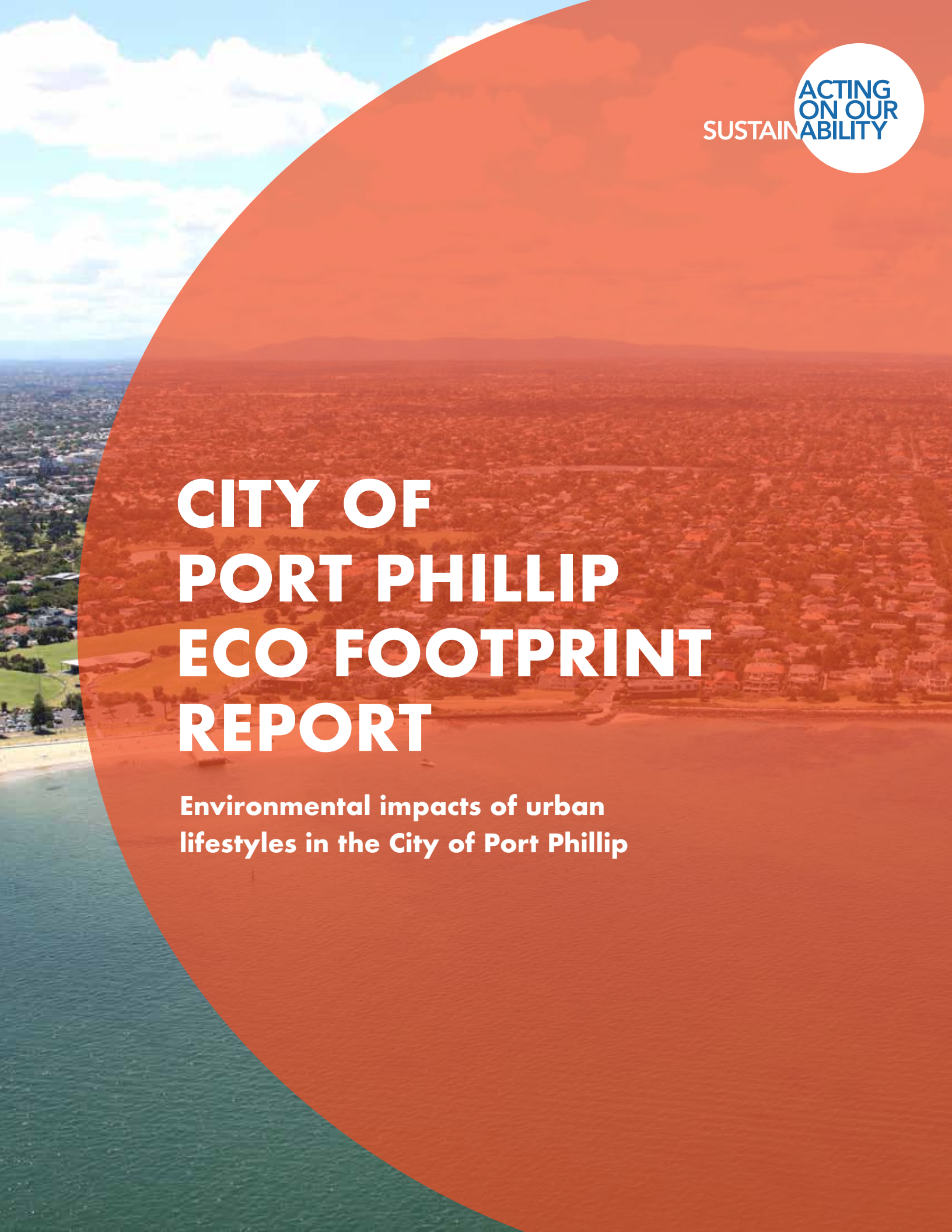

ACTING ON OUR SUSTAINABILITY

CITY OF PORT PHILLIP ECO FOOTPRINT REPORT

Environmental impacts of urban lifestyles in the City of Port Phillip

Project partners:
The University of Melbourne
Melbourne Sustainable Society Institute
The City of Port Phillip

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For enquiries about this report, contact:
Dr Seona Candy at MSSI
candys@unimelb.edu.au

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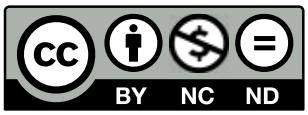

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Executive Summary

This project investigated the environmental impacts of urban lifestyles in the City of Port Phillip, a beach side municipal council area in the Greater Melbourne region. Two key aspects were explored:

- The city's current and future environmental footprint – the natural resources required to support urban lifestyles and the greenhouse gas emissions and waste generated.
- Opportunities to reduce this footprint and increase the sustainability of the city.

The key findings of this research were:

- 48,294 square metres per person are required to support urban lifestyles in the City of Port Phillip, over four times the size of Luna Park.
- 3,808 litres of water are required per person per day, more than twelve times per capita household water usage.
- The average per capita carbon footprint is 29,798 kg per year, equivalent to the emissions generated by running twelve average passenger cars over the same period.
- An average resident of the City of Port Phillip will generate almost 12 kg of waste per day. This includes not only household waste, but also waste generated earlier in the supply chain.
- Overall, in 2018 the City of Port Philip requires 5,482 square kilometres of land and 155,775 million litres of water per year, and is responsible for the production of 3.4 million tonnes of greenhouse gas emissions and 503,709 tonnes of waste per year.
- In 2050, in a business as usual scenario, the city's total environmental footprint per year would increase to 6,183 square kilometres of land, 262,650 million litres of water, 4.8 million tonnes of greenhouse gas emissions and 1.2 million tonnes of waste.
- Potential strategies to reduce the environmental footprint of the City of Port Phillip include better insulating homes, reducing unnecessary consumption of goods and services or recycling existing goods, reducing consumption of environmentally intensive foods such as red meat, switching to renewable

electricity generation, reducing car use, reducing consumption of imported goods and divesting superannuation and investment portfolios away from fossil fuels.

- A quantitative 'EcoFuture' scenario was developed based on these strategies and on previous footprinting scenarios. It extended them to investigate the combined effects of changes across multiple sectors on multiple environmental impacts at a local council level.

- The results show the first iteration of this combined approach. It was found that in 2050, compared to business as usual:

    - The land footprint could be reduced by 15% to 5,280 square kilometres

    - The water footprint could be reduced by 39% to 160,007 million litres per year

    - The carbon footprint could be reduced by 65% to 1.6 million tonnes

    - The waste footprint could be reduced by 83% to 208,183 tonnes per year.

- Although these all represent significant reductions, the per capita footprint figures for land, water and carbon are still higher than recommended sustainable levels to varying degrees. This indicates that more iterations are needed but were unfortunately beyond the scope of this report.

- The results do, however, indicate the directions to follow to make progress towards meeting these recommended sustainable levels. They also show which strategies have complementary benefits across different environmental impacts, making it possible to identify synergies and prioritise areas for action. These include:

    - Reducing overall consumption of goods

    - Switching from fossil-fuel powered to clean, renewable energy

    - Changing diets, particularly lowering red meat consumption, and reducing food waste.

- To facilitate these strategies, the City of Port Phillip council should:

    - Support sharing, repairing and recycling programs and initiatives to reduce overall consumption of goods

    - Advocate for the decarbonisation of state electricity generation.

- Encourage and support City of Port Phillip residents to switch to green power to drive change in the energy sector, and support or expand clean energy programs within City of Port Phillip boundaries.
- Educate residents about the environmental impacts of current diets and strategies to avoid food waste.

Introduction
1.0

Urban lifestyles and activities consume resources from the environment and produce waste and emissions that the environment must then deal with. Although urban areas cover just 3% of the world's land surface, they are responsible for 53-87% of global CO_2 emissions[1]. They are also reliant on significant resources such as land and water from outside urban boundaries.

Due to effective and seemingly invisible supply systems and processes, urban dwellers are often unaware of the potential reach of their activities and their actual impact on the environment. They are also often unaware of their vulnerability to climate change impacts and, more importantly, the economic and cultural power of urban centres and their potential role to create change and improve sustainability both inside and outside city boundaries.

This project investigates the environmental impacts of urban lifestyles in the City of Port Phillip, a beach side municipal council area in the Greater Melbourne region. Two key aspects are explored:

- The city's current and future environmental footprint – the natural resources required to support urban lifestyles and the greenhouse gas emissions generated.

- Opportunities to reduce this footprint and increase the sustainability of the city.

For the purposes of this investigation, 'sustainability' means meeting our needs and living our lives while not using more than our fair share of global resources and without compromising the ability of future generations to do the same.

Lifestyles in the City of Port Phillip are supported by a complex socio-ecological system, and its footprint extends far beyond Victoria to other states of Australia and also to other countries. This investigation extends previous estimates by taking into account all embodied environmental impacts of urban lifestyles, not just those within the geographical city area. Few, if any, other city councils have attempted to quantify environmental impacts of urban lifestyles in this way. This places the City of Port Phillip Council as a leader in this respect.

The Australian Stocks and Flows Framework, a simulation platform that links resource use and environmental impacts with the supply of food,

1 Seto, K. C., Dhakal, S., Bigio, A., Blanco, H., Delgado, G. C., Dewar, D., ... Ramaswami, A. (2014), 'Human Settlements, Infrastructure and Spatial Planning', in Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Edenhofer, O., Pichs- Madruga, R., Sokona, Y et al (Eds.). Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press

housing or other goods and services in the Australian economy, is used to determine the ecological footprint. The results will be communicated via both written and visual forms. Alongside the project report, the ecological footprint will be represented as an infographic accompanied by ‘day in the life’ narratives describing future lifestyles.

Narratives are an effective way to engage people by personalising the ecological footprint data, connecting it to a bigger picture and helping them to envision a positive and more sustainable future.

The report is structured as follows:

- Section 2 outlines the details of our approach for calculating and communicating the environmental footprint for the City of Port Phillip.
- Section 3 gives an overview of local demographics and urban lifestyles.
- In Section 4 the results of the environmental footprint calculations are presented.
- Section 5 briefly shows how some of the footprint data has been presented as an infographic.
- In Section 6 opportunities to reduce the environmental impact of lifestyle in the City of Port Phillip are discussed and supported by case studies of existing examples in other areas. Some of these aspects are incorporated into a future scenario for the city in the form of day-in-the-life narratives. These are then translated into quantitative settings and modelled to explore their collective impact on the environmental footprint of the city.
- Section 7 outlines the main conclusions from this study.


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Our approach 2.0

This urban environmental footprint for the City of Port Phillip assesses the environmental impact of the city by quantifying the natural resources that are required to support urban lifestyles now and in 2050. It draws on the mainstream concept of an ecological footprint[2] but extends it to include multiple environmental impacts - not only the land required to support urban activities, but also the water used, greenhouse gas emissions and waste generated.

It is calculated using a consumption-based accounting approach including both direct and indirect environmental impacts. Direct impacts, like household water use and emissions from vehicle exhaust or burning gas to heat houses, occur within city boundaries. Indirect or embodied environmental impacts are associated with the production of goods and services that support urban lifestyles but are usually generated outside the city, like food production, manufacturing of household appliances and the generation of electricity.

The tool that will be used to do the calculation is the Australian Stocks and Flows Framework (ASFF)[3]. ASFF is a scenario modelling platform for assessing environmental sustainability challenges in Australia and potential solutions. It tracks the supply of resources – like land, water and minerals – and it models the physical processes by which those resources are converted into food, housing or other goods and services in the Australian economy. It also provides the ability to examine mechanisms to reduce environmental impacts in alternative future scenarios, and to determine flow on effects such as material implications or economic impacts.

ASFF has similarities to both input-output analysis and Life Cycle Analysis, which have been used elsewhere for ecological footprinting, but is more transparent because it draws from a comprehensive and explicit account of economic activities.

Because ASFF is a model of the Australian physical economy, it does not include simulations of processes that occur outside Australia, i.e. the resources used and environmental impacts of goods produced in other countries. It does however, have means of calculating these quantities for goods produced for export.

In order to maintain a stable trade balance, the amount that Australia exports determines how much it can import. For this reason, in the calculation of the overall environmental footprint for the City of Port Phillip we have made the assumption that the resources used and environmental

2 EPA Victoria (2008) Victoria's Ecological Footprint, Melbourne: EPA Victoria and the Commissioner for Environmental Sustainability

3 Turner, G., Hoffman, R., McInnis, B., Poldy, F. and Foran, B. (2011) A tool for strategic biophysical assessment of a national economy: The Australian stocks and flows framework, Environmental Modelling & Software, 26 1134-1149.

impacts generated in the production of goods for export are equivalent to those that are generated in the production of imported goods.

ASFF has been used successfully at a capital city level to calculate the environmental impacts of feeding Melbourne as part of the Foodprint Melbourne project[4], and to calculate current and future city carbon footprints for the Visions and Pathways 2040 (VP2040) project[5].

While the Foodprint Melbourne project investigated one sector and multiple environmental impacts, and the VP2040 project investigated multiple sectors and one environmental impact, this investigation goes one step further to calculate multiple environmental impacts from multiple sectors. It also calculates these impacts at a municipal council level, something which has not been attempted previously.

The key elements of our approach were as follows:

- Household Expenditure Survey (HES) spatial data[6] from the Australian Bureau of Statistics, some local data[7] and previously derived average diet profiles[8] were used to create a City of Port Phillip consumption index (essentially a lifestyle profile) relative to state levels.

- This profile was then used to apportion activities to the City of Port Phillip from which the amount of land and water required to support urban lifestyles, and also the associated greenhouse gas emissions and waste, could be estimated from larger scale data sets (e.g at State level).

- This generated the city's current footprint and the 'business as usual' footprint for 2050, based on projected consumption and production trends within ASFF (2050 BAU scenario). Some of the results were also used to create an infographic to communicate the key findings to the public.

- ASFF findings about the City of Port Phillip's footprint were validated against external sources of data, such as industry and local government reports, and expert consultation.

- Opportunities to improve the sustainability of typical lifestyles in the City of Port Phillip were identified, based on the current ecological footprint and a review of examples of sustainable initiatives in other locations.

4 Sheridan, J., Carey, R. and Candy, S. (2016) Melbourne's Foodprint: What does it take to feed a city?, Victorian Eco-Innovation Lab, The University of Melbourne.

5 Candy, S, Larsen, K, Twomey, P, McGrail, S, & Ryan, C (2017) Pathways 2040. Results from Visions and Pathways 2040: Scenarios and Pathways to Low Carbon Living, Melbourne, Australia

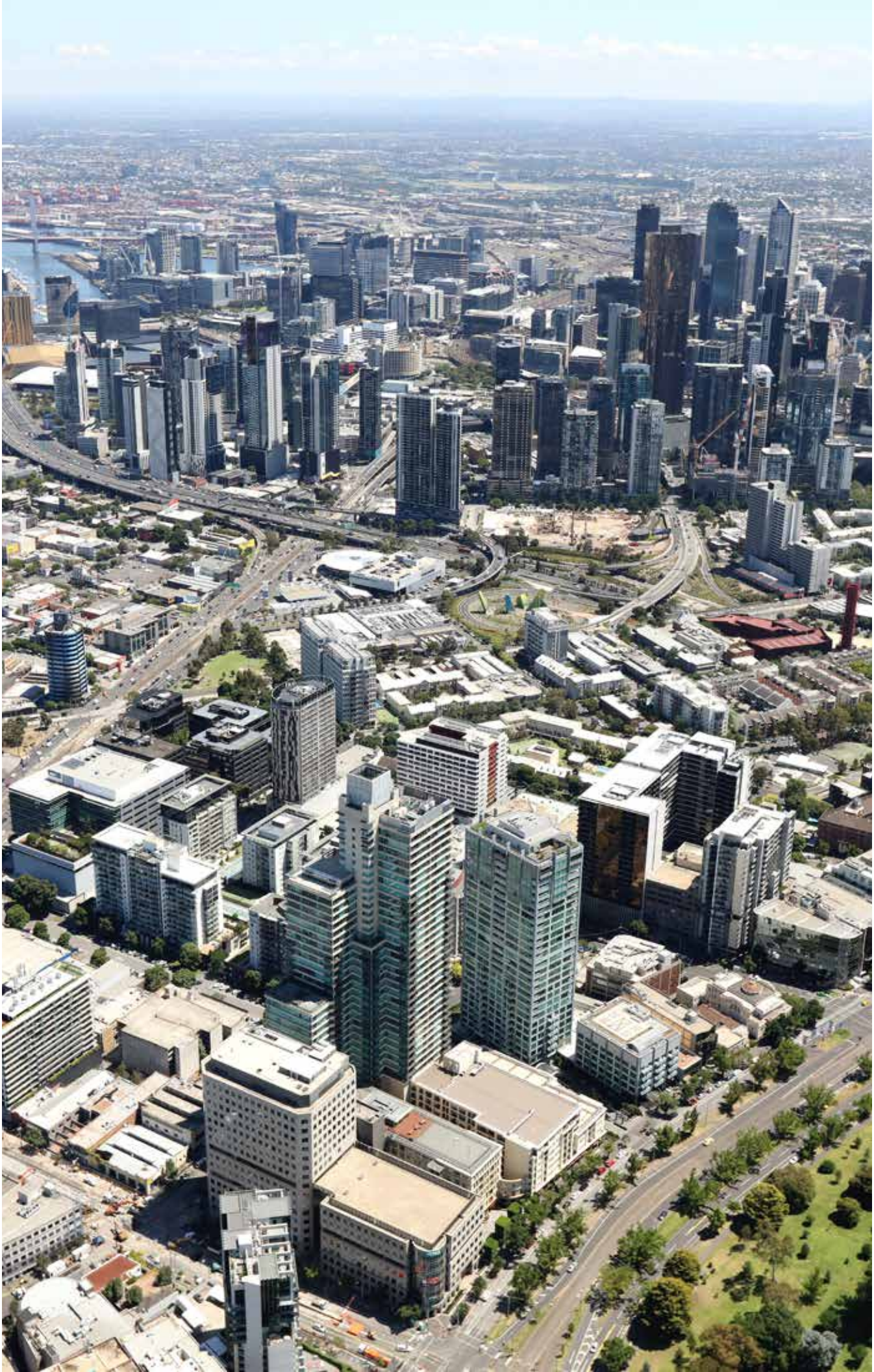
6 http://abs.gov.au/household-expenditure

7 https://profile.id.com.au/port-phillip/

8 Turner, et al (2017) 'Squandering Australia's Food Security— the Environmental and Economic Costs of our Unhealthy Diet and the Policy Path We're On', Journal of Cleaner Production.

- These opportunities were combined to create the ‘2050 EcoFuture’ scenario and translated into quantitative settings in ASFF to model the extent to which they could improve the ecological footprint of the City of Port Phillip in the future towards more sustainable levels. These results were supported by the development of ‘day in the life’ narratives to communicate to both the public and policy makers what a more sustainable lifestyle might look like on a day-to-day basis.

The EcoFuture scenario builds on previous scenarios that focused on either how changes across one sector affected multiple environmental impacts, or how changes across multiple sectors affected one environmental impact. The results of the EcoFuture scenario modelling should be viewed as the first iteration of bringing these earlier perspectives together to envision the effects of changes across multiple sectors on multiple environmental impacts at a local council level. Although further iterations might be needed to reach sustainable levels, initial results highlighted where action needs to be taken and how existing sustainability strategies could be strengthened.



Overview of lifestyles in the City of Port Phillip 3.0

The City of Port Phillip is a beach side municipal council southeast of Melbourne, extending some 11km along the coastline of Port Phillip Bay. The natural beauty of the bay and the many leafy gardens, parks and lake areas located throughout the area all help make the City of Port Phillip a desirable place to live and work. The 11 suburbs that comprise this council area are diverse; from the fast growing high rises along the bay and other growth corridors, to established tree lined heritage areas.

Approximately 110,397[9] people live in the City of Port Phillip and this number is predicted to grow by over 53% by 2041[10]. Spread over an area of 21 square kilometres[11], it is the most densely populated council area in Victoria, with close to 90% of residents living in either high or medium density dwellings[12].

Around 50% of the population rent their home[13], but the percentage varies greatly between suburbs. For example whilst more than half of the residents in St Kilda rent, in Albert Park more residents own their home or are paying off a mortgage. Household income is similarly varied between the 11 suburbs - Middle Park has a median household income more than 60% higher than those nearby in Ripponlea. Culturally, around 30% of residents in the City of Port Phillip were born overseas[14] and 21%[15] of residents speak a language other than English at home.

One thing that all residents in the City of Port Phillip have in common though is their dependence on goods and services to sustain their lifestyles, which depend on natural resources outside the Council's boundaries. Figure 1 shows average levels of household expenditure on goods and services across different suburbs, with a comparison to average levels for Australia and Greater Melbourne. It is clear that household expenditure, and in most cases overall consumption, in all suburbs in the City of Port Phillip is higher than both the Australian average and the average for Greater Melbourne.

9 ABS estimated residential population in 2017 https://profile.id.com.au/port-phillip/population

10 ABS estimated residential population in 2041 https://forecast.id.com.au/port-phillip

11 City of Port Phillip land area https://profile.id.com.au/port-phillip

12 ABS estimated dwelling size https://profile.id.com.au/port-phillip/dwellings

13 ABS estimated housing tenure https://profile.id.com.au/port-phillip/tenure

14 ABS estimated population data https://profile.id.com.au/port-phillip/population

15 ABS estimated ethnicity data https://profile.id.com.au/port-phillip/language?BMACOIID=10

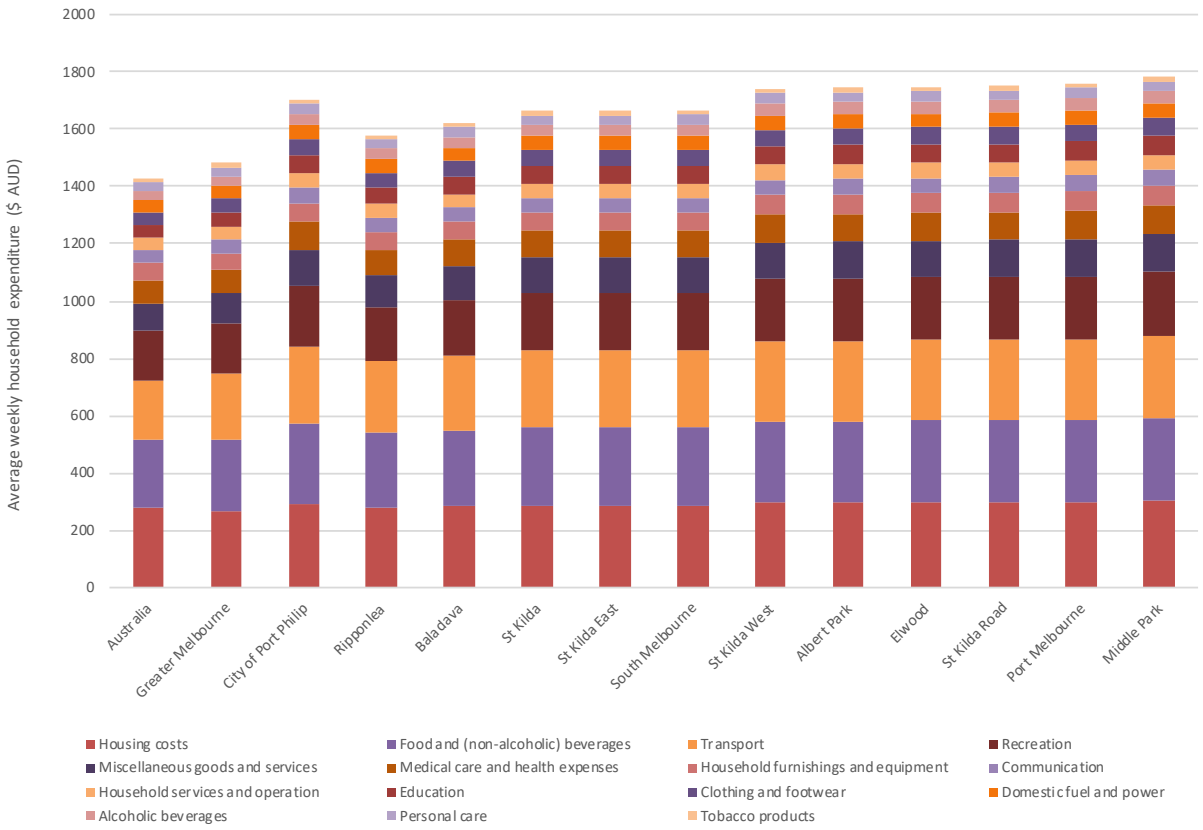


Figure 1 - Average weekly household expenditure on goods and services ($)

Various strategies and reports have highlighted the challenges and opportunities for creating a more sustainable City of Port Phillip, focusing on topics such as water use[16], transport[17], waste[18], urban design[19] and climate change [20]. The sustainable environment strategy Towards Zero[21] emphasises the need for public behaviour change to achieve the Council's overall sustainability goals. However the Sustainability City Community Action Plan[22] notes that in the years since Towards Zero was released, community action regarding the adoption of more sustainable lifestyles has been less successful.

This report complements these previous strategies and studies, but focuses specifically on the environmental impact of resident's lifestyles. In doing so, this report aims to both foster public understanding of their own personal environmental impact, and, in turn, help inform future Council policies and strategies to assist members of the community to adopt more sustainable lifestyles.

16 City of Port Phillip (2010) Water Plan - Toward a Water Sensitive City, City of Port Phillip

17 City of Port Phillip (2014) Sustainable Transport Strategy A Connected and Liveable City, City of Port Phillip

18 City of Port Phillip (2009) Waste Management and Resource Recovery Plan 2009 – 2014, City of Port Phillip

19 City of Port Phillip (2011) Sustainable Design Strategy, City of Port Phillip

20 City of Port Phillip (2010) Climate Adaptation Plan, City of Port Phillip

21 City of Port Phillip (2007) Towards Zero - Sustainable Environment Strategy, City of Port Phillip

22 City of Port Phillip (2017) Sustainable City Community Action Plan, City of Port Phillip

Environmental Footprint of City of Port Phillip 4.0

In this section the current environmental footprint for the City of Port Phillip is presented, along with the projected environmental footprint for 2050, according to an established 'business as usual' (BAU) scenario previously created in ASFF[23]. Estimates of per capita and total footprint figures are calculated for land, water, carbon emissions and waste.

The total footprint figures were calculated based on the assumption that the population of the city would be113,512 in 2018 and 190,000 in 2050. The 2018 population figure came from local population forecasts[24]. Since these forecasts only extend to 2041, the estimation of the population in 2050 was derived using a linear extrapolation based on 2016 and 2041 population figures (see Figure 2).

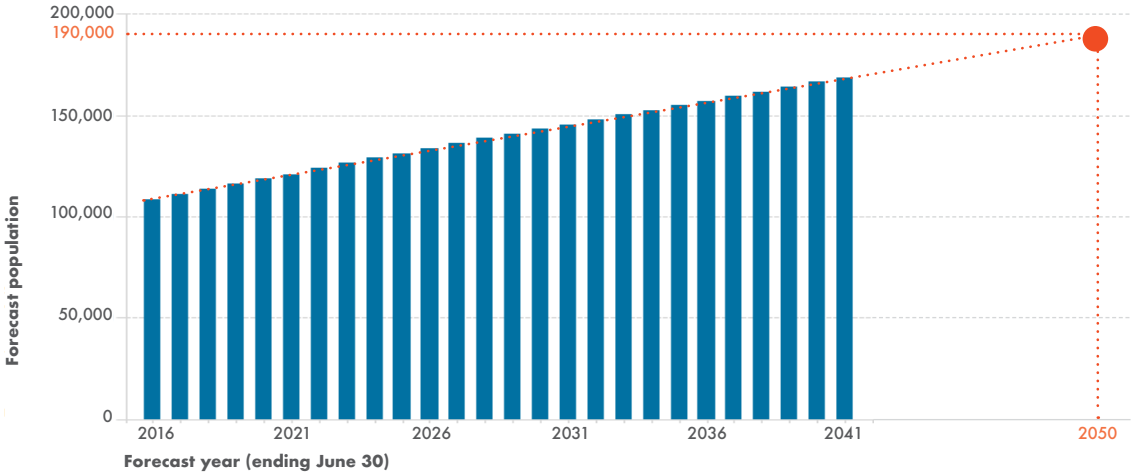


Figure 2 – Extrapolation of estimated population in City of Port Phillip based on existing population forecasts[25].

4.1 Land footprint

Supporting the urban lifestyles of the 113,512 people expected to be living in in the City of Port Phillip in 2018 requires around 5,482 square kilometres of land[26]. This area is equivalent in size to almost 250 times the

23 Turner, et al (2017) As above.

24 https://forecast.id.com.au/port-phillip

25 https://forecast.id.com.au/port-phillip

26 It is important to note that land is a 'stock' rather than a 'flow' so it doesn't really make sense to put a 'per year' attached to the figure (unlike water use, where a per day or per year figure is relevant because it will ultimately determine the quantity of water used). In 2018, 5482 sq km of land is required to produce food, raise cattle, provide housing, etc for that particular population based on the number of people and their consumption patterns. In 2030, or 2050 it may be higher or lower.

combined area of all the suburbs in the municipal area[27]. It is equivalent to 48,294 square metres per person (4.8 hectares), over four times the size of Luna Park.This is the amount of land needed to produce the food that residents eat, as well as the wood and other agricultural products that are used in the products they buy, the construction materials for housing and for other purposes. The land required for housing is only 2.4% of the overall land footprint. Figure 3 shows the breakdown of this land footprint across different types of consumption.

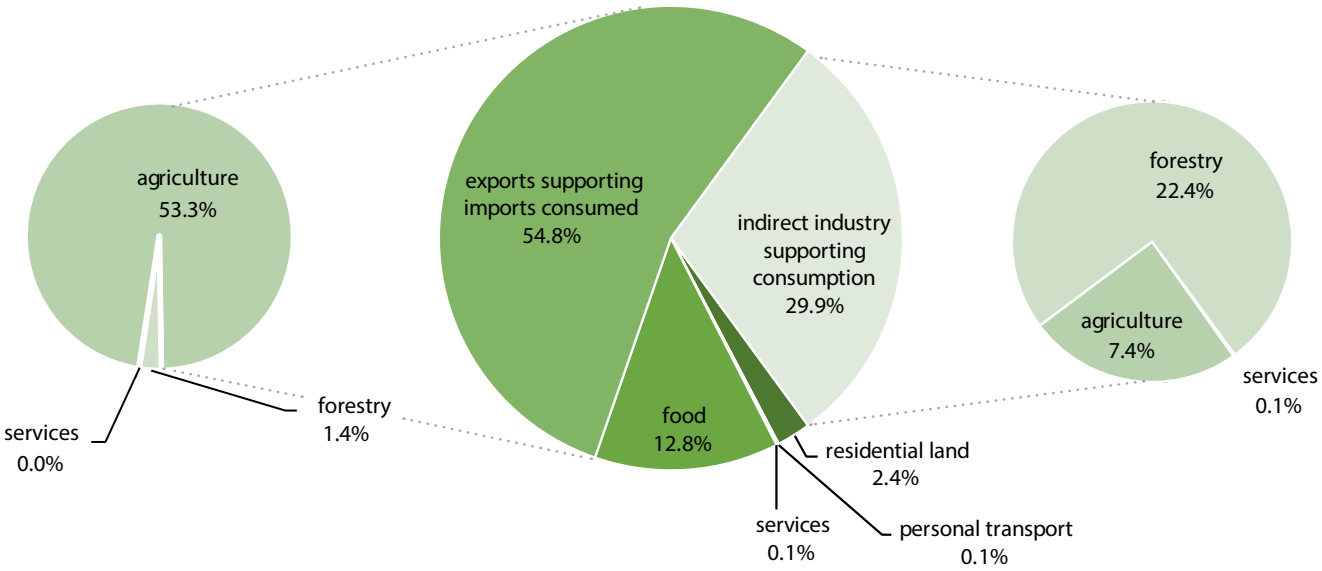


Figure 3 – Breakdown of the City of Port Phillip land footprint by consumption type

The 12.8% of the land footprint attributed to food is just the direct land on which crops are grown and animals are raised. If the land used by indirect industries and the land used to produce exports (which allow us to consume imported foods) are considered, the food footprint is much larger. Almost three-quarters of the overall land footprint is attributed to the agricultural sector (Figure 3). From previous research[28] it can be derived that almost 80% of this agricultural land (2.9 hectares per person) is required for food production. This is lower than the Australian average of 3.2 hectares per person[29] but significantly higher than many other parts of the world. Comparable cities in the UK and USA have food footprints of around 1 hectare [30] [31], while cities in more sparsely populated countries tend to have a higher footprint (e.g. Calgary in Canada has a per capita footprint of 2.6 hectares[32]).

27 Combined area of all suburbs in City of Port Phillip is 21 square kilometres.

28 Sheridan, J., Carey, R. and Candy, S. (2016) As above.

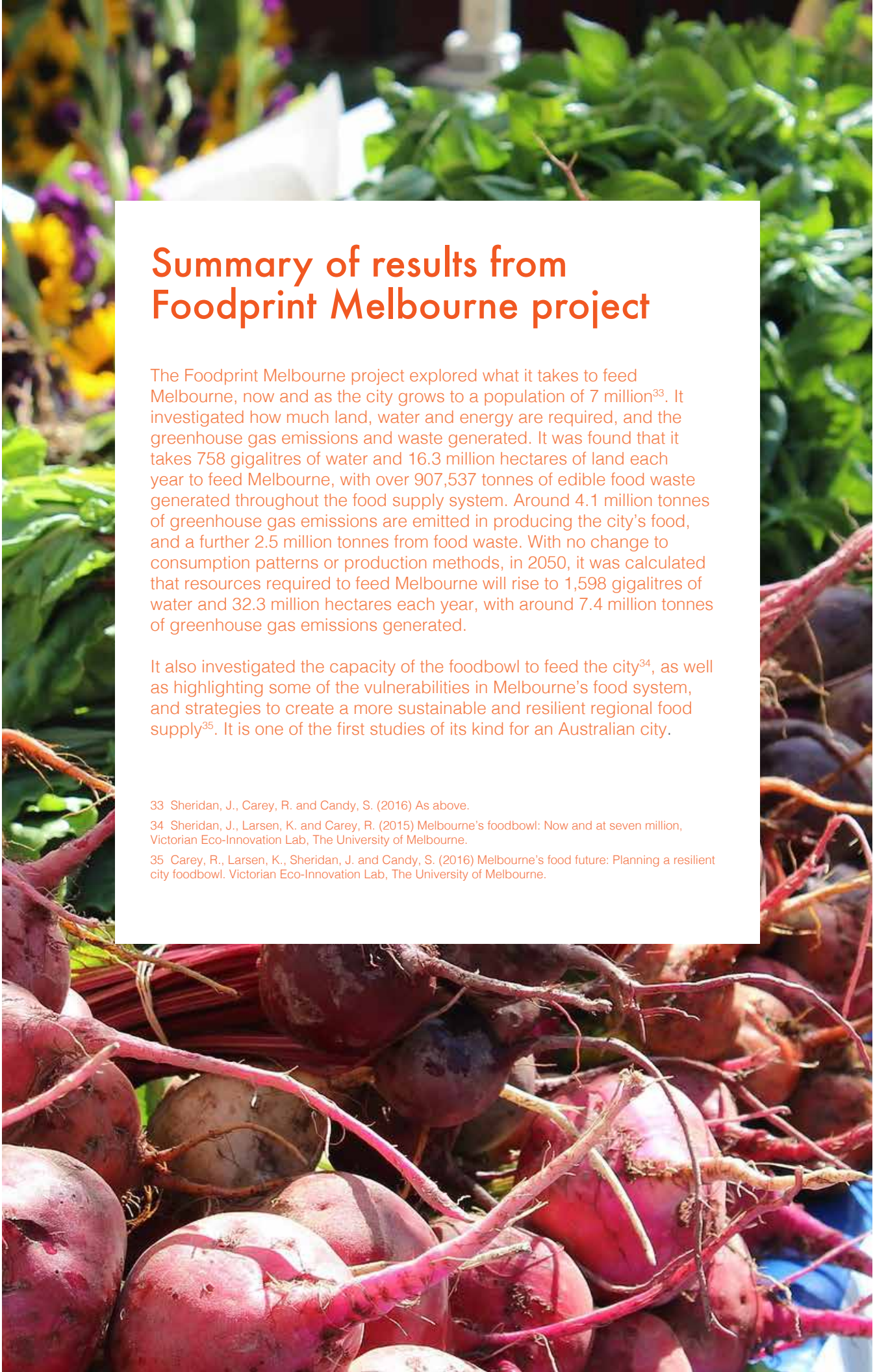
29 Lutter, S., Burrell, L., Giljum, S., Patz, T., Kernegger, L., Rodrigo, A. (2013), Hidden impacts: How Europe's resource overconsumption promotes global land conflicts, Vienna: Global 2000 and Sustainable Europe Research Institute

30 Moore, D (2011) Ecological Footprint Analysis San Francisco-Oakland-Fremont, CA, Oakland: Global Footprint Network

31 World Wildlife Fund (2007) City Residents Ranked by Size of Their Food Footprint, http://www.wwf.org.uk/ lelibrary/pdf/food_footprint.pdf

32 Kuzyk, L., Hummel, M., Rockley, M., Green, B., Hall, J.W., St Arnaud, N. (2014) Ecological Footprint and Land Use Scenarios, Calgary, Alberta, Calgary: The City of Calgary Land Use Planning & Policy.

Image credit: Matthew Carey



Summary of results from Foodprint Melbourne project

The Foodprint Melbourne project explored what it takes to feed Melbourne, now and as the city grows to a population of 7 million[33]. It investigated how much land, water and energy are required, and the greenhouse gas emissions and waste generated. It was found that it takes 758 gigalitres of water and 16.3 million hectares of land each year to feed Melbourne, with over 907,537 tonnes of edible food waste generated throughout the food supply system. Around 4.1 million tonnes of greenhouse gas emissions are emitted in producing the city's food, and a further 2.5 million tonnes from food waste. With no change to consumption patterns or production methods, in 2050, it was calculated that resources required to feed Melbourne will rise to 1,598 gigalitres of water and 32.3 million hectares each year, with around 7.4 million tonnes of greenhouse gas emissions generated.

It also investigated the capacity of the foodbowl to feed the city[34], as well as highlighting some of the vulnerabilities in Melbourne's food system, and strategies to create a more sustainable and resilient regional food supply[35]. It is one of the first studies of its kind for an Australian city.

33 Sheridan, J., Carey, R. and Candy, S. (2016) As above.

34 Sheridan, J., Larsen, K. and Carey, R. (2015) Melbourne's foodbowl: Now and at seven million, Victorian Eco-Innovation Lab, The University of Melbourne.

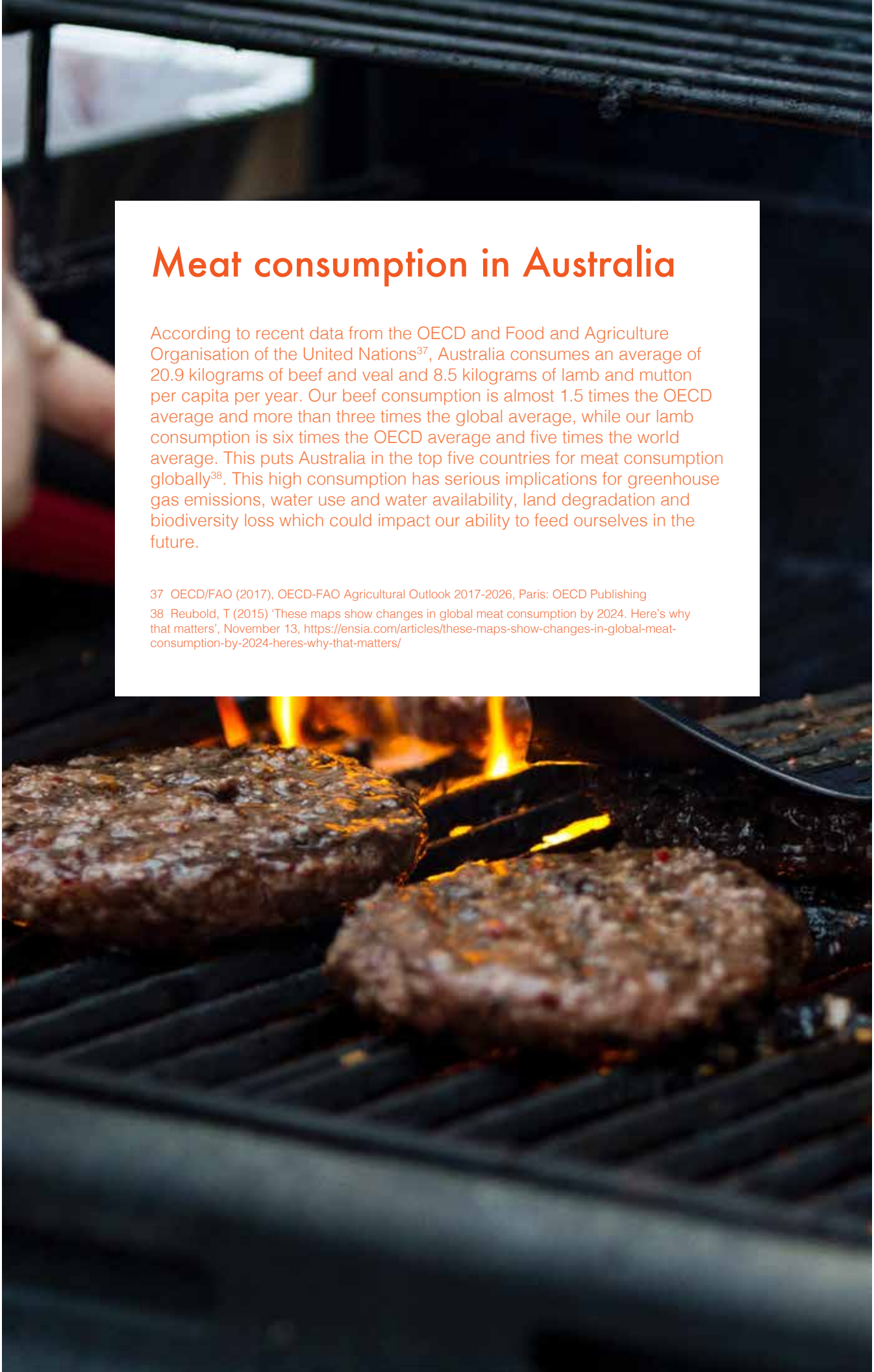
35 Carey, R., Larsen, K., Sheridan, J. and Candy, S. (2016) Melbourne's food future: Planning a resilient city foodbowl. Victorian Eco-Innovation Lab, The University of Melbourne.

Around 90% of the food footprint (2.6 hectares per person or 55% of the overall land footprint) is required for beef and lamb production. This includes not only the land on which livestock are raised, but also the indirect land used to grow feed for these animals (for both domestic consumption and for export).

Australia's high per capita land footprint for agriculture is mainly due to its production systems for beef and lamb production, which primarily involve pasture based grazing systems, rather than feedlots, with animals at low stocking densities over large areas of land. Although much of this land is unsuitable for other types of food production[36], extensive livestock farming in general has implications for other environmental impacts such as water use, greenhouse gas emissions (see Section 4.2 and 4.3), land degradation and biodiversity loss, which could impact both food production and urban areas (via extreme weather events) in the future.

36 Wiederman, S., McGahan, E., Murphy, C. and Yan, M. (2016) Resource use and environmental impacts from beef production in eastern Australia investigated using life cycle assessment, Animal Production Science 56: 882-894

Image credit: Zac Cain on Unsplash



Meat consumption in Australia

According to recent data from the OECD and Food and Agriculture Organisation of the United Nations[37], Australia consumes an average of 20.9 kilograms of beef and veal and 8.5 kilograms of lamb and mutton per capita per year. Our beef consumption is almost 1.5 times the OECD average and more than three times the global average, while our lamb consumption is six times the OECD average and five times the world average. This puts Australia in the top five countries for meat consumption globally[38]. This high consumption has serious implications for greenhouse gas emissions, water use and water availability, land degradation and biodiversity loss which could impact our ability to feed ourselves in the future.

37 OECD/FAO (2017), OECD-FAO Agricultural Outlook 2017-2026, Paris: OECD Publishing

38 Reubold, T (2015) 'These maps show changes in global meat consumption by 2024. Here's why that matters', November 13, https://ensia.com/articles/these-maps-show-changes-in-global-meat-consumption-by-2024-heres-why-that-matters/

Figure 4 shows the variation in land footprint across different suburbs in the City of Port Phillip. The difference between Ripponlea and Middle Park is not just due to house block sizes, but mainly because households in Middle Park typically consume more goods and services than those in Ripponlea (see differences in household expenditure data in Figure 1). The larger amount spent on food for example contributes to a larger land footprint, particularly if it includes red meat products. A very similar pattern across different suburbs was also apparent for the water footprint, carbon and waste footprints, so separate graphs of those results have not been included.

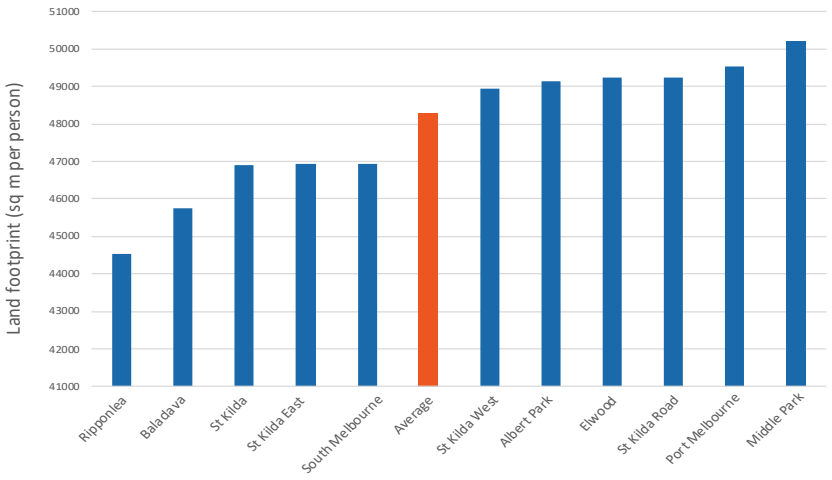


Figure 4 – Variation in land footprints across different suburbs in the City of Port Phillip.

By 2050, with a population increase to 190,000, the total land required to support urban lifestyles in the City of Port Phillip will have increased to 6,183 square kilometres. Although factors such as land degradation increase the land required for agricultural production[39], the projected reduction in red meat consumption according to historical trends[40] will reduce the average land footprint of the City of Port Phillip from 48,294 to 32,452 square metres (3.3 hectares) per person. This incidental reduction represents progress in the right direction, however it is not nearly enough. The overall land footprint is still more than triple the one hectare per person recommended as a sustainable global level for land use[41].

39 Turner, G.M., Dunlop, M., Candy, S., (2016) 'The impacts of expansion and degradation on Australian cropping yields—An integrated historical perspective', Agricultural Systems 143: 22-37

40 Historical data up until very recently shows a trend of decreasing red meat consumption, and increasing levels of poultry and pork consumption. With increasing health concerns associated with consumption of red meat it is considered reasonable to assume that it will continue (see also https://theconversation.com/three-charts-on-australias-declining-taste-for-beef-and-growing-appetite-for-chicken-78100).

41 Tukker, A., Bulavskaya, T., Giljum, S., de Koning, A., Lutter, S., Simas, M., Stadler, K., Wood, R., 2016. Environmental and resource footprints in a global context: Europe's structural deficit in resource endowments. Glob. Environ. Change 40, 171–181. https://doi.org/10.1016/j.gloenvcha.2016.07.00

Image credit: Brad Halcrow on Unsplash

Sustainable global land footprints

Globally, the potential for expanding agricultural land use is limited. The UNEP[42] suggests that the maximum possible expansion of cropland is about 1.5 million km^2, in part at the expense of pastures and forests, on a total amount of existing agricultural and forest land of 88 km^2. Simply dividing this 88–89.5 million km^2 by the future global population in 2050 of 9–10 billion people[43] provides a land availability of 0.009–0.01 km^2 per person[44] (0.9 – 1 hectare). This is probably a generous target since it accepts the existing levels of biodiversity pressures by land use, while reduction of such pressures is widely seen as necessary[45].

42 UNEP (2014), The emissions gap report 2014, United Nations Environment Programme, Nairobi.

43 Gerland, Patrick, Adrian E., Raftery, Hana, Ševčíková, Nan, Li, Danan, Gu, Thomas, Spoorenberg, Leontine, Alkema, Bailey K., Fosdick, Jennifer, Chunn, Nevena, Lalic, Guiomar, Bay, Thomas, Buettner, Gerhard K., Heilig, John, Wilmoth (2014). World population stabilization unlikely this century., p. 1, 10.1126/science.1257469.

44 Tukker, et al. (2016) As above.

45 H.A. Mooney, A. Cropper, D. Capistrano, S.R. Carpenter, K. Chopra, P. Dasgupta, R. Leemans, R.M. May, P. Pingali, R. Hassan, C. Samper, R. Scholes, R.T. Watson, A.H. Zakri, Z. Shidong (Eds.), (2005), Ecosystems and Human Well-Being: Synthesis, Millennium Ecosystem Assessment Island Press, Washington, DC.

4.2 Water footprint

Supporting urban lifestyles in the City of Port Phillip takes over 155,775 million litres of water per year. It is equivalent to 3,808 litres per person per day or 1.4 million litres per person per year, equivalent to almost four times the volume of the St Kilda Sea Baths. This is more than twelve times per capita household water consumption.

This is an under-estimate of the total amount of water required to support urban lifestyles, as it includes only the water extracted from lakes, rivers and dams, known as 'blue water'. An example of this is irrigation water that is used to grow food and textile crops and animal feed, as well as drinking water for animals, or water that is used in coal fired power plants. 'Green water' - the water that falls directly onto land as rain - is not included in this figure, because it is not tracked in Australia's water accounts[46].

This water footprint includes residential water use, as well as the water required to produce goods and supply services (Figure 5). More than half of the city's water footprint is attributed to the production of agricultural products like food and textiles (e.g. cotton). Around 16% is required for raw materials extraction in the mining sector to support both domestic consumption and for export, and 9% overall for electricity generation. Although it is well known that fossil fuel electricity generation in Victoria has significant carbon intensity, it is less known that it is also very water intensive. Water is not only required directly to run the generators, but also indirectly to mine coal, oil and gas that power them[47]. Only 8.3% of the overall water footprint is due to residential water use.

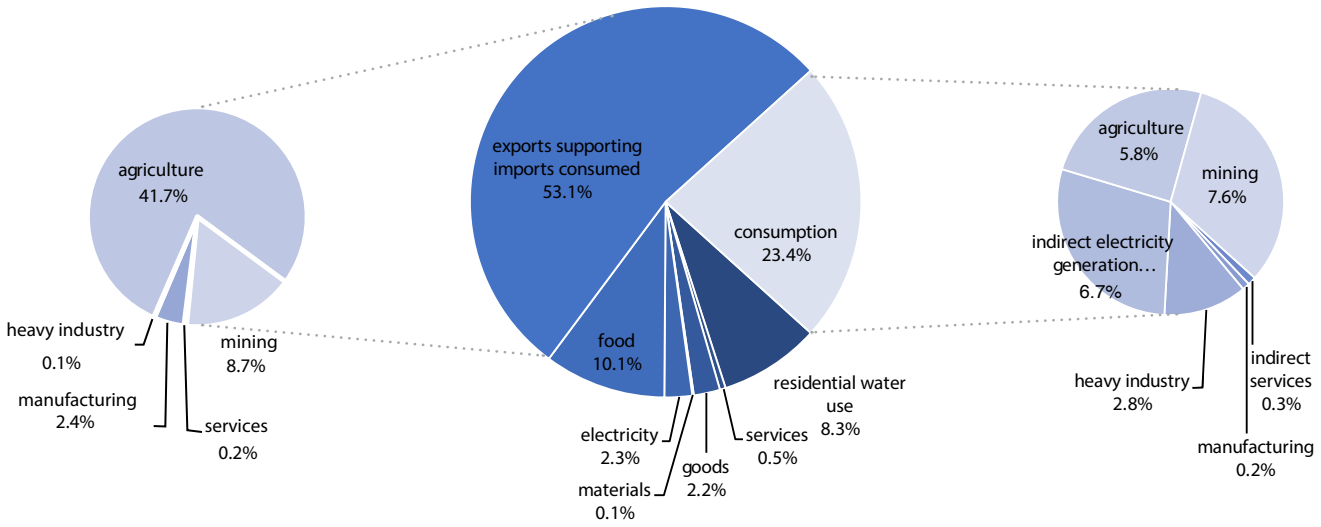
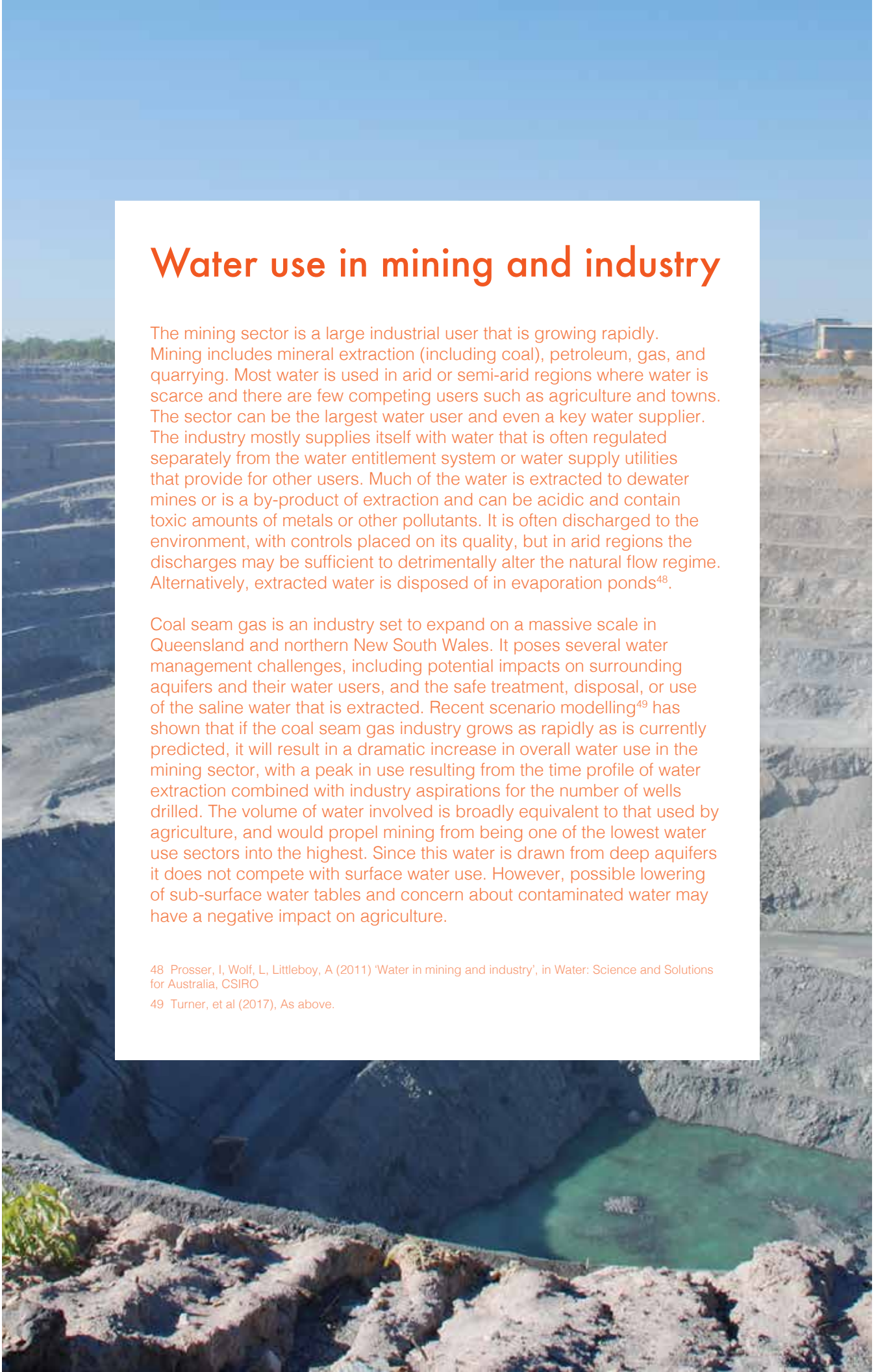


Figure 5 – Breakdown of the City of Port Phillip water footprint by consumption type

46 Australian Bureau of Statistics (2015a) 4610.0 – Water Account 2013-14, Canberra: Australian Bureau of Statistics

47 Commissioner for Environmental Sustainability Victoria (2008), State of the Environment report, Commissioner for Environmental Sustainability, Melbourne, Victoria

Image credit: Alberto Otero Garcia



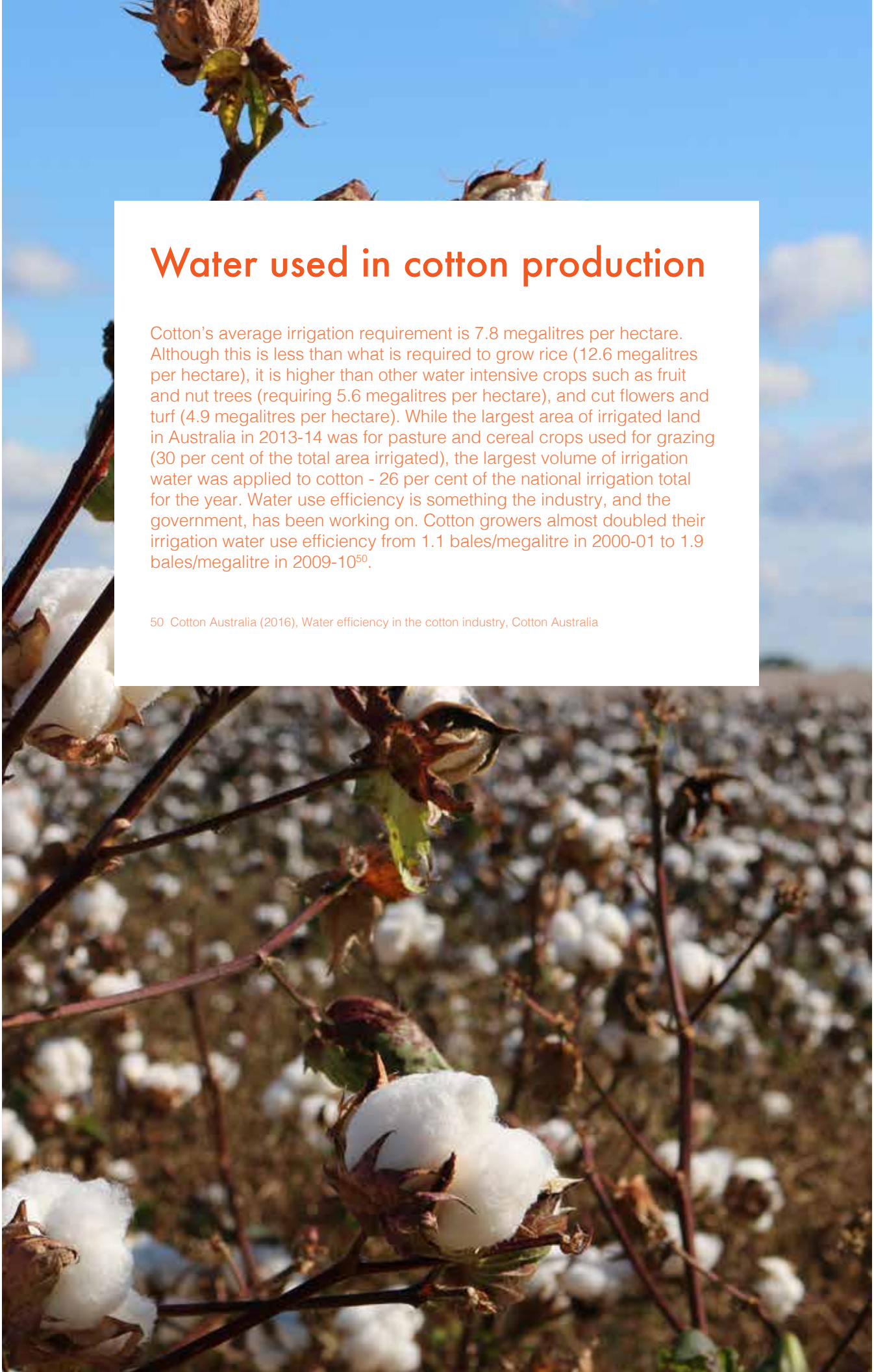
Water use in mining and industry

The mining sector is a large industrial user that is growing rapidly. Mining includes mineral extraction (including coal), petroleum, gas, and quarrying. Most water is used in arid or semi-arid regions where water is scarce and there are few competing users such as agriculture and towns. The sector can be the largest water user and even a key water supplier. The industry mostly supplies itself with water that is often regulated separately from the water entitlement system or water supply utilities that provide for other users. Much of the water is extracted to dewater mines or is a by-product of extraction and can be acidic and contain toxic amounts of metals or other pollutants. It is often discharged to the environment, with controls placed on its quality, but in arid regions the discharges may be sufficient to detrimentally alter the natural flow regime. Alternatively, extracted water is disposed of in evaporation ponds[48].

Coal seam gas is an industry set to expand on a massive scale in Queensland and northern New South Wales. It poses several water management challenges, including potential impacts on surrounding aquifers and their water users, and the safe treatment, disposal, or use of the saline water that is extracted. Recent scenario modelling[49] has shown that if the coal seam gas industry grows as rapidly as is currently predicted, it will result in a dramatic increase in overall water use in the mining sector, with a peak in use resulting from the time profile of water extraction combined with industry aspirations for the number of wells drilled. The volume of water involved is broadly equivalent to that used by agriculture, and would propel mining from being one of the lowest water use sectors into the highest. Since this water is drawn from deep aquifers it does not compete with surface water use. However, possible lowering of sub-surface water tables and concern about contaminated water may have a negative impact on agriculture.

48 Prosser, I, Wolf, L, Littleboy, A (2011) 'Water in mining and industry', in Water: Science and Solutions for Australia, CSIRO

49 Turner, et al (2017), As above.



Water used in cotton production

Cotton's average irrigation requirement is 7.8 megalitres per hectare. Although this is less than what is required to grow rice (12.6 megalitres per hectare), it is higher than other water intensive crops such as fruit and nut trees (requiring 5.6 megalitres per hectare), and cut flowers and turf (4.9 megalitres per hectare). While the largest area of irrigated land in Australia in 2013-14 was for pasture and cereal crops used for grazing (30 per cent of the total area irrigated), the largest volume of irrigation water was applied to cotton - 26 per cent of the national irrigation total for the year. Water use efficiency is something the industry, and the government, has been working on. Cotton growers almost doubled their irrigation water use efficiency from 1.1 bales/megalitre in 2000-01 to 1.9 bales/megalitre in 2009-10[50].

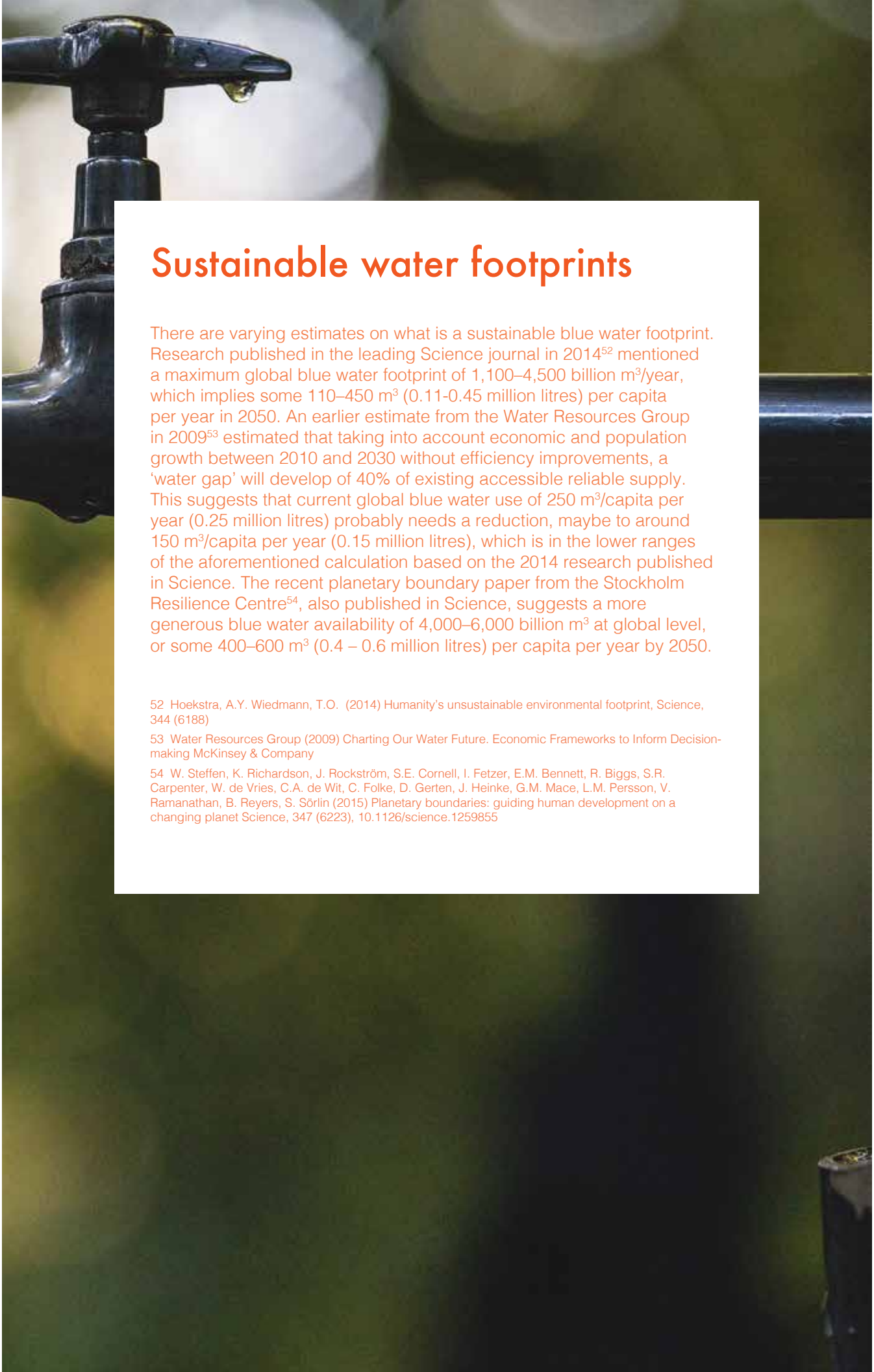
50 Cotton Australia (2016), Water efficiency in the cotton industry, Cotton Australia

By 2050, the total water required to support urban lifestyles will have increased to 262,650 million litres per year. Although the 2050 per capita water footprint (3,787 litres per person per day or 1.3 million litres per person per year) does not differ significantly from the 2018 figure (3,808 litres per person per day) it is because increases in water use over time by the majority of sectors are offset by a reduction of water use in the agricultural sector. This reduction can be attributed to a reduction in the production of agricultural products for export and water efficiency increases in production. These reduction trends are based on actual recent and longer term data that are part of the extensive historical calibration database within ASFF.

Similar to the results for the land footprint, this is progress in the right direction. Again, however, it is not nearly enough. The current and projected water footprints for the City of Port Phillip are more than double even the most generous estimations of sustainable water footprints of around 0.6 million litres per person per year[51].

51 Tukker et al., (2015) As above.

Image credit: Trisha Downing on Unsplash



Sustainable water footprints

There are varying estimates on what is a sustainable blue water footprint. Research published in the leading Science journal in 2014[52] mentioned a maximum global blue water footprint of 1,100–4,500 billion m^3/year, which implies some 110–450 m^3 (0.11-0.45 million litres) per capita per year in 2050. An earlier estimate from the Water Resources Group in 2009[53] estimated that taking into account economic and population growth between 2010 and 2030 without efficiency improvements, a 'water gap' will develop of 40% of existing accessible reliable supply. This suggests that current global blue water use of 250 m^3/capita per year (0.25 million litres) probably needs a reduction, maybe to around 150 m^3/capita per year (0.15 million litres), which is in the lower ranges of the aforementioned calculation based on the 2014 research published in Science. The recent planetary boundary paper from the Stockholm Resilience Centre[54], also published in Science, suggests a more generous blue water availability of 4,000–6,000 billion m^3 at global level, or some 400–600 m^3 (0.4 – 0.6 million litres) per capita per year by 2050.

52 Hoekstra, A.Y. Wiedmann, T.O. (2014) Humanity's unsustainable environmental footprint, Science, 344 (6188)

53 Water Resources Group (2009) Charting Our Water Future. Economic Frameworks to Inform Decision-making McKinsey & Company

54 W. Steffen, K. Richardson, J. Rockström, S.E. Cornell, I. Fetzer, E.M. Bennett, R. Biggs, S.R. Carpenter, W. de Vries, C.A. de Wit, C. Folke, D. Gerten, J. Heinke, G.M. Mace, L.M. Persson, V. Ramanathan, B. Reyers, S. Sörlin (2015) Planetary boundaries: guiding human development on a changing planet Science, 347 (6223), 10.1126/science.1259855

4.3 Carbon footprint

Urban activities and the consumption of goods and services in the City of Port Phillip generate 3.2 million tonnes of greenhouse gas emissions each year. The average per capita carbon footprint is 29,798 kg (29.7 tonnes) per year, which is equivalent to the emissions generated by twelve average passenger cars over the same period. It is around six times the global average of 4.97 tonnes per capita per year[55].

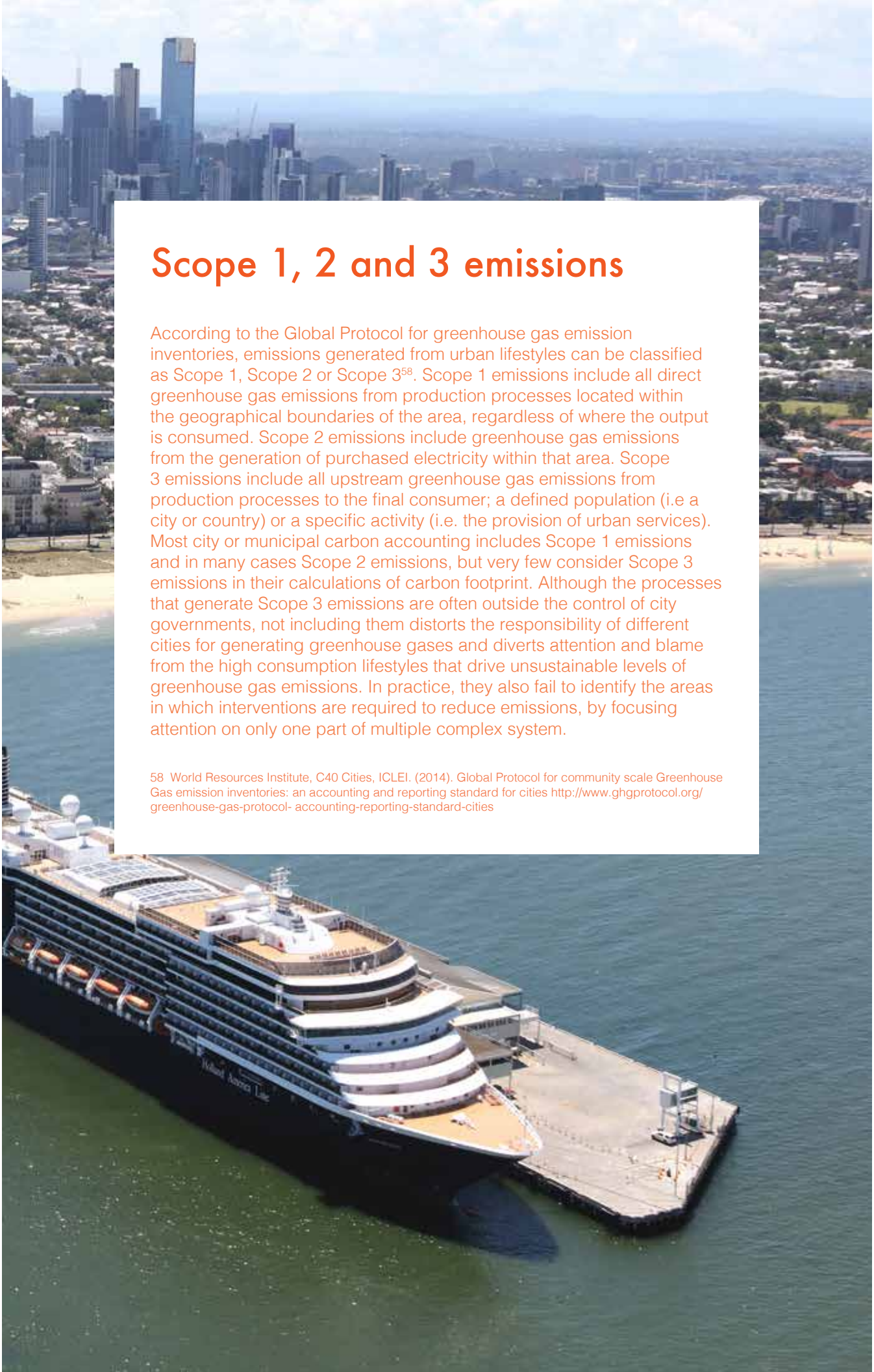
This overall figure is higher than a previous estimate of around 1.7 million[56] because it is consumption-based and includes both direct and indirect emissions (Scope 1, 2 and 3 emissions). Recent research[57] looking at consumption-based carbon footprints for Melbourne and Sydney using input-output analysis found that more than 50% of the overall footprints were attributable to imported, or Scope 3, emissions from goods and services (i.e. from the indirect and export industries supporting direct consumption), which accounts for the difference between the higher carbon footprint in this report and the previous estimate.

55 https://data.worldbank.org/indicator/EN.ATM.CO2E.PC based on 2014 data.

56 City of Port Phillip (2018), A Sustainable Future: The City of Port Phillip's Sustainable Environment Strategy 2018-2028, City of Port Phillip (DRAFT)

57 Chen, G., Hadjikakou, M., Wiedmann, T. (2016) Urban carbon transformations: unravelling spatial and inter-sectoral linkages for key city industries based on multi-region input–output analysis. Journal of Cleaner Production. DOI:10.1016/j.jclepro.2016.04.046

Image credit: Trisha Downing on Unsplash



Scope 1, 2 and 3 emissions

According to the Global Protocol for greenhouse gas emission inventories, emissions generated from urban lifestyles can be classified as Scope 1, Scope 2 or Scope 3[58]. Scope 1 emissions include all direct greenhouse gas emissions from production processes located within the geographical boundaries of the area, regardless of where the output is consumed. Scope 2 emissions include greenhouse gas emissions from the generation of purchased electricity within that area. Scope 3 emissions include all upstream greenhouse gas emissions from production processes to the final consumer; a defined population (i.e a city or country) or a specific activity (i.e. the provision of urban services). Most city or municipal carbon accounting includes Scope 1 emissions and in many cases Scope 2 emissions, but very few consider Scope 3 emissions in their calculations of carbon footprint. Although the processes that generate Scope 3 emissions are often outside the control of city governments, not including them distorts the responsibility of different cities for generating greenhouse gases and diverts attention and blame from the high consumption lifestyles that drive unsustainable levels of greenhouse gas emissions. In practice, they also fail to identify the areas in which interventions are required to reduce emissions, by focusing attention on only one part of multiple complex system.

58 World Resources Institute, C40 Cities, ICLEI. (2014). Global Protocol for community scale Greenhouse Gas emission inventories: an accounting and reporting standard for cities http://www.ghgprotocol.org/greenhouse-gas-protocol- accounting-reporting-standard-cities

Figure 6 shows the breakdown of the carbon footprint by consumption type. It is different to the typical categories and definitions in the Global Protocol for carbon emissions inventories to show more clearly how aspects of urban lifestyles contribute to the overall carbon footprint. It particularly shows which emissions are more visible and which are invisible. Using electricity as an example, if a household were to gauge their carbon footprint based only on their household electricity consumption, it would be much smaller than if they considered all the indirect electricity used (e.g. during manufacturing of appliances or processing of food), and the subsequent carbon emissions generated.

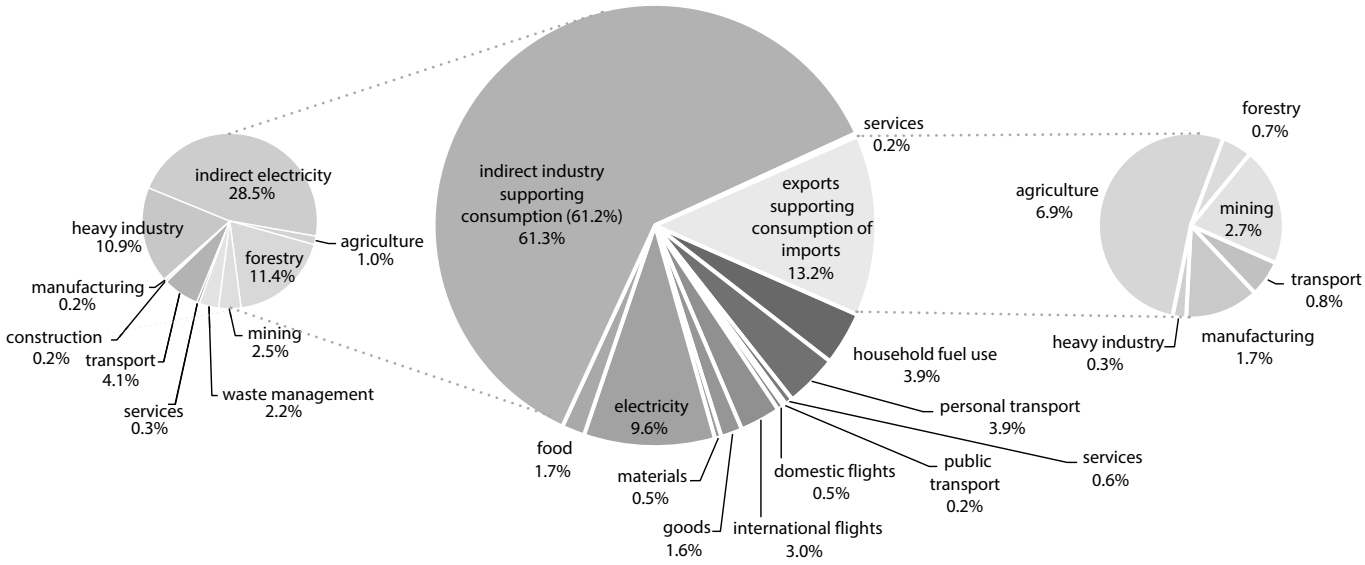


Figure 6 – Breakdown of City of Port Phillip carbon emissions by consumption type

The combination of direct and indirect electricity generation is responsible for 38% of the overall carbon footprint. Emissions generated from electricity supply are high not only due to consumption levels but also due to the carbon intensive nature of electricity production. Electricity in Victoria is primarily generated by brown-coal fired power plants. While it is an abundant resource, it is also highly polluting. Because of its reliance on brown coal, Victoria has the highest rate of pollution in Australia, and indeed in the world[59]. The carbon intensity of Yallourn power station, for example, is 1.404 tonnes of carbon dioxide per megawatt-hour of energy produced[60]. This is significantly more than other forms of power generation such as gas (0.4 – 0.55 tonnes CO_2 / MWh) and wind (0.02 tonnes CO_2/MWh)[61].

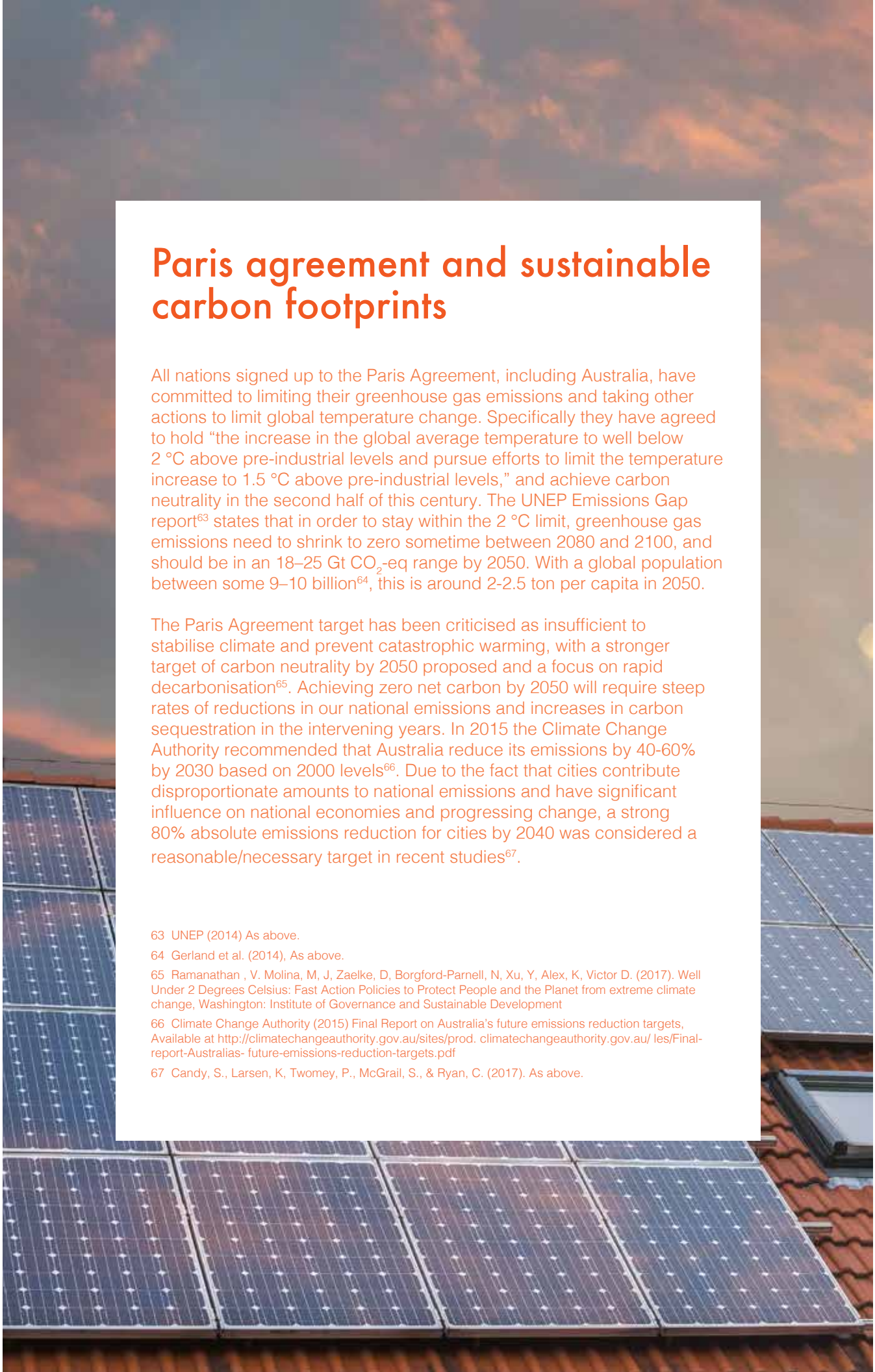
59 Berger, C, Phelan, T (2005) Greenhouse pollution intensity in the Victorian Brown Coal Power Industry, Australian Conservation Foundation / Environment Victoria / Greenpeace.

60 Berger and Phelan (2005) As above.

61 Berger and Phelan (2005) As above.

By 2050, the total carbon footprint of urban lifestyles and activities will have increased to 4.8 million tonnes per year. On a per capita basis, there is a reduction in carbon footprint from 29,798 kg (29.7 tonnes) per year to 25,119 kg (25.1 tonnes) per year. This reduction is due to projected reduction in carbon intensity in the electricity sector (due to the retiring of older power plants) and some reduction in the consumption of carbon intensive agricultural products. Overall, however, this level of per capita reduction is nowhere near sufficient to reduce the total carbon footprint of the City of Port Phillip to sustainable levels of around 2 – 2.5 tonnes per capita per year by 2050 to meet international obligations such as the Paris Agreement. It would also not be sufficient to meet Australia's lesser stated target to reduce emissions to 26-28 per cent below 2005 levels by 2030 (equivalent to 15 tonnes per capita per year)[62].

62 Australian Government (2015) Australia's 2030 climate change target fact sheet, Department of the Environment Canberra Australia, http://www.environment.gov.au/ climate-change/publications/factsheet-australias-climate-change-target



Paris agreement and sustainable carbon footprints

All nations signed up to the Paris Agreement, including Australia, have committed to limiting their greenhouse gas emissions and taking other actions to limit global temperature change. Specifically they have agreed to hold "the increase in the global average temperature to well below 2 °C above pre-industrial levels and pursue efforts to limit the temperature increase to 1.5 °C above pre-industrial levels," and achieve carbon neutrality in the second half of this century. The UNEP Emissions Gap report[63] states that in order to stay within the 2 °C limit, greenhouse gas emissions need to shrink to zero sometime between 2080 and 2100, and should be in an 18–25 Gt CO_2-eq range by 2050. With a global population between some 9–10 billion[64], this is around 2-2.5 ton per capita in 2050.

The Paris Agreement target has been criticised as insufficient to stabilise climate and prevent catastrophic warming, with a stronger target of carbon neutrality by 2050 proposed and a focus on rapid decarbonisation[65]. Achieving zero net carbon by 2050 will require steep rates of reductions in our national emissions and increases in carbon sequestration in the intervening years. In 2015 the Climate Change Authority recommended that Australia reduce its emissions by 40-60% by 2030 based on 2000 levels[66]. Due to the fact that cities contribute disproportionate amounts to national emissions and have significant influence on national economies and progressing change, a strong 80% absolute emissions reduction for cities by 2040 was considered a reasonable/necessary target in recent studies[67].

63 UNEP (2014) As above.

64 Gerland et al. (2014), As above.

65 Ramanathan , V. Molina, M, J, Zaelke, D, Borgford-Parnell, N, Xu, Y, Alex, K, Victor D. (2017). Well Under 2 Degrees Celsius: Fast Action Policies to Protect People and the Planet from extreme climate change, Washington: Institute of Governance and Sustainable Development

66 Climate Change Authority (2015) Final Report on Australia's future emissions reduction targets, Available at http://climatechangeauthority.gov.au/sites/prod. climatechangeauthority.gov.au/ les/Final-report-Australias- future-emissions-reduction-targets.pdf

67 Candy, S., Larsen, K, Twomey, P., McGrail, S., & Ryan, C. (2017). As above.

4.4 Waste

On average each year, residents in the City of Port Phillip will generate 503,709 tonnes of waste, or 12 kg of waste per person per day due to their lifestyles and activities. Around 50% of the waste footprint is generated indirectly by industries supporting consumption (Figure 7), mainly in the construction sector. About a quarter of the footprint consists of waste that is not typically put in household bins (restaurant waste, hard rubbish and building waste) and only a small proportion is direct household waste, including both landfill and recycling waste (14.7% or 1 – 2 kg per person per day).

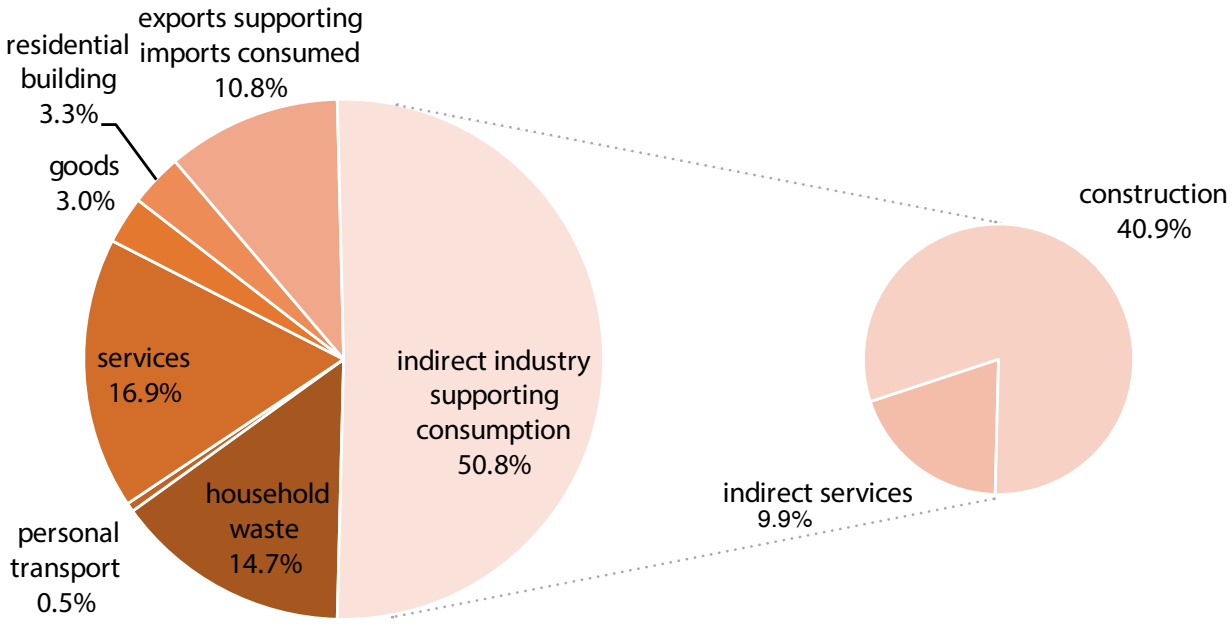


Figure 7 – Waste generated due to consumption type

By 2050, when the City of Port Phillip has a projected population of around 190,000 people, the total waste footprint of urban lifestyles and activities will have increased to 1.2 million tonnes per year. This is equivalent to around 17 kg per person per day. There is no clear estimate on a sustainable level of waste for 2050. Although it is arguable as to whether a portion of household waste such as packaging 'belongs' to the household or to the producer of the goods that are packaged, there is still significant scope for improvement to reduce waste at a municipal level by targeting household and service sector waste.

Infographic of Eco Footprint 5.0

The infographic on the next page presents a visual concept of the key aspects of the eco-footprint for the City of Port Phillip discussed in the previous sections. It was developed to communicate the main findings of this study to a wider audience, with the aim to increase awareness of the impacts of urban lifestyles on land, water and greenhouse gas emissions and inspire action towards change. The following section details opportunities to create a more sustainable community to reduce the environmental footprint of the City of Port Phillip.

Figure 8 – City of Port Phillip's environmental footprint infographic

What does a sustainable community look like? 6.0

Around the world, increasing attention is being paid to co-developing future visions and scenarios to crack open the transformation necessary for more sustainable urban living. Scenarios of possible futures can open up new conversations on the nature, culture and dynamics of city development and planning, breaking from the existing institutional perceptions of possibilities that underpin planning and urban design decisions [68] [69].

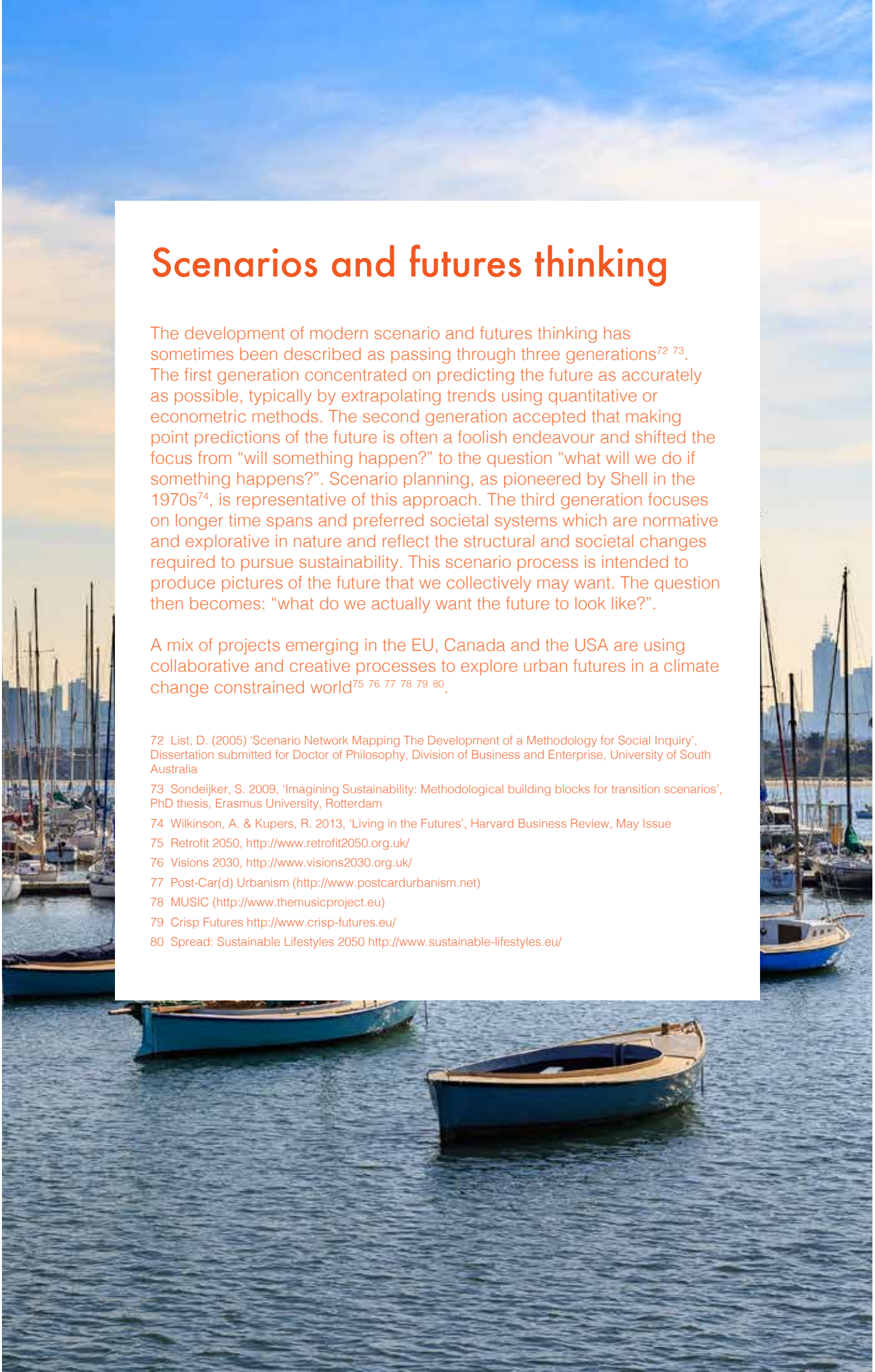
In this section we present the results of a scenario modelling exercise for the City of Port Phillip. First, opportunities to create a more sustainable community are explored. Following this, scenario narratives for different demographics were developed based on these opportunities, and on previous scenarios developed as part of the Visions and Pathways 2040 project[70] and the Foodprint Melbourne Project[71]. These were then translated into quantitative settings in ASFF (Table 1) to create the 'EcoFuture' scenario and model what the impact of the interventions might have on the environmental footprint of the City of Port Phillip.

68 Hajer, M (1995) The Politics of Environmental Discourse, Oxford University Press

69 Hajer, M. A, & Dassen, T (2014) Smart about cities: visualizing the challenge for 21st century urbanism, NAI PBL Books Rotterdam

70 Candy, S., Larsen, K, Twomey, P., McGrail, S., & Ryan, C. (2017). As above.

71 Sheridan, J., Carey, R. and Candy, S. (2016) As above.



Scenarios and futures thinking

The development of modern scenario and futures thinking has sometimes been described as passing through three generations[72] [73]. The first generation concentrated on predicting the future as accurately as possible, typically by extrapolating trends using quantitative or econometric methods. The second generation accepted that making point predictions of the future is often a foolish endeavour and shifted the focus from "will something happen?" to the question "what will we do if something happens?". Scenario planning, as pioneered by Shell in the 1970s[74], is representative of this approach. The third generation focuses on longer time spans and preferred societal systems which are normative and explorative in nature and reflect the structural and societal changes required to pursue sustainability. This scenario process is intended to produce pictures of the future that we collectively may want. The question then becomes: "what do we actually want the future to look like?".

A mix of projects emerging in the EU, Canada and the USA are using collaborative and creative processes to explore urban futures in a climate change constrained world[75] [76] [77] [78] [79] [80].

72 List, D. (2005) 'Scenario Network Mapping The Development of a Methodology for Social Inquiry', Dissertation submitted for Doctor of Philosophy, Division of Business and Enterprise, University of South Australia

73 Sondeijker, S. 2009, 'Imagining Sustainability: Methodological building blocks for transition scenarios', PhD thesis, Erasmus University, Rotterdam

74 Wilkinson, A. & Kupers, R. 2013, 'Living in the Futures', Harvard Business Review, May Issue

75 Retrofit 2050, http://www.retrofit2050.org.uk/

76 Visions 2030, http://www.visions2030.org.uk/

77 Post-Car(d) Urbanism (http://www.postcardurbanism.net)

78 MUSIC (http://www.themusicproject.eu)

79 Crisp Futures http://www.crisp-futures.eu/

80 Spread: Sustainable Lifestyles 2050 http://www.sustainable-lifestyles.eu/

6.1 Opportunities to create a more sustainable community

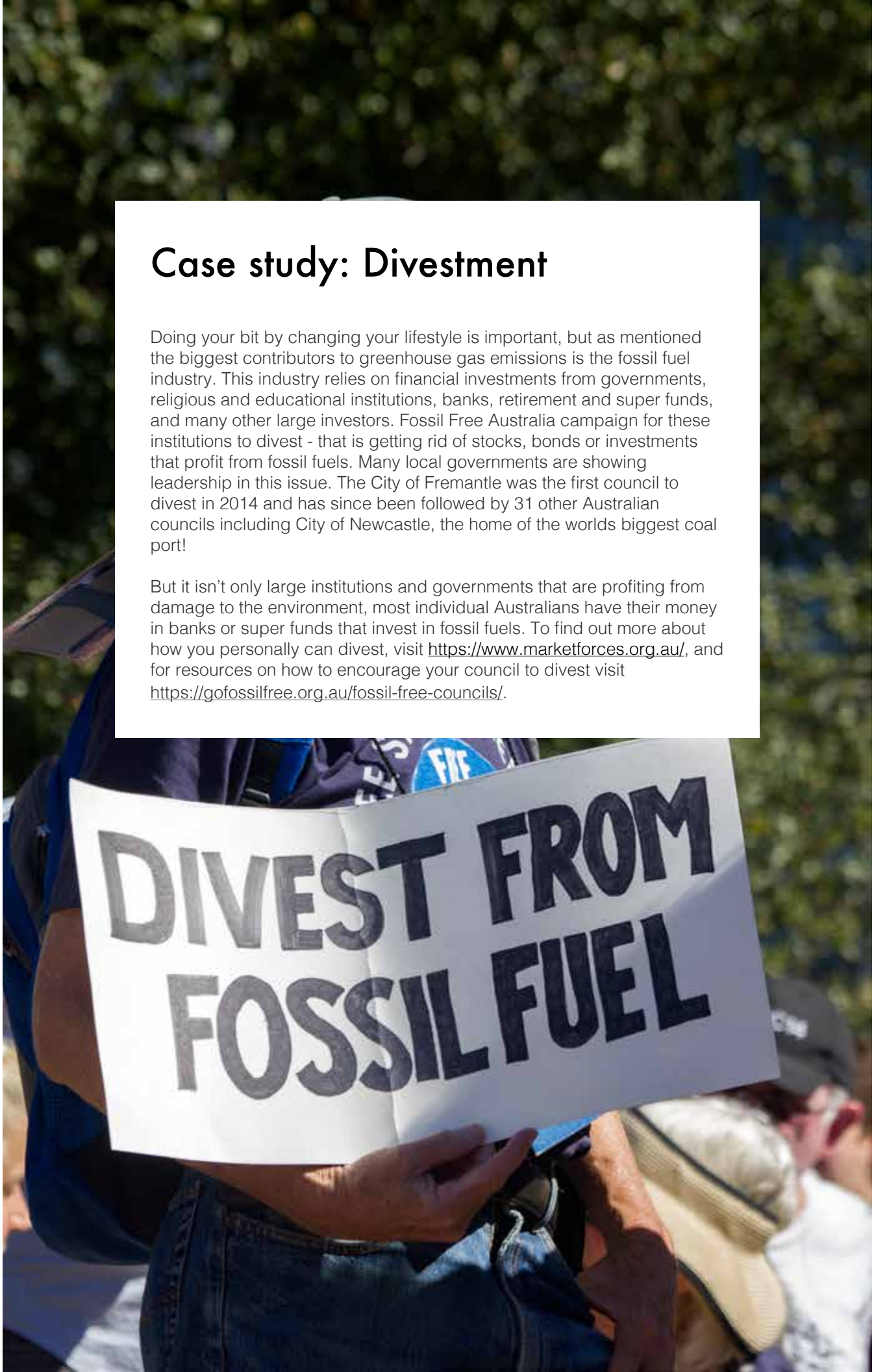
6.1.1 Electricity, Energy and Water

Whilst everybody understands that they can save water by having shorter showers, or they can reduce their energy consumption by turning off the lights when they leave the room, few consider where this energy, water and electricity comes from. Approximately 80% of Victoria's electricity comes from the burning of brown coal at Australia's dirtiest power stations, meaning that Victorians are amongst some of the highest greenhouse gas polluting people per capita in the world. Not only are our electricity systems and power plants carbon and water intensive, we are also producing emissions at home with the burning of gas to heat our hot water systems, or turn on our stoves. In addition, Australian homes are also often poorly insulated[81], requiring energy intensive heating and cooling systems to keep them comfortable in our varying climate.

Better insulation in homes drastically reduces the amount of heating and cooling used, both saving energy and money for residents. Switching to an energy provider that supports renewable energy projects, installing solar to power your home and changing your lightbulbs are just some of the other ways you can personally reduce your lifestyle's overall footprint. Making these small decisions at home can also demonstrate to governments the willingness of the public to support the transition towards a decarbonised future.

81 Harrington P, Toller V (2017) Best Practice Policy and Regulation for Low Carbon Outcomes in the Built Environment, Cooperative Research Centre for Low Carbon Living

Image credit: Quinn Dombrowski



Case study: Divestment

Doing your bit by changing your lifestyle is important, but as mentioned the biggest contributors to greenhouse gas emissions is the fossil fuel industry. This industry relies on financial investments from governments, religious and educational institutions, banks, retirement and super funds, and many other large investors. Fossil Free Australia campaign for these institutions to divest - that is getting rid of stocks, bonds or investments that profit from fossil fuels. Many local governments are showing leadership in this issue. The City of Fremantle was the first council to divest in 2014 and has since been followed by 31 other Australian councils including City of Newcastle, the home of the worlds biggest coal port!

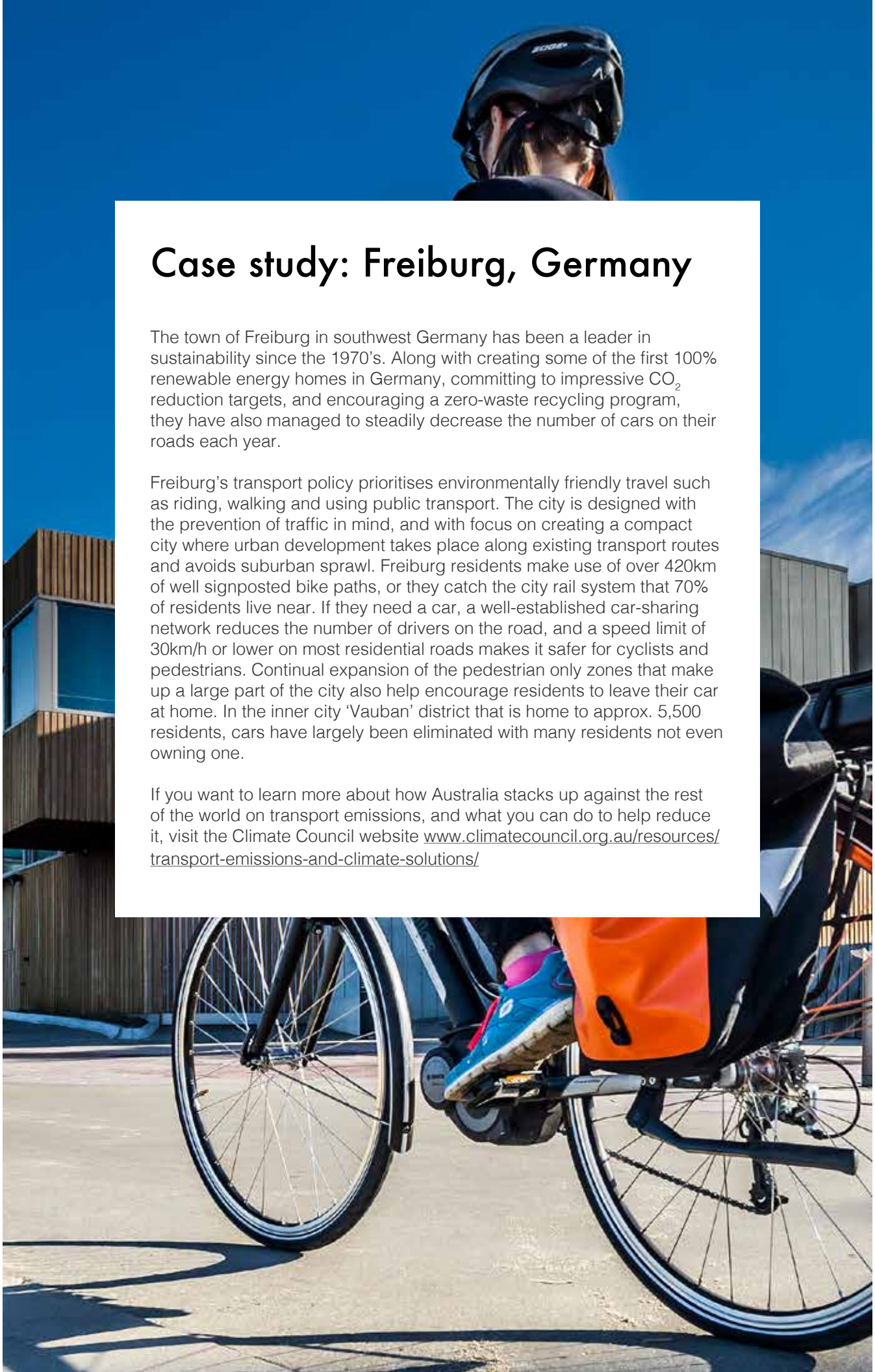
But it isn't only large institutions and governments that are profiting from damage to the environment, most individual Australians have their money in banks or super funds that invest in fossil fuels. To find out more about how you personally can divest, visit https://www.marketforces.org.au/, and for resources on how to encourage your council to divest visit https://gofossilfree.org.au/fossil-free-councils/.

6.1.2 Transport and Mobility

The transport sector – which includes not only the way people travel, but also the way goods travel - accounts for 13% of an individual's greenhouse gas emissions, the second highest contributor after electricity generation (38%).

While reducing reliance on cars and encouraging people to use public and active transport (eg. walking, riding) is crucial, it is also important to understand the transport related greenhouse gas emissions embodied in the food and products that they buy. The City of Port Phillip imports from other cities, states and nations, the overwhelming majority of all their goods and services. This means that at some stage everything in the homes, workplaces and stores, from the food to the furniture, was transported in to the City of Port Phillip from other locations. Whether it be cargo ships at sea or trucks across the country, these forms of transport use large amounts of greenhouse gas emissions to get goods to the City of Port Phillip.

So alongside changing your commute, you should consider the commute of the products you buy. Prioritising local food and goods when possible is a start to reducing the environmental impact of the amount of emissions created by transport that your lifestyle uses.



Case study: Freiburg, Germany

The town of Freiburg in southwest Germany has been a leader in sustainability since the 1970's. Along with creating some of the first 100% renewable energy homes in Germany, committing to impressive CO_2 reduction targets, and encouraging a zero-waste recycling program, they have also managed to steadily decrease the number of cars on their roads each year.

Freiburg's transport policy prioritises environmentally friendly travel such as riding, walking and using public transport. The city is designed with the prevention of traffic in mind, and with focus on creating a compact city where urban development takes place along existing transport routes and avoids suburban sprawl. Freiburg residents make use of over 420km of well signposted bike paths, or they catch the city rail system that 70% of residents live near. If they need a car, a well-established car-sharing network reduces the number of drivers on the road, and a speed limit of 30km/h or lower on most residential roads makes it safer for cyclists and pedestrians. Continual expansion of the pedestrian only zones that make up a large part of the city also help encourage residents to leave their car at home. In the inner city 'Vauban' district that is home to approx. 5,500 residents, cars have largely been eliminated with many residents not even owning one.

If you want to learn more about how Australia stacks up against the rest of the world on transport emissions, and what you can do to help reduce it, visit the Climate Council website www.climatecouncil.org.au/resources/transport-emissions-and-climate-solutions/

6.1.3 Food and Agriculture

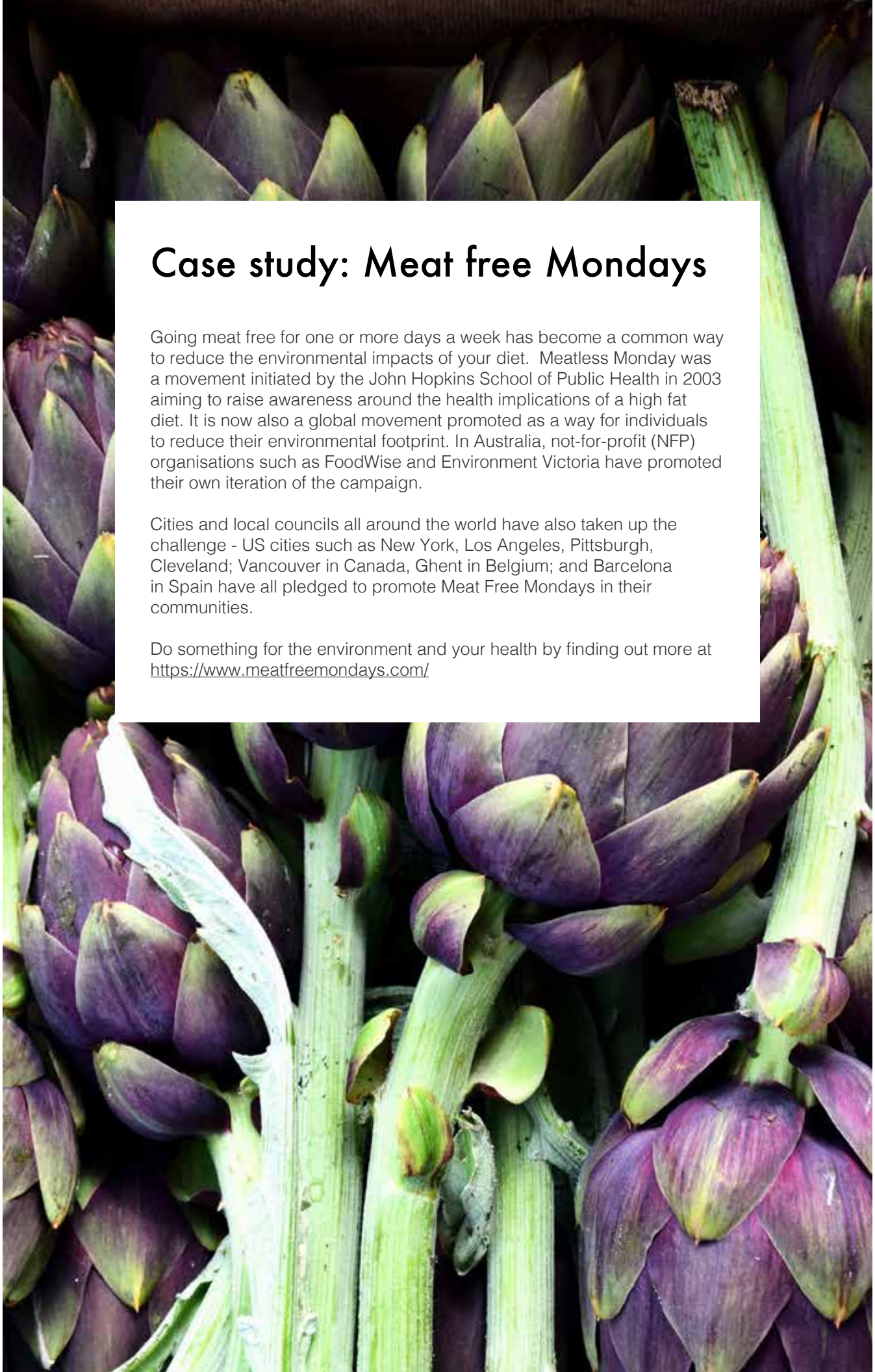
The convenience and availability of food in the City of Port Phillip can provide a misleading picture of how easily these products arrived on the shelf. But an individual's dietary choices significantly contributes to the amount of environmental damage their lifestyle causes outside of the City of Port Phillip.

It is often easy to picture that the amount of land our lifestyle uses is related to the size of our home and backyard, but this isn't the case. The production of meat and dairy products requires extremely large amounts of land, land which is often cleared through the destruction of existing forests and ecosystems. Deforestation creates greenhouse gas emissions, which, combined with the amount of greenhouse gas emissions ruminant animals[82] create, means that meat and dairy are a key contributor to our environmental footprint.

Not only does the food we eat use a large amount of land, it also uses enormous amounts of water. Meat and dairy contribute to those litres, but so does processed food. It takes more water to create soft drink and candy than it does to create whole fruits and vegetables, and large scale industrial agriculture overall uses more water, energy and air polluting chemicals than more sustainable, small scale alternatives. So the more processed foods, meat and dairy that you consume - the larger your overall environmental footprint.

82 Ruminant animals include cattle, sheep and goats. Ruminants have four stomachs, and the one called the rumen digests food through a fermentation process carried out by microorganisms that live there. It is this process that produce methane, a greenhouse gas.

Image credit: public domain



Case study: Meat free Mondays

Going meat free for one or more days a week has become a common way to reduce the environmental impacts of your diet. Meatless Monday was a movement initiated by the John Hopkins School of Public Health in 2003 aiming to raise awareness around the health implications of a high fat diet. It is now also a global movement promoted as a way for individuals to reduce their environmental footprint. In Australia, not-for-profit (NFP) organisations such as FoodWise and Environment Victoria have promoted their own iteration of the campaign.

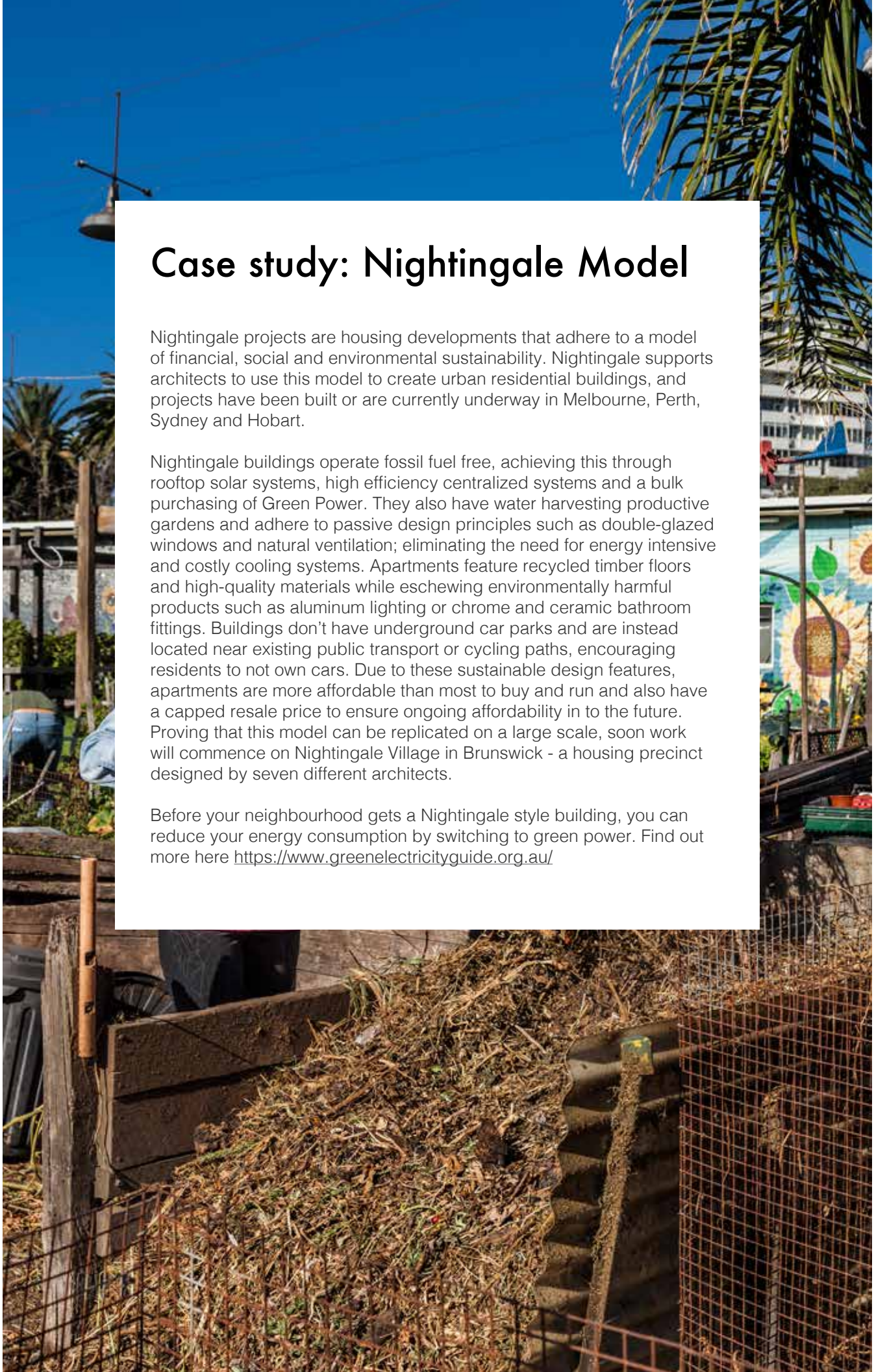
Cities and local councils all around the world have also taken up the challenge - US cities such as New York, Los Angeles, Pittsburgh, Cleveland; Vancouver in Canada, Ghent in Belgium; and Barcelona in Spain have all pledged to promote Meat Free Mondays in their communities.

Do something for the environment and your health by finding out more at https://www.meatfreemondays.com/

6.1.4 Urban Form

The way your home, street and neighbourhood looks plays a large role in your environmental footprint. Better insulation in your home will help to reduce the amount of energy you use, as will uptake of passive design features and smaller footprint houses. Using more sustainable and recycled building materials in the construction of new homes is also important.

But while house design is important, a well designed neighbourhood also plays a principal role in the environmental impact of residents. Greener cities with ample parklands and trees help mitigate urban heat island effects, support vibrant ecosystems, and help capture stormwater runoff. Their aesthetic appeal also increases walkability, encouraging residents to forgo their emissions producing cars. Green roofs and walls provide shade and canopy cover, cooling buildings and alleviating the reliance on air conditioning. Further, greener cities connect a resident with their natural environment, in turn encouraging them to engage with and learn more about their environmental impact.



Case study: Nightingale Model

Nightingale projects are housing developments that adhere to a model of financial, social and environmental sustainability. Nightingale supports architects to use this model to create urban residential buildings, and projects have been built or are currently underway in Melbourne, Perth, Sydney and Hobart.

Nightingale buildings operate fossil fuel free, achieving this through rooftop solar systems, high efficiency centralized systems and a bulk purchasing of Green Power. They also have water harvesting productive gardens and adhere to passive design principles such as double-glazed windows and natural ventilation; eliminating the need for energy intensive and costly cooling systems. Apartments feature recycled timber floors and high-quality materials while eschewing environmentally harmful products such as aluminum lighting or chrome and ceramic bathroom fittings. Buildings don't have underground car parks and are instead located near existing public transport or cycling paths, encouraging residents to not own cars. Due to these sustainable design features, apartments are more affordable than most to buy and run and also have a capped resale price to ensure ongoing affordability in to the future. Proving that this model can be replicated on a large scale, soon work will commence on Nightingale Village in Brunswick - a housing precinct designed by seven different architects.

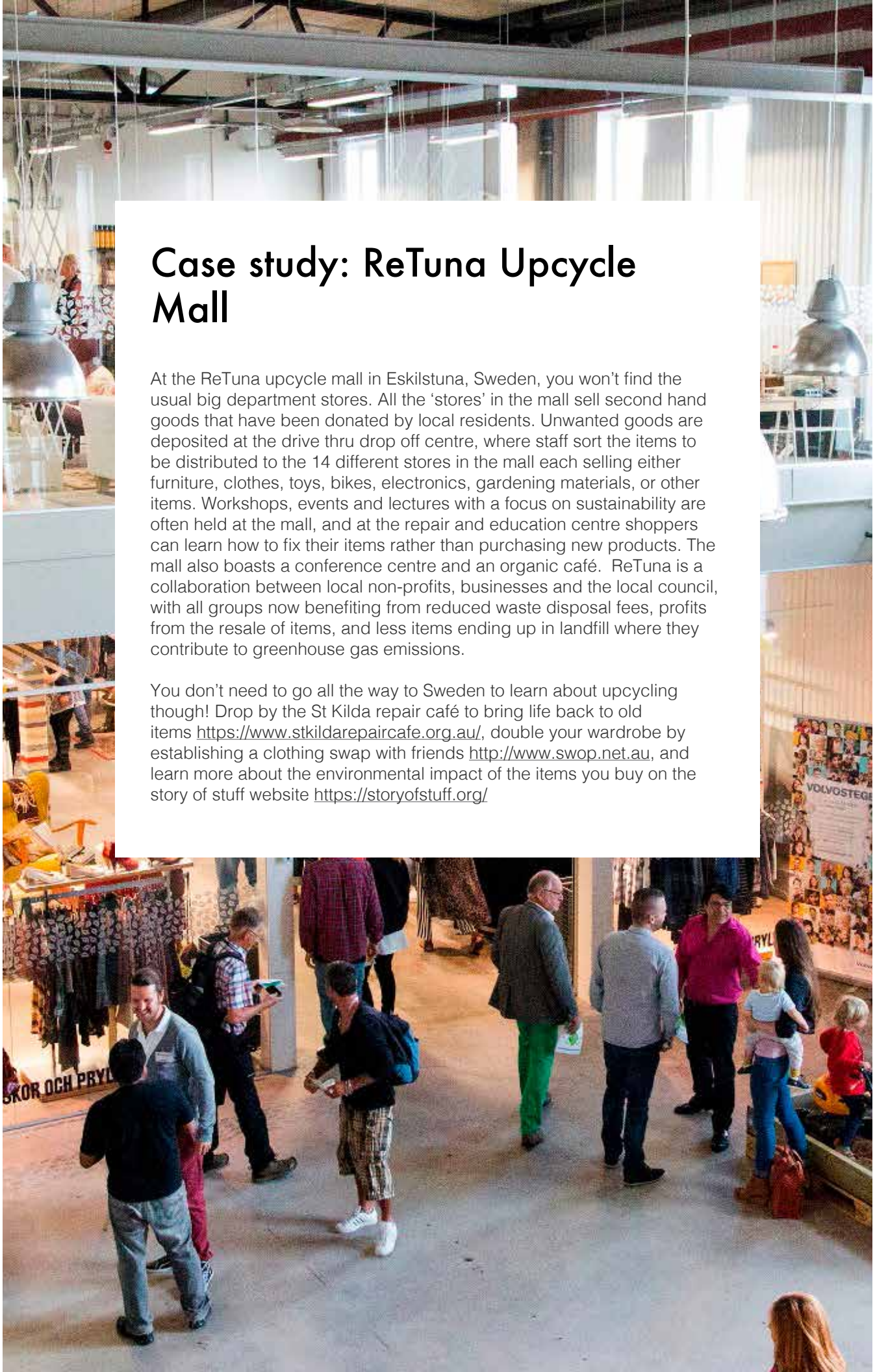
Before your neighbourhood gets a Nightingale style building, you can reduce your energy consumption by switching to green power. Find out more here https://www.greenelectricityguide.org.au/

6.1.5 Goods and manufacturing

One of the largest ways a lifestyle uses natural resources and contributes to global greenhouse gas emissions is through the products we buy. From their materials and manufacturing to their eventual disposal, consumer goods produce greenhouse gas emissions, consume land, water and electricity. Once you are finished with them, iPhones, books, kitchenware, makeup and any other product you've ever thrown out continues to damage the environment as they lay to waste in landfills that release methane into the atmosphere. Things like plastic toys and products, mass produced cheap clothing, and low quality poorly built furniture, while temptingly cheap, all have a short lifespan. This means that they will likely need to be replaced soon after their purchase, further fueling the demand for the manufacture of cheap consumer goods.

Reducing the amount of unnecessary purchasing you do, buying longer lasting quality products, fixing things when they break instead of disposing of them, and buying second hand goods can all help reduce the impact of your lifestyle.

Image credit: Eemab



Case study: ReTuna Upcycle Mall

At the ReTuna upcycle mall in Eskilstuna, Sweden, you won't find the usual big department stores. All the 'stores' in the mall sell second hand goods that have been donated by local residents. Unwanted goods are deposited at the drive thru drop off centre, where staff sort the items to be distributed to the 14 different stores in the mall each selling either furniture, clothes, toys, bikes, electronics, gardening materials, or other items. Workshops, events and lectures with a focus on sustainability are often held at the mall, and at the repair and education centre shoppers can learn how to fix their items rather than purchasing new products. The mall also boasts a conference centre and an organic café. ReTuna is a collaboration between local non-profits, businesses and the local council, with all groups now benefiting from reduced waste disposal fees, profits from the resale of items, and less items ending up in landfill where they contribute to greenhouse gas emissions.

You don't need to go all the way to Sweden to learn about upcycling though! Drop by the St Kilda repair café to bring life back to old items https://www.stkildarepaircafe.org.au/, double your wardrobe by establishing a clothing swap with friends http://www.swop.net.au, and learn more about the environmental impact of the items you buy on the story of stuff website https://storyofstuff.org/

6.1.6 Waste and Recycling

The amount of waste that you create harms the environment in more ways than one. When you throw out uneaten food, useless packaging and other items, you are also wasting the water, energy and other natural resources that were used to create them. Then once these items reach landfill, they add to the large amount of waste already there that produces greenhouse gas. Day to day, it can be surprising to realise the amount of waste one person's lifestyle creates. From the empty packet of washing detergent you throw out in the morning, your disposable coffee cup on the way to work and your gum wrapper after lunch, all of this adds up.

Going totally zero waste can seem daunting, but you can start by doing simple things like using reusable bags and containers when shopping; reducing your food waste by planning ahead and getting a compost or worm farm; and taking the time to learn how to fix things you own instead of buying new items.

Case study: Living zero waste

Approximately 58% of the waste Australia generates is recycled thanks to our separation of household waste in to two or three waste streams – general, recycling and occasionally green waste. But many cities around the world have more than three bins to choose from when it comes to throwing out their waste. Residents in Seoul, South Korea, separate their waste in to four waste streams and are charged by volume for the amount of organic waste that they create. Those living in the small village of Kamikatsu in Japan separate their waste in to an astounding 34 separate categories that are then recycled, reused or composted.

But you don't need to live in these places or wait for government policy to reduce the amount of waste you put in landfill - Sustainability Victoria is just one of the places you can find waste saving tips for your home http://www.sustainability.vic.gov.au/You-and-Your-Home/Waste-and-recycling. Further, you can increase your positive environmental impact by getting your neighbours or co-workers involved in a zero waste lifestyle too!

To find out more about what you can do to start a zero waste campaign in your community, visit the Zero Waste Network website: www.zerowastenetwork.org.au/

6.2 Scenario narratives

The following three scenario narratives describe a ‘day in the life’ of a City of Port Phillip resident in 2050. These are based both upon the opportunities described in Section 6.1, and on previous scenarios developed as part of the Visions and Pathways 2040 project[83] and the Foodprint Melbourne Project[84].

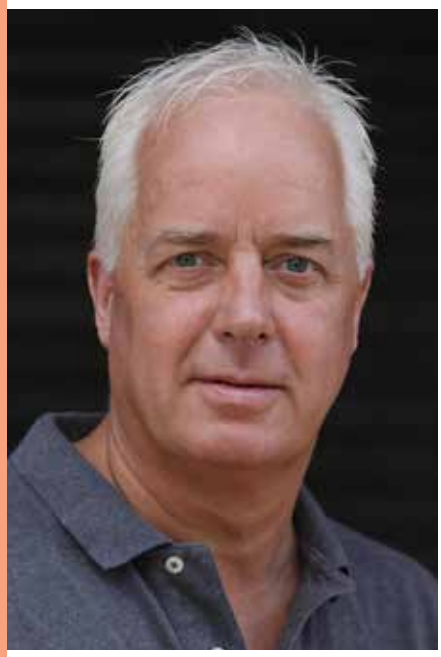
These stories personalise the data, encouraging City of Port Phillip residents to envision what a more ecologically sustainable lifestyle could look like.

83 Candy, S., Larsen, K, Twomey, P., McGrail, S., & Ryan, C. (2017). As above.

84 Sheridan, J., Carey, R. and Candy, S. (2016) As above.

Image credit: public domain

Christos, late 50s



Hi I'm Christos and I live in Middle Park with my wife Michelle. We bought our house here about twenty-five years ago, but it is pretty much unrecognisable from when we first moved in with our young kids.

Government programs in the early 2020s helped us access finance for renovations to our place including solar panels, water tanks, improved insulation and double-glazed windows. We are glad we made the investment back then, as the house as it was would definitely not meet today's Australia wide energy efficiency standards.

The kids moved out a few years ago. But that doesn't seem to stop my son dropping in to borrow the car more frequently than he should! I don't mind, we sold our second car years ago and barely use this one. I do wish though that he would return it fully charged once in a while!

Now that we are in our late 50s, Michelle and I are planning to drop back to part time work soon before retiring, and our retirement income is currently looking good. Since our super fund divested from fossil fuels years ago it has been going from strength to strength, and between you and me, I've also done pretty well for myself! My company turns plastic waste in to furniture and business boomed after the recycling crisis of 2018 when China stopped accepting our plastics. It then grew even more when we became the main supplier to flatpack furniture outlets in 2030 after they began only manufacturing products out of recycled materials.

Michelle is an electrical engineer and was one of a team of local residents who consulted on the building of the community waste to energy plant in 2035 that transforms organic waste into biogas that powers our bus system. Once she works part time, Michelle is going to join the team of volunteers that work at the redeveloped EcoCentre helping educate new residents to the area about how to ensure your home is zero waste.

Nobody ever seems to have much rubbish to deposit anymore though now that landfill is so expensive, and thanks to all the new technology that transforms waste in to a shared resource. For example, when we found we had leftover catering from Michelle's birthday lunch last week we simply added the items to the CoPP ShareFood app. The local men's shed saw this, picked up the food, and then served it at a meeting that night. Nothing goes to waste anymore in our home.

Kevin, 23

I'm Kevin, and I guess you could say my main preoccupation is that I'm a design student. In reality though that is just one of the many activities in my day! I live in a small footprint house in East St Kilda with two housemates who are also in their early 20's like me.

Most mornings I get up early to water the community farm I manage a few doors down from my house. It is built on the site of an unused petrol station that was handed back to the community when I was just a little kid.

I then ride to uni after eating breakfast at home – mostly fresh fruit and vegetables obviously, as who can afford meat and dairy these days after the environmental cost of food began being reflected in the price!

Since most roads are now car free and there are over 500km of dedicated bike paths throughout the surrounding suburbs, getting to uni on the other side of Melbourne only takes me about 30 minutes. I'm doing my masters in Textile Waste Design, whilst also running a fashion design label called Envio with friends. Our label uses a technology we patented to remove micro plastics from old synthetic clothing. We then transform these micro plastic free fibres in to new material to create our designs.

In the afternoon after class, I work at the Upcycle Centre in Port Melbourne, where I show people how to repair their clothes or how they can transform their pieces in to new designs.

I'm always amazed at the type of clothing some of the older residents bring in; the toxic materials and low quality that some fashion retailers used to be able to get away with 30 years ago is crazy! On my way home, I stop by the community farm again to pick up some things for dinner from the attached food co-op.

My housemates and I pay an annual membership fee that allows us to take food when we need it. Our small footprint home doesn't have room for a big pantry, as the smaller and more energy efficient the house, the larger rent discount we get from the government.

We also save money on bills by keeping to our free 50L per person per day water limit, and by getting our electricity from the community solar farms located in Port Melbourne, Middle Park and Elwood. As a student and small business owner, any savings I can make are fine by me!

Image credit: public domain

Jessica, 35

Hi, I'm Jessica. I'm 35 years old and live with my wife Saanvi and six year old son Ethan in an apartment we only recently bought in Ripponlea. We had been on the waitlist for one of these apartments for a while now, before this we were renting in St Kilda. Our new place is small but I love it. Like all new apartment buildings in the City of Port Phillip, the building has passive heating and cooling systems, communal laundry facilities, uses recycled water and is 100% powered by green energy. It also has a community garden that is fed with soil conditioner made by our basement organic digester that takes all residents' organic waste!

So even though buying an apartment was a big financial decision for us, our bills are now next to nothing compared to what we were paying in our old weatherboard in St Kilda East. We were living in one of the last buildings in the area to be retrofitted to meet the mandatory 9 star NatHERS[85] star rating, and so with the carbon pricing that has been in place for the last 25 years, it was both expensive to live in and freezing in winter!

Moving to a new neighbourhood has been easy, as everything still feels so close and accessible with the 24hour trams and BioBus stops that are never further than 100 metres away. We have never owned a car and neither do any of our friends – the idea seems so redundant to me! In the mornings I walk Ethan to school before opening up the Elwood branch of Bulkmarket, the zero waste bulk goods supermarket I started. It's the third store I have opened in City of Port Phillip since single use plastics were banned and everybody started buying bulk, unpackaged goods.

Saanvi works from home as a financial consultant. After the last Australian business divested from fossil fuels in 2031 (took their time to catch up to the rest of the world in my opinion!), Saanvi began helping businesses invest in small to medium scale environmentally sustainable energy projects.

She has been so busy, so I'm looking forward to getting away camping together as a family this weekend. We are going to book a car through the CarShare group we belong to and take Ethan to the wetlands located on the site of the old power station in the Latrobe Valley. On the way we will stop off at the Port Melbourne co-operative farm to pick up some food; this farm was one of the first suppliers to stock at BulkMarket, and I love eating omelettes made with their quail eggs and Warrigal greens!

Ethan learns all about sustainable agriculture through the Junior Environmental Education Program at his primary school, and it has been great for him to see what he learns in the classroom in real life.

85 NatHERS is a star rating system that provides a score out of ten for the thermal performance (the heating and cooling) of a home. The score takes in to consideration the design, construction materials used, and also the climate of where the house is located.

Image credit: public domain

6.3 Quantitative modelling of future scenarios

Ultimately the credibility of any set of scenarios will depend on estimates of their likely success in improving the sustainability of a community. Quantitative modelling is a way to measure or estimate the impact of interventions and help to identify the most promising sectors for future investment in the necessary urban transformation towards sustainability.

Table 1 shows how the opportunities from Section 6.1 and aspects of the scenario narratives have been translated into quantitative settings in ASFF to form the representative 'EcoFuture' scenario. These settings are designed to both improve unsustainable trends in production and consumption and push any incidental improvements further, because it was clear in Section 4 that the 2050 BAU trajectory would overshoot sustainable levels of resource use and greenhouse gas emissions and waste production.

The EcoFuture scenario was also based on previous scenarios that focused on either how changes across one sector affected multiple environmental impacts[86], or how changes across multiple sectors affected one environmental impact[87]. The results of the EcoFuture scenario modelling should be viewed as the first iteration of bringing these earlier perspectives together to envision the effects of changes across multiple sectors on multiple environmental impacts at a local council level.

For this reason it may not achieve a 'sustainable' outcome according to estimates of sustainable levels of resource use and production of greenhouse gas emissions. It should, however, indicate the direction to follow to make progress towards meeting these recommended sustainable levels. It will also show which strategies have complementary benefits across different environmental impacts, making it possible to identify synergies and prioritise areas for action.

Further iterations on these scenario settings may be needed to reach a sustainable outcome, however this was beyond the scope of this report.

86 Sheridan, J., Carey, R. and Candy, S. (2016) As above.

87 Candy, S., Larsen, K, Twomey, P., McGrail, S., & Ryan, C. (2017). As above.

Domain	EcoFuture scenario settings
Electricity & Energy	Fossil fuel powered plants are decommissioned faster than expected due to reduced demand and economic factors. A transition to majority renewable electricity generation is achieved by 2040 with 11% gas, 63% solar PV, 21% wind and 5% hydro. Any variable renewable technologies are also assumed to be increasingly deployed with some electrical storage. Energy intensity and non-electricity energy demand of residential and commercial buildings is reduced by 50% due to widespread use of installation of solar hot water and better passive design features such as double glazing and insulated ceilings and walls. Manufacturing efficiency improves at 1.2% per annum according to rate for 'Best Practice Technologies'[88], reducing energy demand by 38%.
Transport & Mobility	The mode of travel for local trips shifted to 25% car, 25% public transport and 50% walking/cycling, intercity trips 50% bus & 50% rail and international trips 50% air & 50% ship. The remaining car fleet is transitioned to greener transport technologies (electric and gas) due to rising costs of fossil fuels. From 2020, all new personal and light commercial vehicles are 100% electric, transit vehicles are 50% electric and 50% gas, and intercity vehicles are 100% gas. Freight vehicles are 50% electric and 50% gas, and freight modes have shifted to 50% rail and 50% by ship. Cars are made here, to reduce imports from overseas. Due to car sharing schemes and '20 minute' walkable cities, there is a 67% reduction in car ownership per household, 50% reduction in public transport trips and a 30% reduction in the average distance travelled by car. The occupancy of each car has doubled per trip due to sophisticated ride sharing schemes.
Food and Agriculture	Diet by 2040 is 'flexitarian'[89] for everyone—mostly plant-based with only local sources of animal products. The majority of cropland is shifted to mixed grazing/cropping with regenerative agricultural practices over ten years starting in 2025 to reduce water and fertiliser use and improve land condition. The reduction in red meat (approximately 50%) and other food consumption overall make remaining land available for forestry and carbon sequestration.
Urban form	Housing unaffordability leads to more instances of co-housing—by 2040 the average number of people per dwelling has doubled (represented by an increase in dwelling units per household by 50%). This also drives a increase in the proportion of multiple dwelling units such as apartments to 50% overall. Office space intensity per worker is reduced by 30% due to hot-desking and shared facilities. New dwellings use light insulating outer structures, keeping thermal mass inside, resulting in past trends continuing over 20 years until a 50% decrease in overall building mass is achieved. Building material composition has been adjusted to higher percentages of glass and wood, and lower percentages of brick and concrete.
Goods and Manufacturing	Reduction in consumption of consumable such as paper, textiles, chemicals, and other non-specific goods by 50% overall due to sharing and reuse, and also extended product lifetimes by 100% because goods are built to last. Ownership fraction of residential white appliances such as washing machines and dishwashers is reduced by 50% due to sharing and co-housing. Aluminium production and other heavy industry production is reduced due to the reduction in exports made possible by the reduction in consumption of imported goods. Reuse of goods is simulated by adjusting the domestic material demand. The remaining materials required for manufacturing are adjusted to allow a proportion to be supplied from equivalent recycled materials.
Water	Reduced wastewater emissions intensity by 60% due to biogas incorporated in distributed treatment plants (waste to energy).
Waste	Edible food waste is reduced by 90% by 2030 due to sophisticated food sharing and reuse practices and networks. Inedible food waste is used as feedstock for small-scale biogas plants to transform waste to energy. Other landfill waste (and associated emissions) are reduced due to overall reduction in consumption of goods, extensive reuse and some recycling.

Table 1 - Quantitative settings for EcoFuture scenario for City of Port Phillip

88 United Nations Industrial Development Organisation (UNIDO) 2010, Global Industrial Energy Efficiency Benchmarking, An Energy Policy Tool, Working Paper, Vienna.

89 Hosie, J, (2016) Flexitarianism predicted as key food trend for 2017. The Independent, https://www.independent.co.uk/life-style/food-and-drink/flexitarianism-predicted-as-key-food-trend-for-2017-vegetarian-less-meat-a7465156.html

6.3.1 Land footprint

After incorporating the interventions listed in Table 1, the total land footprint for the City of Port Phillip in 2050 has been reduced from 6183 square kilometres in the BAU scenario to 5280 square kilometres. This corresponds to a per capita land footprint of only 27,790 square metres per person or 2.8 hectares (Figure 9). This is a reduction of 15% compared to the original per capita footprint projection for 2050 of 3.2 hectares.

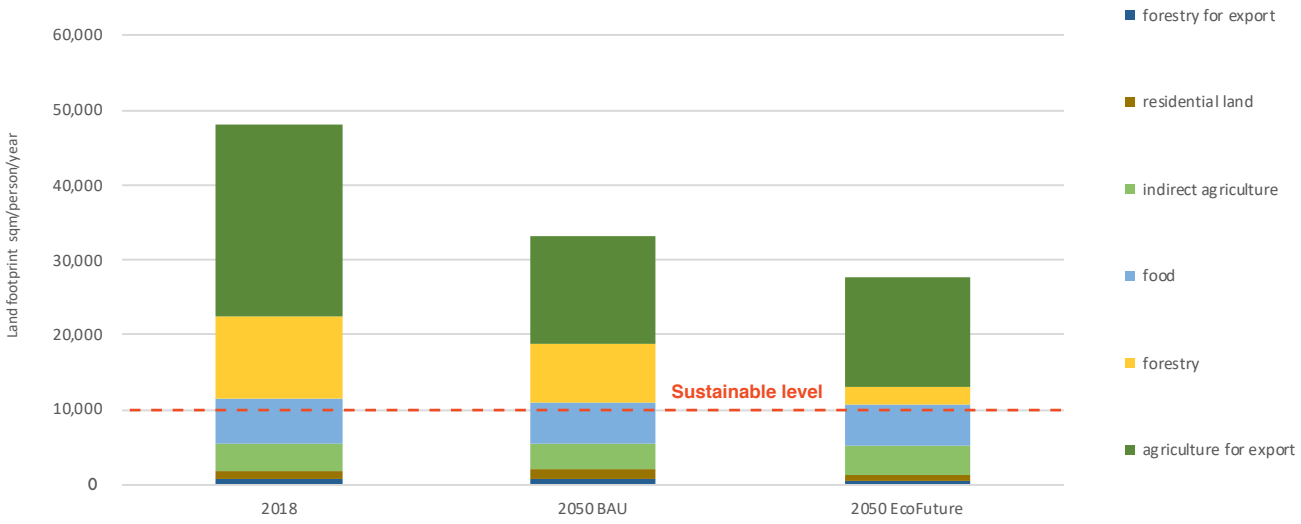


Figure 9 - Comparison of original projected per capita land footprint and sustainable alternative land footprint by consumption type for 2050.

It is clear in Figure 9, that the reduction in land footprint is mostly due to the reduction of land used indirectly to support consumption. This is includes a more significant reduction in agricultural products for export and forestry products than in the BAU scenario, as well as reductions due to the adoption of the flexitarian diet and reduction of food waste which reduces that amount of land required to meet direct food needs.

Although the per capita land footprint has been reduced by almost 50% compared to 2018 levels and by 15% compared to the BAU case in 2050, a further 60% reduction is required to reach the recommended sustainable level.

6.3.2 Water footprint

The total water footprint for the City of Port Phillip per annum in 2050 has been reduced from 262,650 million litres (262 gigalitres) to just 160,007 million litres (160 gigalitres). On a per capita basis, this translates to 2307 litres per person per day, compared to 3787 litres per person per day in the BAU scenario (Figure 10).

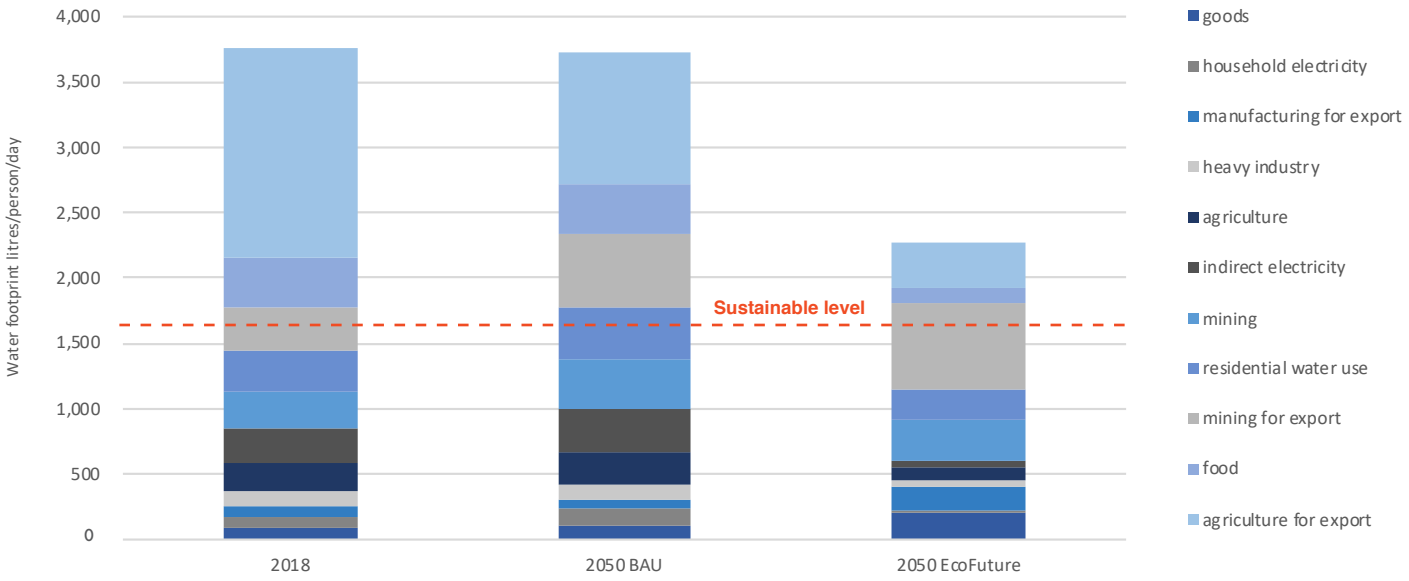


Figure 10 - Comparison of original projected per capita water footprint and sustainable alternative water footprint by consumption type for 2050.

A big reduction has occurred in indirect water use supporting consumption. This has come from the reduction in agricultural exports (facilitated by a reduction in consumption of imports), the switch to flexitarian diet (that also reduced the land footprint), as well as a switch to electricity generated from renewable sources instead of fossil fuels. There has also been a reduction in residential water use due to higher density living.

The overall reduction in water footprint is significant, but a further reduction of around 30% is required to reach the recommended sustainable global per capita level for 2050.

6.3.3 Carbon footprint

The total carbon footprint for the City of Port Phillip per annum in 2050 has been reduced from 4.8 million tonnes per year to 1.6 million tonnes per year. On a per capita basis, this translates to 25,119 kg per person per year to just 8,669 kg per person per year (Figure 11).

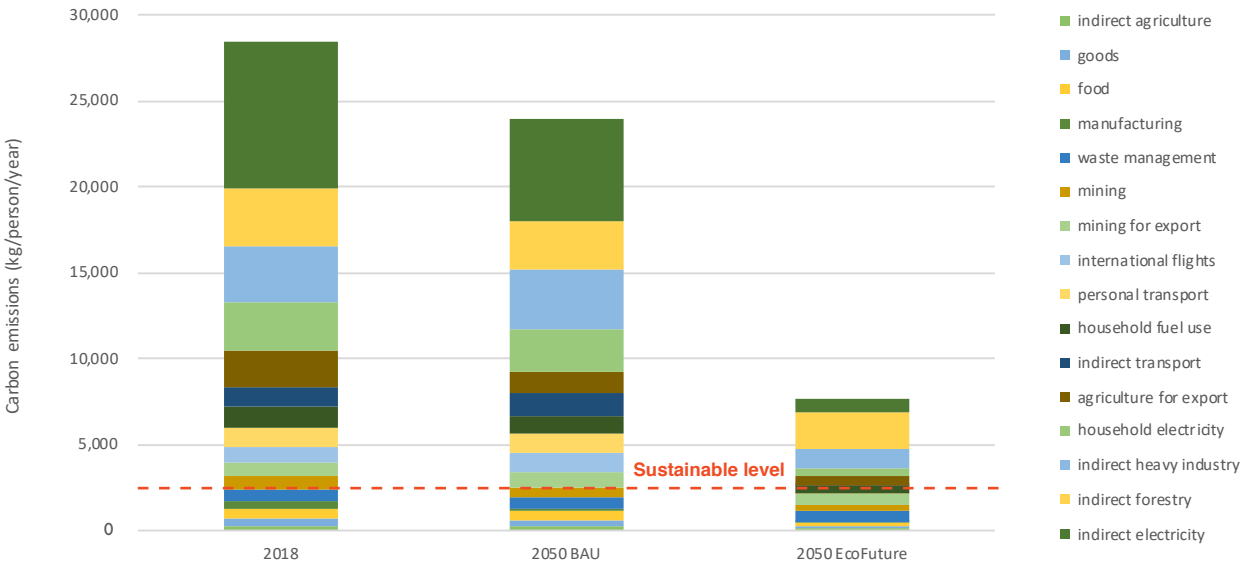


Figure 11 – Carbon emissions generated per person per year for current and future scenarios by consumption type.

Similar to the water and land footprints, there is a significant drop in carbon emissions across all types of consumption based on the quantitative settings detailed in Table 1. This example shows clearly the impact of implementing multiple strategies across all sectors on reducing environmental footprint. Even so, when comparing the reduced carbon footprint with recommended global per capita levels for 2050, it is clear that it needs to be a reduced by a further 60%.

6.3.4 Waste footprint

The total waste footprint for the City of Port Phillip per annum in 2050 has been reduced from 1.2 milion tonnes per year in the BAU scenario to 208,183 tonnes per year in the EcoFuture scenario. As Figure 12 shows, this translates to a reduction from 6,337 kg per person per year in the BAU scenario (17 kg per person per day) to 1,096 kg per person per year in the EcoFuture scenario (3 kg per person per day).

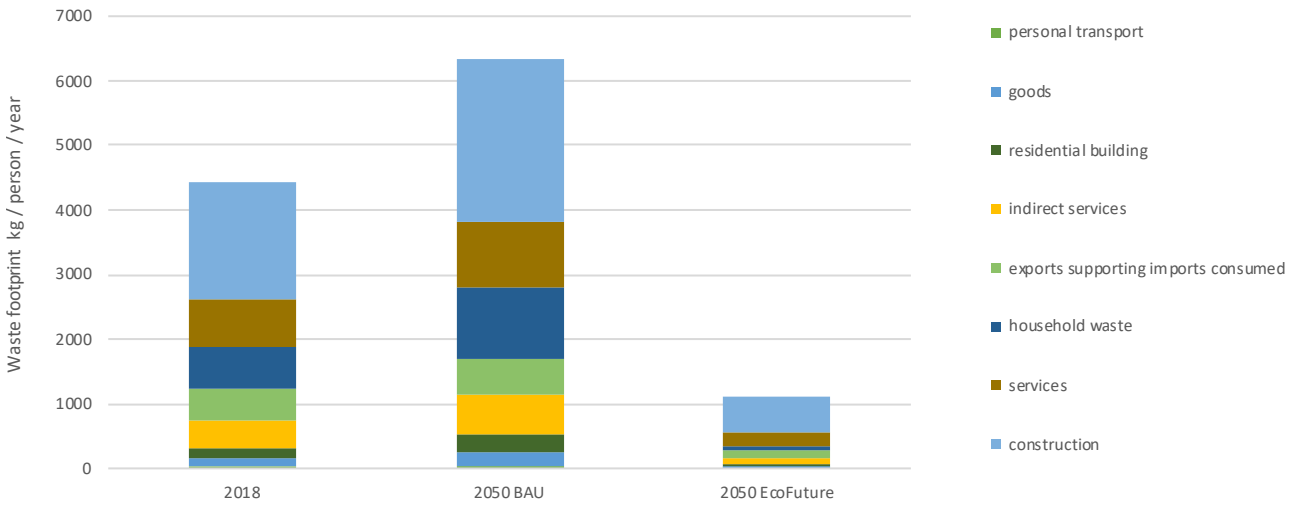


Figure 12 - Waste generated per person per year for current and future scenarios by consumption type.

This dramatic 83% decrease is due to a combination of extended product lifetimes because goods are built to last, reduced purchases of new goods due to extended lifetimes and sharing of existing goods, and substantial recycling of goods and materials at the end of their working lives.

Conclusion
7.0

Urban lifestyles and activities in the City of Port Phillip have a significant environmental footprint.

- 5,482 square kilometers of land are required for the city in total. This is equivalent to 48,294 square metres per person (4.8 hectares), over four times the size of Luna Park.

- 155,775 million litres of water are used per year. This is equivalent to 3,808 litres of water per person per day, more than twelve times per capita household water consumption.

- Around 3.4 million tonnes of carbon emissions are generated. This is equivalent to 29,798 kg per person per year, the same as the emissions generated by running twelve average passenger cars over the same period.

- An average resident of the City of Port Phillip will generate almost 12 kg of waste per day.

For both land and water, around 20-25% of the overall footprint is due to direct consumption of goods and services and another 20-25% is due to indirect industries supporting that consumption. In both cases, over half of the overall footprint is generated by the production of exports to support the consumption of imported goods. A significant proportion of the land and water footprint is due to agricultural production, particularly red meat products (including supporting feed grown for animals) for both domestic consumption and export.

Like land and water, around a quarter of the overall carbon footprint of the City of Port Phillip is due to direct consumption of goods and services. However, just 14% is generated by the production of exports to support the consumption of imported goods. The remaining two thirds of the overall carbon footprint is generated via processes that support the consumption of goods, largely hidden from urban dwellers. Likewise, the majority of the waste footprint is generated not from household waste, but indirectly from industries supporting consumption (such as the construction sector) and from waste types not typically put in household bins (e.g. restaurant and other service sector waste).

The City of Port Phillip is likely to grow rapidly between now and 2050. Although per capita footprints for land, water and carbon are expected to remain the same or decrease marginally, the higher rate of population increase will mean that the City of Port Phillip will have a significantly larger environmental footprint if consumption patterns continue according to a ‘business as usual’ scenario.

Supplies of the natural resources that underpin urban lifestyles and activities – including land, water, fossil fuels and phosphorous – will become more constrained in the future. Pressure is also likely to increase to reduce greenhouse gas emissions associated with food production and consumption.

Scenario modelling of changes to both consumption and production of goods and services as part of an 'EcoFuture' scenario has shown that it is possible to reduce the environmental footprint of the City of Port Phillip. By 2050 land footprint could be reduced by 15%, the water footprint by 39% and the carbon footprint by 65% per capita. The amount of waste generated per capita could also be reduced by 83%.

Key strategies included adoption of a flexitarian diet, reduction of consumption of goods via sharing and designing them to last, increasing recycling to reduce waste and reuse materials, switch to clean, renewable electricity production and reduction of overall energy demand due to better insulation and smaller dwellings. A number of these strategies were also found to have complementary benefits across different environmental impacts, making it possible to identify synergies and prioritise areas for action to increase the sustainability and resilience of the City of Port Phillip community.

These include:

- Reduced overall consumption of goods
    - reduces reliance on imported goods and the need to export land, water and carbon intensive products,
    - reduces the amount of land required to produce forestry products,
    - reduces consumption of indirect electricity with associated carbon emissions and water use and reduces emission from heavy industry.
- Switch from fossil-fuel powered to clean, renewable energy
    - reduces emissions and water use associated with both direct and indirect electricity generation.
- Change in diet, particularly lowering red meat consumption, and reduction in food waste
    - reduces direct and indirect water and land footprints associated with domestic food production
    - reduces the need for further agricultural land expansion and makes more land available for carbon sequestration and biodiversity preservation.

To facilitate these strategies, the City of Port Phillip council should:

- Support sharing, repairing and recycling programs andinitiatives to reduce overall consumption of goods.
- Advocate for the decarbonisation of state electricity generation.
- Encourage and support City of Port Phillip residents to switch to green power to drive change in the energy sector, and support or expand clean energy programs within City of Port Phillip boundaries.
- Educate City of Port Phillip residents about the environmental impacts of current diets and food waste.

References
8.0

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