for this program to achieve change. Once the rental and multi-unit development sector of the solar PV installation market is opened up with support from Council's intervention, the sector should continue to deliver new installations and emissions reductions will continue without Council's influence.

Looking Forward

Local solar retailers and manufacturers stand to benefit significantly from opening up a new sector of the market and will be approached as a first step in stimulating this segment of the economy during and post-COVID-19. Any measures to open up the rental property solar PV market should be focused on enabling these stakeholders to operate at their full capacity to service this market and removing barriers that currently prevent this.

Other stakeholders that stand to benefit include landlords, who will see an increase in their property value. It is advised that real estate agents, renters groups, strata committees or other relevant local property consultants are included in initial consultations regarding program design, to ensure that proposed financial mechanisms or solutions are appropriate. Council can build on the success of programs such as the Solar Savers program and the Australian Energy Foundation Energy Saving Advice service, to support tenants and landlords with the uptake of residential solar.

Where relevant, existing solar loan providers may be included to play a key role in financial mechanisms and payback scenarios. Currently there are a number of stakeholders working in this space, including major solar installers, the Clean Energy Finance Corporation, major banks and a number of dedicated solar loan institutions.

The objective of the collaborative process would be to connect local market operators offering solutions for multi-unit dwellings or rental properties to rental organisations operating within the municipality and generate confidence amongst landlords and tenants to move forward. Once this facilitation role has occurred, the intention is that it will be maintained by solar installers and manufacturers, who have a vested interest in the ongoing installation of residential solar panels.

Council has the option to investigate partnerships with greenhouse alliances such as EAGA, the State Government, and representative bodies such as the MAV to establish the legal, financial and market mechanisms to support this program.

Additionally, Council can support residents to take advantage of the State Government's recently announced \$797 million energy stimulus package, which seeks to improve the quality of homes, and create jobs. Improving residential energy efficiency addresses social equity challenges faced by some individuals in the municipality. While this will likely only have small impacts on emissions reduction, it will have lasting social impacts, through initiatives that target low income households. This creates an altogether more complete solution for the residential sector.

10.8 Expanding the Electric Vehicle Charging Network

This program seeks to expand the network of rapid charge stations across the City of Knox through collaborative strategic planning and facilitating the installation of the charging infrastructure by private charging companies. With this achieved, there will be a sound enabling environment for the uptake of EVs by the community. This program will build on plans by the Victorian State Government and projects funded by the Australian Federal Government (through the Australian Renewable Energy Agency) to ensure that Knox is ready to support a transitioning car market. By creating an enabling environment for EVs, Council will support local residents to speed up their transition away from internal combustion engine (ICE) vehicles and reduce emissions from the transport sector.

Background

On-road transport is a significant source of emissions in the City of Knox contributing approximately 20% to the municipal profile. An electric vehicle (EV), even when charged through the electricity grid, is a lower emissions alternative than a petrol or diesel vehicle. In addition, for most applications the transition between an ICE vehicle and an EV is a like-for-like replacement. This makes it particularly attractive, as there is no behaviour change required from consumers, simply a different choice at the point of purchase. Moreover, EVs have no exhaust emissions, which brings health and other environmental benefits to the broader community.

There has been significant advancement in the Australian EV market over the past few years with a number of state and industry trials taking place, a more evident network of recharge stations being established and the release of electric vehicle standards. Further to this, both the Federal Government and Victorian State Government have clear plans for supporting the creation of electric vehicle charging networks.

As of June 2020, more than 14 countries have proposed banning the sale of ICE passenger vehicles and over 20 cities around the world have proposed banning ICE passenger vehicles within their city centres. Timelines range from 2025 to 2040 but the direction of change is clear. While Australia has not yet set any targets for banning the sale of ICE vehicles, both national and international pressure is mounting, and it is likely that similar targets will come into effect within the next decade. Regardless of whether such targets are adopted in Australia, there will nonetheless be a shift in international markets and car manufacturing away from ICE and towards EV. This will inevitably result in a shift of costs, not only making electric vehicles cheaper, but driving prices of ICE vehicles upwards.

Whilst the installation of EV charging infrastructure does not directly reduce emissions, it influences the uptake and use of EVs in the community by addressing range anxiety and making it clear that EVs are a viable option for car owners.

Barriers

The identified barriers for the roll out of EV charging infrastructure are:

- **Network availability:** Electric vehicle charging infrastructure requires a connection to the electricity network or a connection to a renewable energy source. This involves collaboration with electricity distribution businesses to enable new points of access to the electricity network in select locations.
- **Land availability for charging infrastructure:** In addition to a network connection, electric vehicle charging infrastructure must include car parking. In towns and cities, this means that often valuable parking spaces must be dedicated to electric vehicles only.
- **High upfront capital:** Required to fund the installation of charging infrastructure.

- **Current low uptake of EVs in the community:** The EV-charging infrastructure problem is a chicken-and-egg situation. Uptake of EVs will likely remain low until there is visible and available charging infrastructure to ease community concerns around reliability and becoming stranded. However, there is limited incentive for private entities to install charging infrastructure whilst community uptake of EVs is low.

Enablers

Electric vehicles are being targeted by a range of key stakeholders across the country, which provide excellent enablers for taking action. Some of these enablers include:

- **The Federal Government.** The Federal Government is participating in several ways to facilitate the uptake of EVs. These include funding for charging infrastructure, incentives for fleet transitions (such as the Future Fuel Fund (ARENA, 2021), and other strategic initiatives. Some of these include plans to equip roughly 250 homes with free or subsidised charging stations and develop the technology for smart charging and vehicle-to-grid power exchanges.
- **The State Government.** The Victorian state government has recently released a plan on transition to clean energy which includes a \$25 million fund for electric vehicles.
- **Electric vehicle advocacy groups.** Groups such as the Australian Electric Vehicle Association (AEVA) and the Electric Vehicle Council (EVC) provide compelling advocacy and continually review the situation on EV technologies and associated solutions.
- Knowledge resources, such as **Chargetogether** (2020)

Interventions

Strategic Planning

The first intervention focuses on the use of strategic planning within Council to expand EV charging infrastructure by making land available for the installation of public charging stations and requiring charging points as part of new developments. It also addresses the need to future proof new buildings and developments to enable easy installation of charging points at a later point. The emissions reductions resulting from this action relate to the subsequent increased uptake of electric vehicles, essentially addressing the barrier of availability of charging infrastructure.

Facilitate Installation by Private Charging Companies

With these locations identified and mapped out, the program can then facilitate discussions with key stakeholders that make them aware of the strategic planning process that has occurred and to identify and remove any remaining barriers to their participation in the activity. This may include discussions with EV charging companies, encouraging them to install infrastructure at key sites. It may include discussions with electricity distribution businesses on ensuring there are network connections at relevant sites. It may also include discussions with developers or car park managers to ensure that additional space is made available to charging companies for infrastructure.

Essentially, these interventions together are striving to create an accessible and well-planned rapid charging network across the City of Knox. With this achieved, there will be a sound enabling environment for the uptake of EVs by the community.

Impact

Electric vehicles are anticipated to have a very large impact over the coming 10 years, leading to an opportunity to create highly effective programs if adequately targeted and designed (see Figure 24).

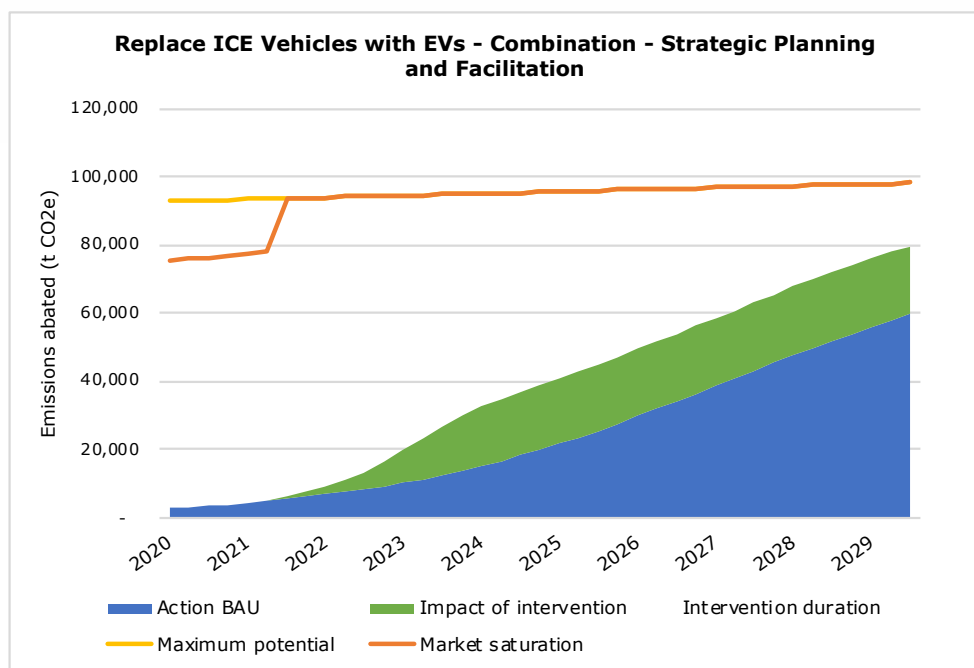


Figure 24: Estimated impact of EV charging interventions in Knox

The effectiveness of acting on EVs and charging infrastructure is something that involves an element of leadership from Council, in that this program won't have much impact if Council waits five years to take action. This also applies to corporate fleet upgrades (see Section 10.1).

Council will implement these interventions for three years, before reassessing the value of this program (see Table 6 for current costing estimates). It is anticipated that the market for EVs and charging infrastructure will change significantly in the coming ten years, so Council's decision on how to progress in this area should be influenced by the most recent information available.

Looking Forward

The Victorian State Government's Zero Emissions Vehicle Roadmap that is currently being developed could provide opportunities to leverage Council's efforts in this space. There could also be opportunities to build on the Federal Government's initiatives to assist businesses to trial new technology for fleets. These include hydrogen, electric and bio-fueled vehicles and installation of charging infrastructure at workplaces nationwide.

The key collaborators once the program moves on to the facilitation aspect are EV charging solution providers. A number of other stakeholders will also be brought into the program at key stages, including electricity distribution businesses, car park operators, Council planning departments, developers and others.

10.9 Changing the Future of Transport

This program is focused on reducing emissions from transport by reducing the incidence of car travel. Trips are instead taken using a car share service. Council's role is to support an increase in the use of car sharing services. In particular, Council will create an enabling environment for car sharing services through favourable policy settings, then engage with car sharing companies to facilitate their entry and expansion within the City of Knox.

Background

A mode shift towards alternative forms of transport is the most important part of reducing car travel. If strong public transport and active transport systems are operating, a shift towards a car-sharing economy becomes more viable. There are several car share service providers operating successfully in Australia. The emissions benefit to car-share programs is in enabling residents to forgo car ownership. Car-share programs typically operate most effectively where there is a strong public transport and cycling network or links to these networks as an end destination.

Emissions reduction through car share programs occurs in multiple ways. Firstly, it changes the convenience of car travel, meaning that people are more likely to seek alternative travel through public transport systems or active transport. It also introduces a pay-per-use mentality to car travel, further influencing a reduction in use. Car share programs often have newer vehicle fleets and minimum requirements for age and efficiency of vehicles, overall improving the efficiency of cars on the road. Finally, many car share programs in Australia are affiliated with carbon offsetting programs.

Barriers

The identified barriers to the uptake of car-sharing services include:

- **Social norms:** In Australia car ownership and travel by car as the main mode of transport are commonplace and for many, habitual. It may be considered against social norms to borrow a car or lend your car to strangers. The use of public transport in some parts of Australia may be considered an option targeted at those who are either of lower socio-economic status or young (e.g. travelling to school).
- **Fear of, or actual, inconvenience:** Whilst the actual inconvenience may not be as high as the perceived inconvenience, it is the perception that hinders uptake. The perception of inconvenience of public transport increases the fear of inconvenience. The possibility of being stranded, more travel time, and waiting for long periods is off-putting. Forgoing car ownership will mean that people may not always have instant access to a car. It also means that when using a car there may be a need to travel further afield to access a car instead of having access at home, or that there will be additional steps required to access the car.
- **Lack of local infrastructure:** Sustainable travel modes require supporting infrastructure. Car share companies for example need dedicated parking spaces with good access to public transport and cycling networks. Without access to these the program may not be able to function optimally.
- **Urban density and geography:** In areas where there is low urban density or challenging geography it will not always be possible or make financial sense to service these areas with car share services. In this case, car ownership will be necessary for residents.
- **Status associated with car ownership:** Not only a social norm, some community members associate their personal status or worth with car ownership. Where car ownership is not for the primary purpose of transport, e.g. people who own an expensive sports car or a vintage hobby car, this transition will not apply.

Interventions

Council's program will seek to create an environment where the use of car share services is viable and attractive, through policy support and facilitation:

Policy Support for Car Share Programs

When approaching increases to the uptake of car sharing, Council will first adopt a policy that promotes car share programs. This policy can focus 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.

Partner with Car Share Companies

Once this environment is established, Council can then facilitate discussions with car sharing companies to make them aware of the beneficial environment and available land space. Council can also seek to understand any further barriers to their entering or expanding their network within the City of Knox and work together with these companies to overcome the barriers.

Enablers

There are several enablers that can be considered when designing interventions in this area, as well as factors that may lead to substantial ongoing shift in transport patterns.

- **Google Environmental Insights Explorer (2020).** This is a new dataset that has been made available by Google. This dataset provides actual local-level data on transport, broken down by transport mode (including cycling and walking). This will assist with programs that seek to change transport patterns as it will facilitate tracking and evaluation.
- **Carshare and rideshare apps.** There are an increasing number of software applications that enable sharing of car resources (such as Car Next Door, which is already operating in Knox). These solutions are opening the options for travellers and may facilitate more consistent mode shift.
- **The Victorian State Government** currently operates 48 hybrid buses and during 2020 trialled its first fully electric bus. The Victorian Budget 2020/21 includes \$20 million dedicated towards a state trial for achieving a zero-emissions bus fleet.

Impact

Whilst, as with other interventions, there will be a point where a critical mass is achieved and Council intervention is no longer required, this is unlikely to be achieved within a three-year program (see Figure 25). Thus, it is recommended that Council implements the interventions listed here for three years, before reassessing the value of the program and making a decision on how to progress. See Table 6 for cost estimates of these interventions.

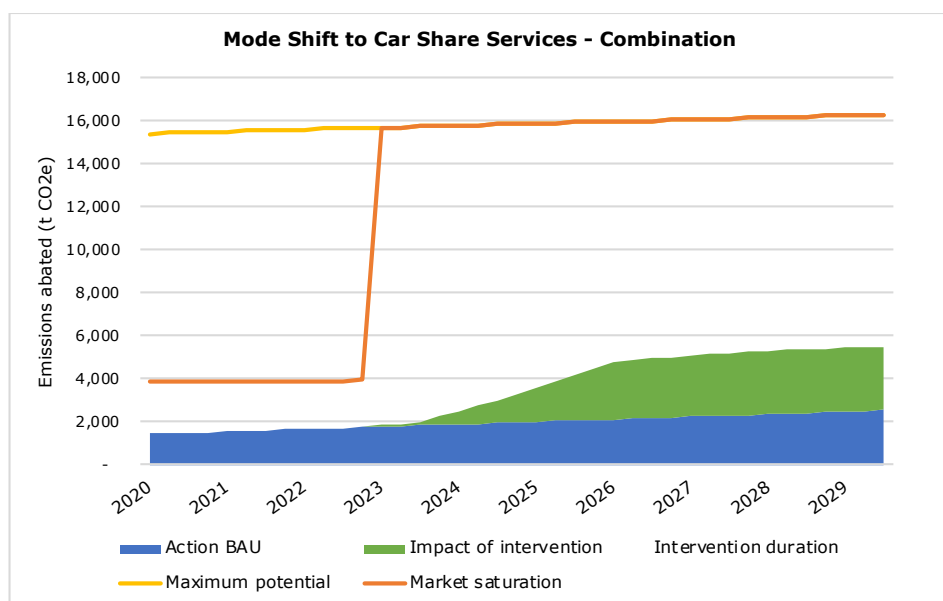


Figure 25: Estimated impact of mode shift to car share services interventions in Knox

Looking Forward

In the case of car-sharing, Council will seek to understand what could be offered to support car share companies to get established; for example, in terms of making available car parking spaces, and promoting individual companies to residents. In particular, Knox City Council will focus on areas around public transport hubs and the city centre.

Since many of the barriers in this action area are social and/or place specific, a key objective of the collaborative planning process will be to understand the nuances of these barriers on the ground. Council will need to have a strong understanding of how residents interact with existing modes of transport so that the interventions implemented can be targeted to the specific characteristics of the communities. Consultation with local communities and relevant community groups will be invaluable in providing this local context.

Once Council understands what is possible from an internal perspective this intervention then requires close engagement with car-share enterprises. These companies will have excellent models for what the impacts of their activities are and what factors influence take up. Examples of enterprises that could be involved in these discussions include Car Next Door (already operating in Knox), GoGet or FlexiCar, amongst others. Additionally, advocacy groups such as South East Melbourne Integrated Transport Group (SEMITG), and community groups should be included to ensure that any fears or other needs of the community are integrated into planning, and so that channels for communicating the intent of the intervention are established early.

10.10 Sustainable Roads and Infrastructure Building

Road construction is an area that Council has direct control over and by making simple changes to the use of materials as well as adjustments to infrastructure guidelines in-line with Department of Transport (DoT) specifications, significant emissions savings can be realised. Council's infrastructure guidelines will be updated with lower emissions DoT specifications.

Background

Council constructs, specifies, and fixes many kilometres of road each year. This construction and maintenance work produces large amounts of greenhouse gas emissions. However, there is wide scale potential for using recycled or lower footprint materials in all aspects of road construction and maintenance as well as lower emission processes such as warm mix asphalt.

There are also many opportunities to lower the emissions from the provisions and maintenance of other hard surface infrastructure. This action can cover a range of works including:

- Roads;
- Footpaths and driveway cross overs;
- Shared paths;
- Car parks;
- Drainage and water infrastructure; and
- Outdoor sporting courts such as tennis, netball, basketball and skating.

This represents a very cost-effective area for Council to take action on and, as Council has significant control over this emissions source, the level of certainty that the project will be successful is high. Updating infrastructure specifications should also be considered important. There are many opportunities within Department of Transport (DoT, formerly VicRoads) specifications to require low emissions roads and pathways without changing specifications. This includes all aspects of road and pathway construction and repair, from the road base to resurfacing. Importantly, the emissions from the concrete in kerb and channel and paths is as much as that from the road and asphalt. Knox can provide leadership to other councils to do the same and, where required, work with DoT to improve requirements. As a relatively low-cost program to implement it could generate much larger impacts externally through influence.

The table below outlines some of the best practice approaches that could be adopted for reducing emissions from the range of normal construction areas. DoT specifies through codes of practice the requirements for road and path building materials.

Table 8: Example differences between specifications

Scenario	Infrastructure type	Description
Standard Specification	Asphalt	Asphalt, standard hot mix, 5.5% virgin bitumen (0% RAP).
	Kerb & Channel	N25 portland cement-based concrete.
Partial Sustainable Specification	Asphalt	As per standard specification and warm mix.
	Kerb & Channel	As per standard specification and assume 50% geopolymer instead of portland cement (25% slag, 25% flyash).
Leading Sustainable Specification	Asphalt	Asphalt, warm mix, 3.5-4.4% virgin bitumen (20-40% RAP). Asphalt is to include maximum amount of recycled material as per relevant state specification.
	Kerb & Channel	As per standard specification and assume 100% geopolymer instead of portland cement (50% slag, 50% flyash).

Barriers

The identified barriers for this action are:

- **Knowledge and technical capacity:** There are still relatively few practitioners in Australia who have experience with the slightly different processes associated with these materials.
- **Procurement issues:** Because there has not been substantial demand for these products to date, it can be challenging to find good procurement channels. Generally, it will require service providers to source new procurement channels, which they may be resistant to doing.
- **Upfront costs:** Use of innovative materials and the associated supply chain challenges may incur an increase in costs which will have to be justified within Council.
- **Concerns around safety and durability:** As this is an innovative specification there are few examples of how the materials perform in situ over time. There may be a requirement from within Council for more research and development before implementation.
- **Specifications:** Both Council and external specifications can reduce the ability of Council to create low emission roads. Influencing the VPA specifications may take longer than any internal action Council can take but will have significantly higher impact on emissions.

Enablers

The most significant enabler for this solution is the price parity and function equivalence of sustainable concrete and asphalt materials for many applications. This ensures that transitioning to these products will be straight forward.

Interventions

Council will update infrastructure guidelines and processes to include the following requirements, in-line with relevant DoT Specifications:

- Use of low carbon recycled priority materials (glass, plastic, rubber, paper or cardboard) in Council infrastructure projects

- Use of recycled civil materials (e.g. soil, rock, crushed concrete, recycled asphalt pavement) in Council infrastructure projects
- Review of road and path designs to identify design changes that can reduce the use of materials. This may also be an opportunity to review the volume of hard surfacing and opportunities to introduce more non-permeable and green space within relevant streetscapes (especially residential roads and key precincts).
- Importantly it is recommended Council implement simple changes in the short term (first 12 months) and then initiate an internal working group to progress some of the longer-term elements that require investigation or detailed consultation over time.

Impact

It can clearly be seen from Figure 26 below that Council has a large degree of influence on this intervention with a significant positive impact.

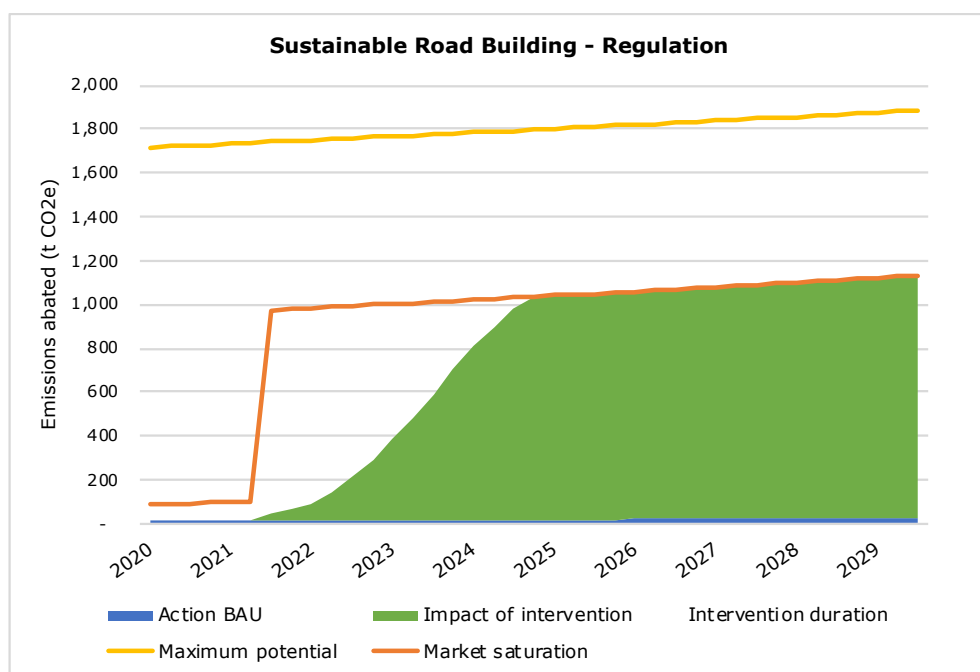


Figure 26: Estimated impact of sustainable road building intervention in Knox

Looking Forward

Knox City Council will build on the existing Sustainable Buildings and Infrastructure Policy, which outlines that certain new infrastructure projects should aim to use a minimum of 5% recycled content for concrete construction works such as roads and footpaths. There is an opportunity for Council to suggest a regional approach involving the councils that are a part of Eastern Alliance for Greenhouse Action (EAGA).

Because of the role that Council plays in road building, there is only limited need for collaboration on this action. One area that would be sensible to focus on, however, is the need for improved capacity and procurement capabilities within local service providers. A first step would be to discuss with service providers the capacity of existing supply chains and understand if there are any barriers to Council implementing this action successfully. Further, a close working relationship with DoT will ensure a leading sustainability specification can be designed within the requirements for road and pathway building in Victoria.

10.11 Vulnerable populations

Background

Supporting the health and well-being of vulnerable members of the community is a strategic priority for Knox City Council. This includes older people and people living with a disability. Noting the potential impacts of climate change, a key area for action is to improve the physical health of the community given the health risks to vulnerable populations. This is specifically in relation to the increased frequency of heatwaves and storms, which may exacerbate existing health sensitivities, accommodation stress, and isolation.

Barriers

Responding to climate hazards in a coordinated way to support community wellbeing is recognised as a new and emerging area of work in Council that requires reconsideration of responsibilities and how to work together across teams. This will involve different functions including Emergency Management, Community Access and Support, City Futures and Community Infrastructure.

While all of the actions are considered to be technically feasible, there remains a number of barriers to implementation. Primary amongst these is how Council will agree to the decision making process for determining how accessible relief centres, emergency accommodation and information are provided during a climate event by taking people with disabilities and their needs into account.

Interventions

In the immediate short term, priority adaptation actions that Council has already identified through existing programs and should continue include:

- Maintain a register of vulnerable persons in the community and checking on their health and well-being leading into and during extreme weather events.
- Develop stronger links with the older persons community to enhance trust and access, including by working with community groups and service providers.

Both actions are considered to be achievable with low cost in the first instance, although it is recognised that they are only part of the risk mitigation response and will be required in conjunction with other actions.

A range of new actions are also identified that are not part of current Council programs. Priorities for the short term include the following:

- Undertake upfront planning and clearly define responsibilities to better coordinate service providers involved in delivering assistance to older persons during emergency events. This includes service providers catering to intersecting sensitivities such as disability, pre-existing health issues, and people who are culturally and linguistically diverse (CALD). This action will require maintenance of a register of vulnerable people, which is noted as an existing priority action.
- Identify areas where urban heat islands intersect with vulnerable populations. Urban heat is well established as having a disproportionate impact on vulnerable members of the community, especially the elderly and people living with a disability.
- Undertake a prioritisation process for investment in urban cooling measures, once areas at the intersection of urban heat and vulnerable members of the community are identified.
- Provide targeted support by developing and prioritising a register of vulnerable persons, based on areas of urban heat islands. This can assist with advanced planning by Council and other emergency services providers. Triggers from the extreme heat management plan already adopted by Council will be integrated into this approach.

All of the additional actions outlined above are considered to be low cost but provide only part of the required risk mitigation response. Given that this is true for all short term priority actions, in trying to meet Council's objective to improve the physical health of its community given the health risks from the increased frequency of heatwaves and storms, close attention will need to be paid to how a program of works is resourced and coordinated.

10.12 Biodiversity

Background

Biodiversity and more broadly the protection and enhancement of the natural environment is a well-established priority for Knox City Council. As such, a key area of action is to protect and buffer the current areas of high biodiversity value and the natural environment from the effects of climate change, whilst enhancing the natural environment. Of note is the increased likelihood and severity of acute and chronic climate stressors that will affect both vegetation and biodiversity (see Section 7).

Barriers

The impact of climate change on biodiversity will be dependent on the actions that are taken now and into the future. The design of streetscapes including the planting of street trees, inclusion of water sensitive urban design assets, vegetation and grassed areas can help to reduce urban temperatures and provide biodiversity and habitat benefit.

There are several barriers to achieving these objectives, including the:

- Increased urbanisation, through the subdivision of residential land and the associated challenge of reduced available land for nature strips;
- Perception of a conflict between large canopy trees and photovoltaic panels;
- Potential conflicts between pavement condition and street tree choices that can result in footpath cracking; and
- Availability of land for new plantings as more private land is converted to buildings and impermeable surfaces.

Interventions

In the immediate short-term, the priority actions already occurring at Knox City Council through existing programs that should be continued include:

- The construction and incorporation of water sensitive urban design assets within council reserves to support the management of peak stormwater flows and to assist in water retention.
- The design and maintenance of council reserves to support conservation of species recovery of bushfire affected areas.

Both of these actions are considered to be limited in the extent to which they support the objectives of Council in climate change adaptation, and therefore additional risk mitigation responses are required.

A suite of new and suggested actions that are not part of current Council programs are listed as future priority actions. This includes the following:

- Seek to strongly discourage or investigate planning responses that aim to ensure that homes are not built in high bushfire risk areas. This action requires a planning response and arises from a need to separate areas of high biodiversity and native vegetation from potential conflict areas including residential and commercial areas.
- Improve vegetation resilience to fire through the development of a fire management plan that allows for vegetation to adapt to future changes in climate patterns. This will help reduce the vulnerability of regional biodiversity to bushfire.

- Prioritise street tree plantings to provide the greatest urban heat island mitigation benefits. Despite the strong drive for increasing the area of tree canopy in councils around Australia, there often is no systematic way of prioritising plantings to deliver the greatest heat mitigation benefits.
- Obtain advice on liability issues relating to tree maintenance and pest management as the potential of risk to Council is exacerbated through the effects of climate change.
- Undertake an Urban Forest Strategy to improve connectivity and mitigate fragmentation through a registry of green assets, both in the public and private realm. This includes evidence based tree canopy targets linked to future planting requirements and long-term financial forecasting. Council has recently approved funding for a Biodiversity Resilience Plan which could consider elements of an Urban Forest Strategy.
- Establish a more climate resilient plant species mix to provide improved resilience against hotter and drier future conditions as part of a street tree planting program.
- Improve Council wide tree planting diversity that incorporates both native species for biodiversity benefits and introduced species for improved cooling benefits.
- Develop a lower impact approach to vegetation management through collaborating with power network managers to develop an innovative approach to vegetation clearance near power lines.
- Revise streetscape models to minimise damage to existing infrastructure assets resulting from poor street tree selection.
- Investigate the preparation and inclusion of additional planning provisions to minimise development from occurring in high bushfire risk areas.

Most of the new and suggested actions outlined above are classed as low cost, with the exception of additional tree plantings which may require additional budget. Given the breadth of actions, work will be required to ensure that the implementation of these programs is coordinated to achieve Council's target to enhance and protect the natural environment from the impacts of climate change.

10.13 Buildings

Background

Knox City Council has a responsibility to ensure the continued operation of Council facilities including the quality and effectiveness of associated services and safety of users. Ensuring the continuity of services and operations through a projected increase in the frequency and intensity of extreme weather events is a strategic target for Council.

Barriers

Climate change presents risks to most Council assets including buildings. Critical to managing these risks is designing and actioning policy that reflects the needs of the organisation and the community to adapt to climate change through the creation, repair and maintenance of resilient buildings. The Sustainable Building and Infrastructure Policy does not mention climate risk or adaptation at present. This represents a significant barrier in planning for and responding to climate change and should be addressed to support implementation of future adaptation actions. This will require input from multiple functional areas within Council to ensure an integrated response.

Interventions

The primary building related program for adapting to the impacts of climate change is the incorporation of proactive climate risk mitigation measures into the schedule of Council's facilities maintenance. While still important, this was not identified as a priority action during the analysis undertaken as part of developing this Plan due to both the ongoing budget of this program and the extent to which the actions of the program mitigate risk.

Several new actions that are not currently part of Council programs were identified. Priorities for the short-term include:

- Engage with the facility operators (Council and third party) to establish safe operating levels for facilities that are at risk of being impacted by climate stressors.

- Incorporate climate variables and future climate risk into building condition assessments to ensure that climate stressors, such as storms, bushfires, floods and heatwaves are considered.
- Develop a site-specific strategy for the ongoing provision of sporting facilities during extreme droughts. This may include staged upgrades over an extended period to ensure sufficient onsite water management, or the sharing of sporting facilities among surrounding councils to address increased operating costs.
- Ensure that a future planning and design criterion directs that critical facilities and emergency services are located in accessible and resilient locations. The Climate Change Risk Assessment found that a number of Council facilities have been developed in areas with potential climate hazard risk exposure due to land use pressures within the municipality.
- Review and update climate hazard mapping to ensure that planning decisions account for areas of future and current risk.

Council policies related to buildings and infrastructure should be reviewed to identify those that are competing or counter to each other. A result of this review should be recommendations on how to streamline future policies.

While almost all of the risk interventions were considered to be technologically and environmentally feasible, strategically aligned and having the support of the community, the primary differentiators are cost and the extent to which the action will mitigate risk. With the exception of one action - Council facilities and emergency services being suitably located - all others were considered to have a low to medium extent of mitigating risk meaning that a program of works and activities will be required.

The additional actions listed above are all considered low cost because they primarily relate to policy development and planning reforms. However, Council should expect that in the future as policies are implemented, the costs of retrofitting may be significant and should be factored into asset management plans and long-term financial plans.

10.14 Infrastructure

Background

Ensuring the continued provision of public infrastructure is a strategic priority for Knox City Council. This includes the delivery of high quality and effective associated services and the safety of infrastructure users. Impacts from climate change on infrastructure that will need to be addressed include floods, bushfires, extreme temperatures and storms that can lead to increased maintenance and operational requirements and costs.

Barriers

The construction, maintenance and repair of infrastructure is core Council business and climate change scenarios are already being considered for current assets, however, there are a number of assets that will need to be enhanced in the future. A potential barrier to this is aligning the requirements of different functional areas of Council to the extent of which upgrades need to address climate change. Addressing this will require a more collaborative approach to agreement on enhancement. This could be achieved through adopting a more place centric design approach that considers multiple issues in the design process. The requirement and approach to enhancement will need to be explicitly addressed in asset management plans.

Interventions

Three existing immediate short-term priority adaptation actions already implemented through existing programs and that should continue include:

- Establish controls in Council's planning scheme to ensure suitable building standards and stormwater measures are implemented in new developments with high flood risk identified in the planning overlays.
- Educating residents on measures they can take to mitigate flood risks on their property. For example, through the provision of guides and factsheets.
- Incorporate requirements for stormwater and drainage infrastructure upgrades into road renewal programs.

All three of these adaptation actions are considered low cost, however, each action in its own right contributes but does not address in full the risk mitigation requirements identified for infrastructure.

A range of new actions were identified that are not a part of current Council programs. Priorities for the short term include:

- Seek legal advice regarding the liability associated with climatic events that have the potential to impact users. The operation and maintenance of stormwater infrastructure, roads and pathways was identified as an area of potentially high liability risk for Council.
- Engage with service providers to signal the importance of being prepared for future climate risks, learn from their practices, identify potential points of intersection with Council services and areas where collaboration might be mutually beneficial. Private or public sector providers delivering essential, transport and waste services are responsible for continuity and safety and are likely to have their own adaptation plans.
- Seek to access capital to support risk mitigation works linked to climate change, though it will require detailed financial impact analysis studies.
- Review and update climate hazard mapping to ensure that planning decisions account for areas of future as well as current risk.
- Identify infrastructure that may be required as retreat, as a long-term adaptation measure due to flood or fire risk. While such a response may not be required immediately, early identification can provide Council with time to sufficiently engage the community around the need for major impacts on asset location and service delivery.

The costs of the new and suggested adaptation actions are considered low given that they primarily relate to planning for the impacts of climate change. As a result, the extent to which each individual action mitigates risk is considered low to medium. It is important that Council continue to assess and respond to infrastructure related climate risk over time and develop pathways to resilience as new risks are determined.