Building Resilience in the Leisure and Recreation Industry in the Face of Climate and Weather Change

Dr Ken Marriott

The following paper and the accompanying pdf ("Marriott Climate change workshop slides") were presented at the PLA Vic/Tas regional conference held in Healesville on June 8-9 2023.

The paper has been slightly amended from that presented at the conference, mainly to add case study materials which were distributed separately at the conference and to add several comments arising from discussions during the presentation session.

Discussion of and responses to any of the issues and recommendations presented in this paper are invited. Similarly, anyone wishing to join a "working group" on the issues is invited to make contact. The author's contact details are provided at the end of the paper. Finally, readers are welcome to use any of the materials in the paper and the accompanying Powerpoint /slide materials provided the source of the materials is acknowledged.

Dr Ken Marriott
PO Box 141, Williamstown Vic 3016

ken.oz@me.com
0418 178 788

Building Resilience in the Leisure and Recreation Industry in the Face of Climate and Weather Change

Dr Ken Marriott [1], [2]

1. Introduction

Melbourne's, south-eastern Australia's, Australia's and the world's *climates* have changed. Similarly, all these locales and the world's *weather* have changed.

People talk about climate change as if it something that is on it's way: *it is not. It is here*. People say, "If we don't achieve X by 2030 or 2050, Y will happen . In fact, Y has already happened to a significant extent: what will occur by 2030 or 2050 is that Y will be far worse than it is already.

Unless sufficient action is taken, by 2050 and certainly by 2075 and 2100, X and Y will potentially be sufficiently severe to threaten life as we know it for the vast proportion of the global population…. of human, animals and plants.

The *Synthesis Report of the IPCC 6th Assessment Report (AR6)* released by the Intergovernmental Panel on Climate Change in March 2023 confirms this in the strongest way possible (IPCC, 2023). The opening paragraph of the report states:

> **A.1 Human activities, principally through emissions of greenhouse gases, have unequivocally caused global warming, with global surface temperature reaching 1.1°C above 1850–1900 in 2011–2020. Global greenhouse gas emissions have continued to increase, with unequal historical and ongoing contributions arising from unsustainable energy use, land use and land-use change, lifestyles and patterns of consumption and production across regions, between and within countries, and among individuals (*high confidence*)". (IPCC, AR6, p. 4)**

2. Session Objectives

This presentation and workshop session has five objectives:

1. To reassert that climate and weather change *have* happened and that change is continuing and intensifying

2. To highlight the importance of climate and weather change to the leisure and recreation industries

3. To propose an action framework that the leisure profession and local government can use as a guide to responding to climate and weather change

4. To discuss the work being undertaken by the Climate Council of Australia that is relevant to local government climate and weather change action, and

5. To run a discussion/question session focused on input from representatives of local government bodies that have implemented action plans on climate and weather change.

I do not plan to debate whether climate and weather change are occurring, as they are. Nor do I want to go into a lot of detail on the evidence. It is widely available. For people who have an interest in this evidence from an Australian and a leisure planning perspective, I wrote a lengthy and detailed paper

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[1] Prior to establishing the leisure consultancy HM Leisure Planning Pty Ltd in 1983, Dr Marriott lectured on leisure research and planning at what is now Deakin University, after completing a PhD on leisure planning in the Department of Geography at Monash University. However, prior to the career change that took him into the leisure industry, Dr Marriott spent over 15 years researching and lecturing on climate, micro-climatology and climate change, also at what is now Deakin University. He published his first research into Melbourne's weather and climate change in 1966 and updated the findings in association with Gothenburg University in 2020. This paper draws on some of Dr Marriott's research in both career areas

[2] The support and assistance of the following people in preparing this paper is gratefully acknowledged: Dr Hans Chen, Assistant Professor, Department of Space, Earth and Environment at Chalmers University of Technology in Gothenburg, Sweden; Dr Portia Odell, Director, Cities Power Partnership, Climate Council of Australia and the wider Climate Council organisation; staff and individual Victorian Councils which have supported the session by recommending the staff invited to present case study material in the discussion and question session.

in 2021 and I have some copies here or I can provide it in an electronic form (Marriott, 2021a). A very abbreviated version was also published in Australian Leisure Management (Marriott, 2021b) [3]

3. Climate and Weather Change and the Leisure Industry

Why are climate and weather change crucial to the leisure industry? The answer is simple: because leisure and recreation are relevant to every person on the planet, something that cannot be claimed by many other industries outside the core elements of food, shelter and health. For many people, leisure is what gives their life meaning and it is what gives them their health.

On a more practical basis, climate change is relevant to our industry because leisure is one of the major investments made by local government. In 2020-21, Australian Councils had a combined expenditure of $43 bn. Of this, $6.5 bn., or 15 percent, was spent on leisure and recreation. That is $65 bn. every decade. The only other larger items were Transport and Communications ($10.3bn.) and "General Public Services" ($9.6bn.). Further, local government in 2020-21 had assets valued at $500 bn. And while separate data is not readily available for the dollar value of leisure and recreation assets, one would have to consider that apart from roads, civic buildings (which often support leisure and recreation pursuits) and equipment and plant, the value of leisure and recreation assets would make up a considerable proportion of the $500bn.

From another perspective, a 2020 study by KPMG for the Victorian government, found that the value delivered and supported by "community sport and active recreation infrastructure in Victoria" was $7.1bn. Annually, this was made up of $2.1bn. of economic value, $2.3bn. of health benefits and $2.6bn. of social benefits (KPMG, 2020, p. 3). I would suspect that across *all* leisure and recreation, the $7.1bn. could be multiplied three- or four-fold to give total annual value of $21-28bn. for Victoria alone. As Victoria is currently home for 6.5 m. people or 25 percent of the Australian population, on a rough per capita basis, this would put the annual value of sports-focused leisure and recreation in Australia at $25 – 32bn. and give all leisure and recreation in the country a value of $100-130bn. *annually*. Almost enough to buy a fleet of submarines every 3-4 years!

So, we have a lot to look after and we deliver a huge amount. And as there is a vast array of facilities, programs and services that could be damaged, destroyed, disrupted, cancelled and downgraded by weather and climate change, our profession must act to protect what we have and more importantly, *guide how it can be best protected*.

4. Climate and Weather Change

3.1 Climate and weather

I mentioned above both climate *and* weather change.

Climate is the long term average (usually over a minimum of 30 years) of daily weather events and the atmospheric systems that create them. Overall, the climate of the earth has not changed greatly. Things have got a bit warmer, some places have got a bit wetter or dryer, but because we are working on 30 year averages, things don't look too bad.

By comparison, *weather* is a daily, weekly or monthly set of atmospheric events and the associated consequences that when averaged, make up "climate". The weather has changed dramatically in many parts of the world. And it is changing rapidly, more dramatically and to greater extremes that "climatic" data would suggest.

And in fact, were it not for some mitigation actions that had nothing to do with climate or weather change, some of the recent events could have worse. Massive floods on many rivers today would be far worse if there were not dozens of dams holding back millions of swimming pools of water –to use the common analogy. If those dams were not there, the flooding would definitely have been unprecedented.

Because the climate has been changed by human activity, the ***weather*** has too. And the damage that changed weather creates is the scary bit. It's the damage that hits us in the face, that causes massive flooding, that blows down trees and powerlines, that causes landslides *and that can and is, already, killing us, destroying our crops and our settlements and*.

[3] The February 2023 edition of *European Sport Management Quarterly* (Vol. 23, Issue 1) warrants close attention. This is a special edition with a focus on "environmental sustainability matters in sport". As well as an extensive literature review, the issue has key papers on current and future environmental challenges in sports management, the environmental sustainability of sports organisations, with a case study from Belgium; sport stadia and water resources and associated environmental impacts and adaption strategies, KPIs, corporate responsibilities and initial reform proposals.

Let me give you some examples of climate and weather change. But first, I need to start with a little bit of meteorology, that is, the functioning of the atmosphere. In the standard atmospheric context, as the temperature of air rises, so does it's capacity to hold water:

• at 10 degrees, a cubic metre of air can hold 9 grams of water. If it's air blowing off the ocean it will be damp and slightly sticky. And of course, we know in Melbourne, if its coming from the north in summer ---where there is essentially no water supply to evaporate--- it will be hot and parching

• at 20 degrees, that cubic metre can hold 17 grams, while

• at 30 degrees, a cubic metre can hold 30 grams.

This room of eg: 8 by 8 by 4 metres or around 250 cubic metres, could be holding, at the conference temperature of 20 degrees, around 4,250 grams or 4.25 litres of water. If the temperature is raised by 1 degree, it *could* hold 5 litres. Raised by 10 degrees, it could hold 7.5 litres.

Generally, conference organisers don't let that happen: they don't let the temperature go too high and they use technical processes to extract excess water. You see that water running out of air conditioners all over town. You see inadequate or poorly operated air treatment systems in aquatic centres when everything is damp or when, in the case of one I knew, it started to "rain".

But in addition to this, massive human-derived carbon dioxide, methane and other gas emissions have trapped heat and energy in the atmosphere and the oceans causing the world's current global temperature to rise by an average of 1.4 degrees above the 1900 level.

For every 1 degree increase of temperature, the earth's atmosphere can hold 7% more water. So with a current increase of 1.4 deg, the earth's atmosphere can hold a fraction under 10 percent *more* water. Some parts of the globe, including Australia's east coast waters, have increased by far more than 1.4 percent, with some increases over 2.2 percent and climbing.

This is a statistically significant change which has led to extensively changed and more dramatic weather events.

One more little bit of meteorology will help a little further. Essentially, the atmosphere circulates in a west-to-east and tropics-to-poles fashion. The west to east component is because it is being dragged along by the spinning of the earth: but because it is light and flexible compared with the earth, it follows a different path.

The tropics to poles movement is essentially the atmosphere trying to balance out the imbalances of heat and energy at the tropics and the poles. At the tropics there is more incoming heat energy than is needed or than can be stored. At the poles, more is lost than is provided. So the earth seeks a balance by sending the excess at the tropics to the poles. Ideally, the movement would be a straight line: but the earth is spinning *and* at different speeds at every degree of latitude we move toward or away from the tropics. Air moving northward is deflected to the right (ie: eastward) and air moving toward the south is deflected to the left, also eastward. There are also land masses of differing shapes and heights in the way, there are oceans of differing sizes and depths and there are ocean currents and submerged ridges. In the lower atmosphere, high and low pressure cells develop due to regional differences of heat and cold and the earth's rotation and these then facilitate the transfer process. Upper atmospheric jet streams, away from surface interruptions, also make a major contribution to the transfer process.

3.1 Climate change

In the following paragraphs I use my own research to show the changes that have occurred to Melbourne's climate. Climates can be classified using information about the key weather characteristics that create them. You have probably all heard of a "Mediterranean climate", one which is typified by mild winters, winter and spring rain and generally hot dry summers. Think Adelaide. And I'm sure you have experienced or heard of tropical climates (eg: Cairns) and polar climates (eg: Mawson Base, Antarctica).

But these are descriptive terms and as such they can be somewhat vague. As with many other scientific fields, Germans led the way in classifying climates more scientifically. Between the 1870s and the mid 1930s, a group of 37 German and other climate scientists from around the world, led by Wladimir Koppen from Graz University, and with an input from the leading Australian geographer of the time, classified and mapped the climates of the world (Koppen, 1936).

Koppen used averaged data covering at least 30 years for monthly, seasonal and annual data on the amount and monthly distribution of precipitation (which includes rainfall, snow, sleet, hail etc), temperature maxima and minima and ranges. Importantly, the analyses were related to naturally-occurring vegetation types and to the physical characteristics of the earth's land masses (eg: coastal,

inland, mountainous). With regard to vegetation, Chen and Chen (2013, p. 69) note that "The classification…has been widely used to map (the) geographic distribution of long term mean climate and associated ecosystem conditions…" and "…to identify changes in climate and potential changes in vegetation over time".

The classification categories ranged from A, representing hot, wet tropical climates through to E, these being high latitude climates with no summers, such as experienced by the Antarctic. In between, B represented arid and semi-arid desert climates, C mid latitude mild climates, and D mid latitude continental climates with severe winters. Second and third letters were used with each category to indicate more specific sub-conditions.

A map of the classification of climates across south-eastern Australia is shown in Figure 1 as adapted from James for my 1966 publication. The classification of was Cfb, this being a "mid latitude marine climate with mild winters and cool summers, and no dry season". By comparison, Sydney was classified as Cfa: a "mid latitude maritime climate with mild winters and hot summers and no dry season". As a contrast, Mildura was classified BSk, this representing a "cool, semi-arid climate" (James, 1959). The perhaps unexpected "cool" categorisation for Mildura reflects the impact of the often very low temperatures the inland of Australia experiences under the influence of large high pressure cells over winter. Western Victoria was Csb, having mild rainy winters and dry, cool to warm summers and Adelaide was Csa, this being mild rainy winters and hot dry summers.

Figure 1. the historic distribution of Koppen climatic zones across mainland south-eastern Australia (after James). **Note:** all of Tasmania is Cfb, the same as the average for Melbourne. However, whereas Melbourne is near the northern limit of the Cfb, Hobart is nearer the southern limit and closer to a Cfc classification

Because the Koppen classification uses specific sets of monthly, seasonal and annual rainfall and temperature data, it is possible to classify individual years and thereby combine an assessment of both the climate and the weather patterns experienced in individual years. The author of this paper did such an analysis for Melbourne data as a university undergraduate in 1966. Data for 1856-1965 was collected from the Australian Bureau of Meteorology and classified year by year. Figure 2 shows the results. In some ways the data in Figure 2 is only of historic interest. Although it is essentially all within the period now recognised as being subject to human-induced climate change factors and processes, there are patterns or cycles of change (most probably related to La Nina/El Nino and other semi-global cycles) but there is little or nothing on an annual scale that could readily be attributed to climate change or weather change. Two possible exceptions are when Melbourne had many more Sydney-like years (Cfa) between 1895 and 1928 and again between 1962 and 1995, both being 33 year cycles.

What the chart reveals very clearly is the variability of Melbourne's climate. We all know of "four seasons in one day": what the chart also shows is four climates in one decade. Thus, while the average classification was Cfb – a marine climate with mild winters, cool summers and no dry season—in reality, these only accounted for 23 percent of the individual years. In 49 percent of the years, Melbourne's weather was much like that of Sydney: mild winters, hot summers, and no dry season. Most of us will recall hot dry summers in Melbourne but the "no dry season" sounds odd until it is noted that Melbourne often has short, sharp summer thunderstorms, known as "southerly busters". These provide sufficiently heavy rainfalls to offset the otherwise dry average conditions. Figure 2 also shows some years with very distinct sub-tropical wet summers (Cwb, more typical of say,

Rockhampton) and both these and the Sydney-style years are probably due to wet La Nina weather reaching as far south as Melbourne [4].

A result that did not stand out in the original analysis was that in one year, 1895, Melbourne had a BSk classification –the same as Mildura and Broken Hill-- with a mild to cold winter and a hot dry summer.

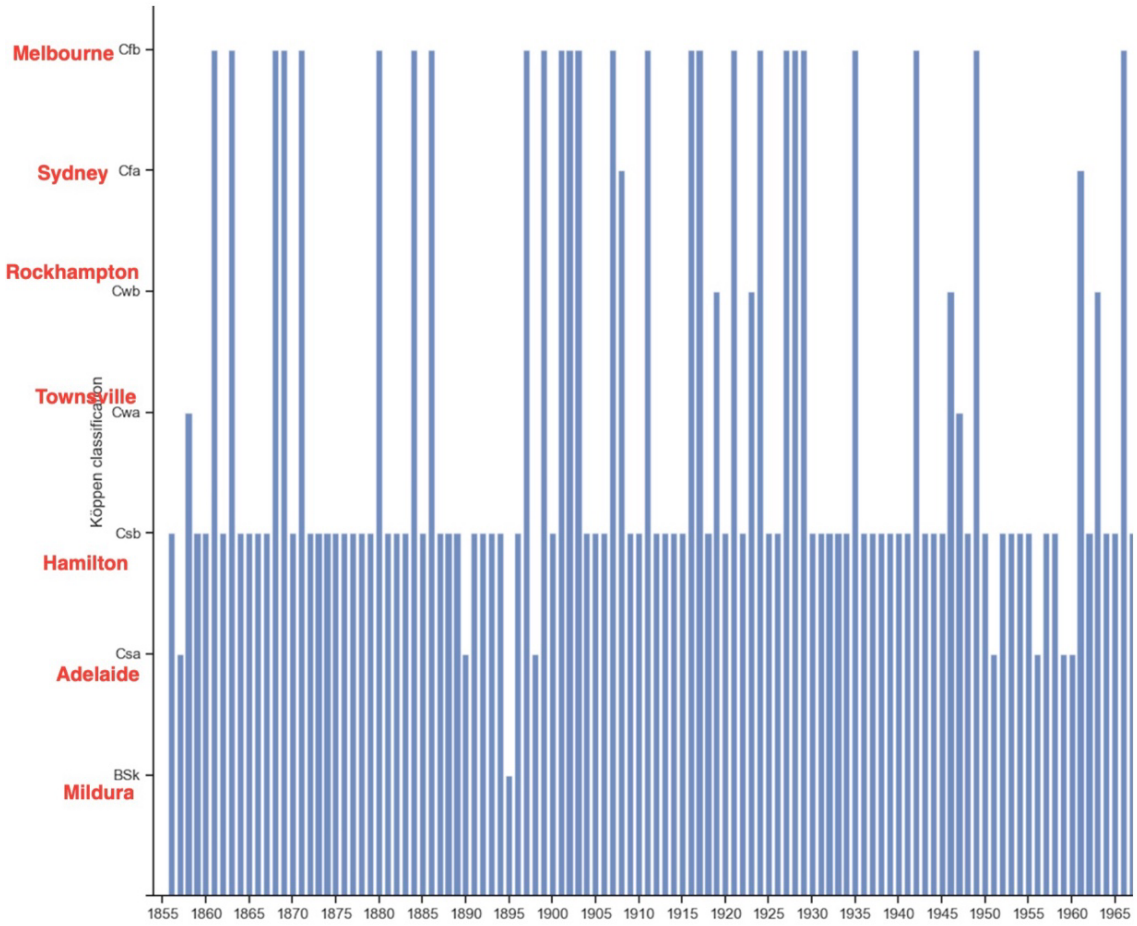

Figure 2. The annual classification of Melbourne's climate for 1856-1965 using the Koppen classification

In 2020 I revisited the 1966 research and in association with Prof Hans Chen, then at the University of Gothenburg in Sweden, recalculated the annual Melbourne records. This time, we were able to extend the analysis through to 2019.

The results from 1963 to 2019 are shown in Figure 3 and Table 1. They are revealing and concerning. First, there has been a substantial drop in the number of years when Melbourne has had either the traditional mild winter, no dry season, cool summers (Cfb) climatic regime or the mild winter, no dry season, hot summers Sydney regime (Cfa). Second, there has been an increase in the number of years with mild, rainy winters and hot dry summers (Csa) and third, and of greatest concern, there has been a dramatic increase in the number of years with a cool, semi-arid Mildura/Broken Hill classification (BSk). Whereas there was one BSk classification between 1856 and 1965, *there were 11 following 1970 and 9 between 1997 and 2019, more than one-third of the last 23 years*. Ominously, the Australian Bureau of Meteorology announced in March this year (2023) that Australia have come to the end of the unprecedented three years of wet, humid La Nina weather and that by the time of this conference it could well be moving into a strong, drier weather cycle and a forthcoming hot summer: in other words, another BSk. This change was presaged by Professor Lesley Hughes, a foundation member of the Climate Council, in January this year (Hughes, 2023).

[4] Melbourne's highly variable climate is explained by several factors. First, it's latitude is at the point on the globe where mid latitude pressure cells interact with sub-polar cells. Second, being close to the coast with no significant mountain ranges for thousands of kilometres to the west (ie: in South America) or south, one or other system can very quickly dominate depending on their relative strength. Third, unlike every other continent, Australia is aligned east-west and is largely confined to the mid latitudes, so there are no barriers to wet, ocean-derived westerly systems moving across the country, whether in the south, centre or north of the country. Fourth, the continent is very flat so that weather systems can travel across the country with very little impediment until they reach the south-east corner. Fifth, the huge, dry interior makes perfect conditions for very hot, dry high pressure systems to develop and sixth, the whole continent is surrounded by water.

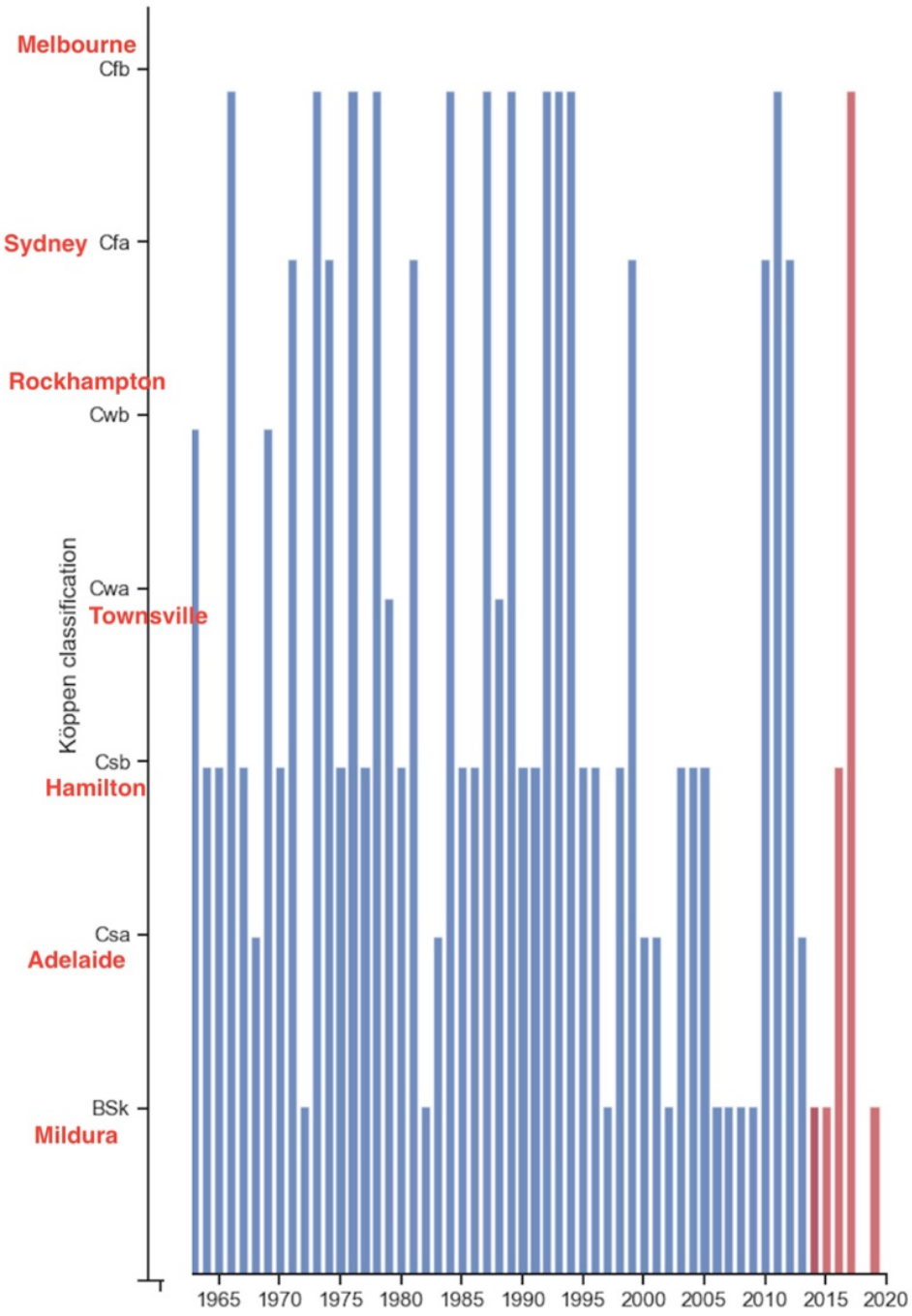

Figure 3. The annual classification of Melbourne's climate for 1965-2019 using the Koppen classification. The bars in red indicate recent years when the Melbourne recording station was, due to the impact of high buildings nearly, moved from a site on the NE corner of the City to a new and more representative site in Olympic Park on the SE corner of the City. Several changes stand out in the graph. First, there is a substantial drop in the number of years since 1990 when the city has the traditional Melbourne mild winter, no dry season, warm summers (Cfb) climatic regime and the mild winter, no dry season, hot summers Sydney regime (Cfa). Second, there is an increase in the number of years with mild, rainy winters and hot dry summers (Csa) and third, and perhaps most significantly, there is a dramatic increase in the number of years with a cool, semi-arid Mildura/Broken Hill classification (BSk). No results are recorded for 2018 due to a malfunction in Bureau of Meteorology equipment.

Classification & Comparable city	1856-1965 No. of 111 Years	1856-1965 Percent	1966-2019 No. of 54 Years	1966-2019 Percent	1995-2019 No. of 24 Years	1995-2019 Percent
Cfb MELBOURNE	26	23.4	12	22.2	2	8.3
Cfa SYDNEY	2	1.8	6	11.8	3	12.5
Cwb ROCKHAMPTON	4	3.6	2	3.7	0	0
Cwa TOWNSVILLE	2	1.8	2	3.7	0	0
Csb HAMILTON	68	61.3	18	33.3	7	29.2
Csa ADELAIDE	5	4.5	5	9.6	3	12.5
BSk MILDURA	1	0.9	11	20.4	9	36.0

Table 1. The changing frequency of Koppen classifications of Melbourne's climate, 1856-2019

My reading of this data is that it proves that Melbourne's and south-eastern Australia's climate has changed and our most recent analyses (June 2023) support this. While Melbourne cannot yet be said to have a BSk (Mildura-Broken Hill) climate, increasing periods are classified the same as western Victoria and northward toward Echuca and the Riverina. As Chen and Chen noted, such a change has implications for many things, not the least of which is that when we go tree planting to sequester greenhouse gases, we should be looking to species types and growing conditions common to Mildura and north, not to what we have been planting in the past. In support of my conclusion, Chen and Chen's research, covering the 1901-2010 period, found a *global* increase in dry arid (B) climates and a "significant areal decrease of the polar climates since 1980" (Chen and Chen, 2013, p. 69).

As a final ominous and directly related note, water authorities have recently issued warnings that Melbourne and south-eastern Australia are most probably moving to an El Nino weather event with a hotter, dry spring and 2023-24 summer. There are also predictions that south-eastern Australia will start running out of water by 2043. At the time of writing, Melbourne's rainfall to date this year is well below the long term average.

My continuing research with Chen in Sweden is to establish a "new" 30 year average set of data for Melbourne (say 1990-2020), to classify that and to see how far the change has gone. Is Melbourne still just within the Cfb zone or has it become a Csa or maybe even a BSk? Linking this analysis with new classifications for other south-eastern Australian cities and regions will assist in understanding the extent of the change that is underway, and which most probably, still has a long way to go.

3.2 Weather change

When we get excessive excess tropical heat and moisture and things in the way, is when we get dramatically-changed weather systems. This has been seen in Australia over the past 2-3 years, as well as in the US, Europe and South America. One needs look no further than a daily newspaper for something to have happened somewhere here are some examples from our part of the world.

In the Australian region, three traditional climatic regimes have been strengthened by climate change and these came together in 2021-23 to bring severe weather conditions. First, the hot and wet Indian Ocean Dipole, second, the western Pacific La Nina and third, the Southern Ocean Oscillation. The first two have brought hot, wet conditions to northern Australia. The third, consisting of strong cold fronts from high southern latitudes, has essentially stopped the hot, wet northern conditions moving south and sometimes, even eastwards. Consequently, the hot and the wet have been intensified. This has led to the east coast Australian flooding of the past 2-3 years, the North Island NZ and Fitzroy River, WA, flooding in January and February this year, the Northern Territory floods of several months back and cyclone Freddy in Mozambique in March.

Cyclone Freddy, (Figure 4), is the most powerful and longest living cyclone ever recorded. It started off the coast of WA on February 7 this year. It then wound it's way "backwards" for 8,400 km across the Indian Ocean *for a month* before hitting Mozambique and Malawi in east African. It travelled inland, circled back and crossed the 1,000 km wide Madagascar Channel to pummel Madagascar. It then rolled eastwards into the Indian Ocean before swirling back westwards to hit Mozambique a second time, five weeks after first forming. There has been massive damage across the region and over 300 deaths.

In the NZ situation (Figure 5), a frontal system extending from tropical cyclonic activity north-west of Darwin (the Indian Ocean dipole) brought massive volumes of hot moist air over the north and east coast of Australia where it linked in to hot seas over the Coral Sea off Queensland, which were until mid March, part of an exceptionally warm Pacific Ocean, the La Nina.

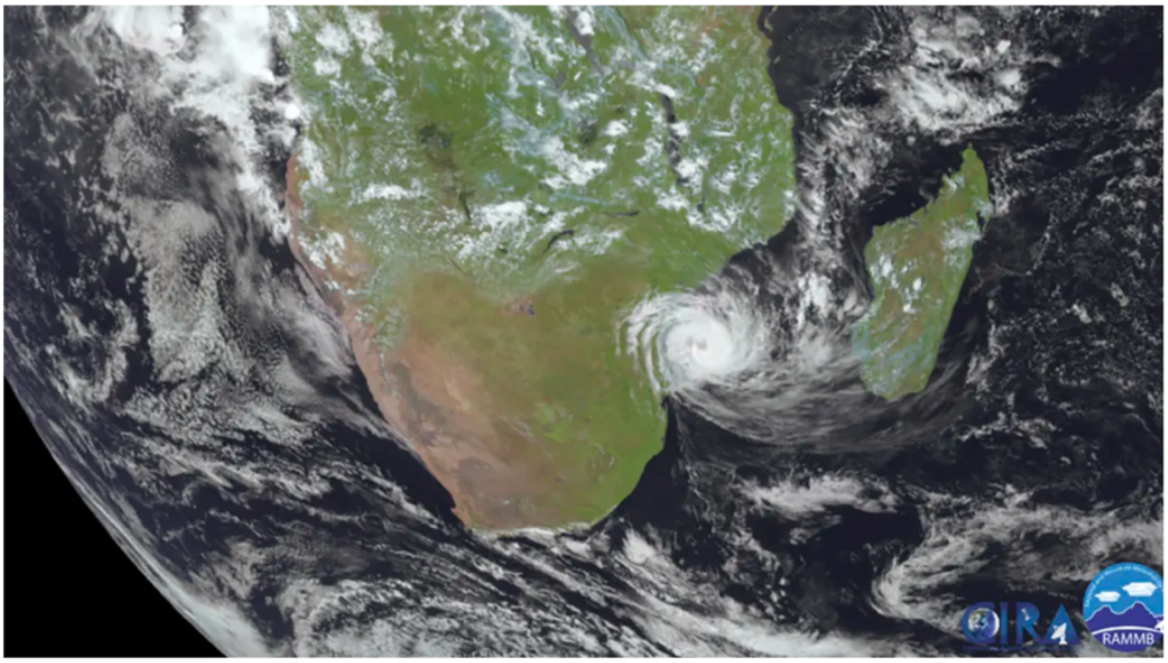

Figure 4. Cyclone Freddy on the Mozambique Coast, March 2023 (Photo: Acknowledgements to GIRA, RAMMB: Colorado State University/Regional and Mesoscale Meteorological Branch)

Described as an "atmospheric river", the airmass picked up still more moisture before it turned south off the east coast of Australia and started to cool, ever so slightly, as it moved south-eastward into higher, generally cooler latitudes. As it cooled, its capacity to hold the moisture in it dropped.

Condensation occurred and rain fell: in some places, as much as 249 mm in 24 hours [5]. That is over one-third of Melbourne's long term average annual rainfall in one day. Worse still, the low over New Zealand was stopped over the northern peninsula by a slow-moving high pressure system further south-east (a far stronger than usual "Southern oscillation" in the Southern Ocean) so the rain continued. And worse again, as the hot moist air rose and cooled, more hot moist air was drawn in from the surrounding southern Pacific region. As a consequence, the expected 7-10 percent increase in moisture capacity probably became something more like 20 percent. The North Island received rainfall and suffered flooding of a scale never experienced before (Welch, 2023).

The conditions that led to the scale and power of the "atmospheric river" over North Island New Zealand were generated by climate change. The never-before experienced rainfall and flooding were the consequent *weather* change. The conditions were near to replicated several weeks later. *This scale of event did not happen before human activity changed the climate*.

The same process caused massive flooding in the Kimberleys and the Fitzroy River in north-western Australia during December- 2022 – January 2023 (Figure 6). In that event, an area larger than Victoria was flooded. Rainfall totals of 200-400 mm in a day or two (half to two-thirds of Melbourne's annual average), led to river flows of 60,000 cubic metres per second. This is the highest ever recorded river flow in Australia and would be sufficient to fill Sydney Harbour in two hours.

[5] James Renwick, The Auckland floods are a sign of things to come –the city needs stormwater systems fit for climate change, The Conversation, January 28, 2023

Figure 5. The "atmospheric river" over Auckland, January, 2023 (Acknowledgement: *The Conversation*)

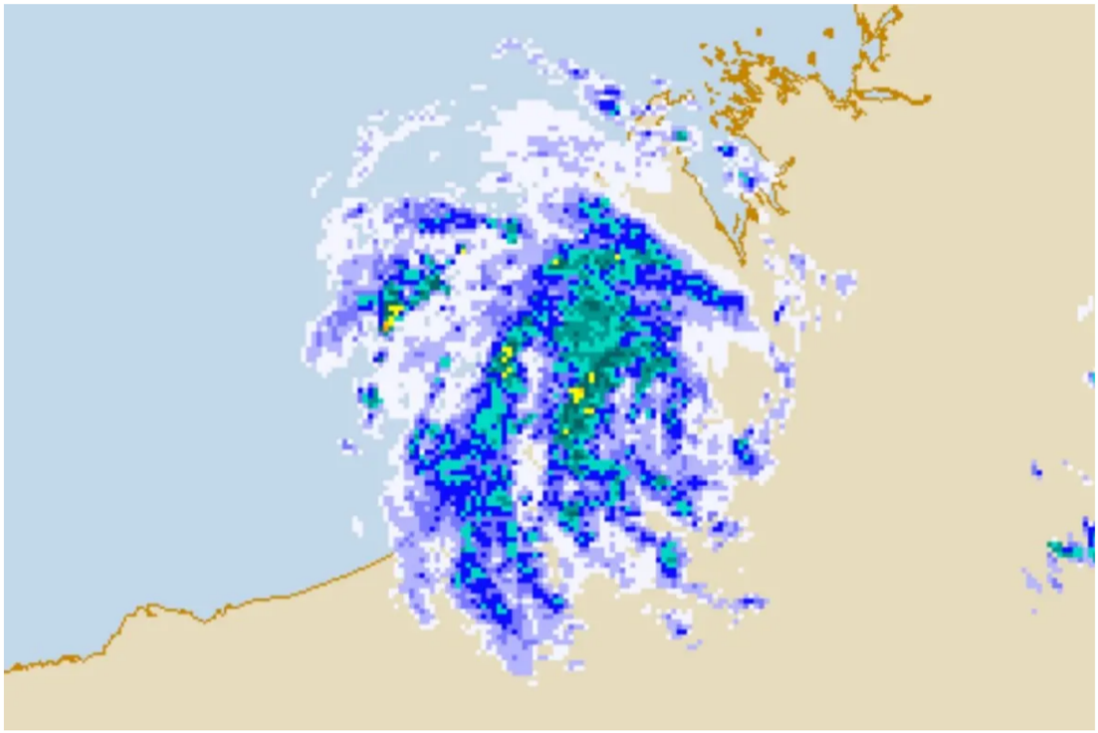

Figure 6. Ex-tropical cyclone Ellie with a diameter of around 500 km. over Broome in early January, 2023. Rainfall totals of 200-400 mm in a day or two (half to two-thirds of Melbourne's annual average), led to river flows of 60,000 cubic metres per second. This is the highest ever recorded river flow in Australia and would be sufficient to fill Sydney Harbour in two hours. Flooding on the Fitzroy River covered an area greater than the state of Victoria.

4. Taking Action

Unless we are to lose everything we have –and it may already be too late—society and leisure professionals are going to need to take some very serious action. Stopping the use of fossil fuels will not be enough: once we do stop, there will still be billions of tonnes of greenhouse gases in the atmosphere. Going solar is the same. When the rains stop falling, we still have the floods. So we will need to get those gases out of the atmosphere. Planting trees will not be enough (and grasslands and mangroves [6] may well be better and are certainly faster) as they take decades to have a marked impact. Rather, we will need to do a mix of things… and nearly all of them at once.

In the context of the local government and leisure focus of this conference, I propose a framework for the actions that need to be taken to create an effective, comprehensive strategy for addressing climate and weather change. A substantial amount of work is already being done and that is encompassed by my framework.

In the framework, items 1. to 4. are logically sequential, but the remainder can and, as far as possible, should be actioned together:

1. **Establish an organisation-wide planning and action group**. Establish an organisation-wide planning and action group to ensure that all areas of responsibility are engaged in addressing climate and weather change. Every area of local government is and will be impacted by climate and weather change and as a consequence, every component of Council activities much be engaged in defining and addressing the issues.

   Actively engage other adjoining, regional or similar (even if distant) Councils and agencies and with the community in establishing an action group. This will ensure that staff, other agencies and community members with differing perspectives, skills and responsibilities are involved in discussions, data collection and analysis, goal setting, budgeting and establishing priorities for action.

2. **Identify the climate and weather change challenges.** Liaise with state and federal agencies, departments and independent bodies (such as CSIRO, Bureau of Meteorology, natural disaster resilience assessment organisations, environmental management and protection departments, Floodplain Management Australia, Climate Council etc [see references in Marriott, 2021a]) to collect and evaluate information regarding the specific mix and scale of climate changes, weather changes and other associated changes and potential crises that will be faced by the Council over the coming years. Many Councils have differences of location, geography, topography, weather and climate that mean that differing action priorities and strategies are likely to be needed. In identifying the challenges, seek to define crisis preparedness strategies relevant to the challenges identified. This step is critical: there is no point putting "generic" solar panels on rooftops of buildings that could be washed away in the next flood

3. **Develop an action plan, define crisis preparedness requirements and establish a performance monitoring plan**. Use the conclusions and information from 2. to devise, adopt and promote a program of actions designed to reduce/eliminate the impacts of climate and weather change on existing and future facilities, programs and services *and* to offset/eliminate the organisation's and community's contribution to future change. With crisis preparedness, define the financial, assets/ infra-structure, operational and personnel requirements created by various scenarios [7].

   As part of the action and performance process, devise a suite of tools to measure and evaluate the outcomes of the strategies used to adapt to, avoid enhancing and offset climate and weather change. Work with other Councils and relevant agencies to refine the evaluation tools, evaluate their usefulness and compare the outcomes and, where practical, to establish action and outcomes benchmarks.

4. **Engage with the community and other organisations and groups**. Engage with the community and other organisations and groups to inform them about the threats of climate and weather change, the strategies adopted to address them and how they can contribute to achieving effective outcomes.

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[6] Mangroves have been found to be able to absorb 6-8 times the level of Co_2 of trees. Further, they are able to traps coastal and riverine sediments and can continue to grow as sea levels rise whereas grasses and trees are killed by salt water

[7] Hammer, Patrick (2022). Crisis Preparedness Webinar. World Leisure Organisation. Moderated by Dr John Tower, June 2022. https://www.youtube.com/watch?v=9CYhdP_frlo Access to the YouTube video can also be gained via the Leisure Management Special Interest Group's (LM SIG) website - https://www.worldleisure.org/leisure-management/

5. **Implement strategies to adapt existing facilities, programs and services** in ways that will minimise climate and weather change impacts on them (eg: upgrade stadia drainage systems, water sensitive urban design (WSUD) through landscaping and permeable surfaces, flood basins (while ensuring that wetlands etc do not encourage mosquito-spread diseases; upgrade cyclone resistance; run outdoor programs in the morning vs afternoon in summer and reduce program duration; provide community transport to senior citizens venues).

6. **Implement avoidance & mitigation strategies** to ensure that new facilities, programs and services make minimal or no contribution to, and/or reduce or eliminate the causes of climate and weather change eg: replace all fossil fuel vehicles; establish forests, grasslands and wetlands on larger informal parks or on rural land elsewhere and replace introduced grasses in all informal parks; pursue the co-benefits of urban forests, natural landscape renewal and environmental cooling; change plant species used in parks and streets, and reduce or eliminate outdoor sporting matches which require lighting; use LED lighting and solar [8].

7. **Monitor and evaluate the outcomes** of the actions, promote the findings and adjust the action plan.

5. What is being done so far

The rest of this paper will review some of what is being done so far. It begins with an overview of work being undertaken by the Climate Council as they are such an important and independent body and then turns first, to local government case studies and then to action strategies.

5.1 The Activities of the Climate Council of Australia

One of the leading agencies in researching climate change and in guiding action in Australia is the independent body, the Climate Council of Australia. This was established out of the remnants of the Climate Commission, an independent advisory agency established by the Australian Federal government in 2011. The Commission was abolished by the incoming Liberal government in 2013 and the Council was formed following a $1m. fundraising program across the Australian community.

The Climate Council conducts and sponsors research, prepares reviews, runs Zoom and in-person seminars, highlights climate change problems and issues and provides support and guidance to a wide range of organisations, government included.

From the perspective of this paper and this conference, a key role of the Climate Council is its work on the Cities Power Partnership. This project has been designed to assist local government agencies in addressing climate change. Councils are encouraged to sign up and in doing so, are immediately able to access a wide array of resources from the Council. These include:

- Access to the Council's "knowledge hub"
- Monthly webinars
- Free action and progress reporting tools
- Networking events
- Expert training
- An on line forum

[8] Care must be taken to avoid actions that amount to little more than "greenwashing" – initiatives that look good on paper but which do little to address climate change or which would be better replaced by other initiatives. Street tree planting is one such initiative. The cost of this action, the time needed for it to have an impact and the scale of the impact may well render it little more than window dressing. Certainly, tree planting can be effective in creating shade and in reducing urban heat islands. But it's climate change contribution is questionable. Planting out one informal park of 5, 10 or 15 ha. with trees and grassland is likely to contribute more than isolated tree plantings along asphalt and concrete footpaths. There trees are subject to vehicular air pollution, root, trunk and canopy damage, a like of water and a severely reduced surrounding ecosystem. From a climate change abatement perspective, the land that is planted out could be anywhere in the country as the overall impact will still be the same.

While beyond the capacity of Councils, mention should be made of the much-derided efforts at mechanical and chemical carbon capture and storage (CCS). Work on such initiatives should continue because even if human emissions can be cut to zero, the atmosphere will still hold billions of tonnes of excess, atmospheric-warming CO_2 and other climate change gases. Removal of this by vegetative means will take decades which is almost certainly too long to achieve the desired outcome. Work is now being done to implement mechanical extraction from mining and related activities in Victoria's Latrobe Valley and to transfer this to storage in the depleted gas and oil wells of Bass Strait. The initial well has been estimated to have a capacity of over 20 m. tonnes and there are upward of 60 other wells that may be available. These have been assessed to have a capacity to store not only local CO_2 but also that from other south-east Asian countries. See Black, A and Duthie, X, 2023, "Re-purposing onshore and offshore infrastructure for CCUS (carbon capture utilization and storage) in Gippsland", *APPEA Journal*, vol. 63, Manuscript ID AJ22134.R1.
The argument by the Australian Greens political party that CCS will allow prolong the use of gas and coal is both true and naïve. If most countries do *not* continue to use coal and gas during a transition to total renewables, their economies will collapse. In Australia, 10 years of inaction by conservative governments, actively supported by the Greens, may well take a decade or more to overcome and as such, research into the ability to remove gases mechanically should be supported.

- A monthly newsletter, and
- Opportunities to be part of regular media and advocacy work.

Councils are encouraged to adopt and pursue 5 key climate change actions from an extensive list of categorised "partnership pledges". Here's examples with a potential or direct leisure-orientation:

- Renewable energy (15 pledge" areas):
  - install renewable energy infrastructure on Council buildings
  - support local community renewable energy projects
  - support community facilities to access renewable energy

- Energy efficiency (6 pledge" areas):
  - adopt best practice energy efficiency measures across all Council and community facilities
  - roll out energy efficiency lighting

- Sustainable transport (9 "pledge" areas):
  - support cycling through adequate cycle lanes, bike parking and end of ride facilities
  - ensure new developments are designed to maximize public and active transport use

- Work together and influence (9 "pledge" areas):
  - support the local community to develop capacity and skills to tackle climate change

The full list of pledges and some Council examples are provided in Appendices A and B of this paper.

As of early 2023, a total of 175 of Australia's 550 Councils –or 31 percent-- have signed up to the Cities Power Partnership. And while 175 is good, less than one-third is not. Of these, all capital cities but Hobart and Perth have signed up, thereby making up 3.75% of the total; 55 or 31% are metro councils; 86 or 49% regional towns and cities and 27 or 16% are rural. A positive figure is that Cities Power Partnership member Councils are home to 69 percent of the total Australian population.

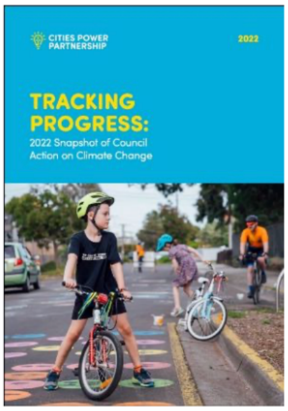
The single largest number is in Victoria followed closely by Western Australia while the fewest proportionally are in Tasmania and Queensland. So despite the work of the Cities Power Partnership team at the Climate Council, there is still a long way to go, though it must be acknowledged of course, that not being a member does not necessarily indicate a lack of action on climate change.

The breadth of the Cities Power Partnership pledges and the offer to members is excellent, although at present it suffers from a lack of detail or prioritisation. There are questions on whether the program provides a sufficiently rigorous or structured program of initiatives, whether many Councils know what to do to implement the pledges and whether the program provides details of the most appropriate or effective actions to take. Fortunately, the Cities Power Partnership is presently undertaking a major project to fill in the details and these will be featured through the regular Q&A on line sessions and will be uploaded to the Resource Library as the sessions unfold. A must-read report for all Councils was released by the Partnership in February 2023 and it paints a picture of significant, wide-ranging action. This should be read by everyone in local government.

NEW REPORT

MUST READ:
Our Tracking Progress Report

Last year we surveyed our member councils to ask how you're all progressing on your climate action initiatives. We heard from 158 councils and we've culminated the findings into a report, titled Tracking Progress: 2022 Snapshot of Council Action on Climate Change. Find out our top 5 insights from the report, PLUS read the full version:



5.2 Council initiatives

In preparing this paper, case study material has been provided by officers from a number of local government Councils across Australia and four are featured here. The Councils and the officers involved are [9]:

- City of Cockburn, Western Australia. Julia Christensen, Acting Head of Sustainability and Environment Sustainability and Environment
- City of Canning, Western Australia. Rachel Williams, Leader Sustainability Development
- Upper Yarra Shire, Victoria, Amy Gregorovich, Energy Resilient Communities Officer, Sustainable Environment & Facilities
- Mornington Peninsula Shire, Victoria, Nicci Tsernjavski**,** Climate Change Partnerships Officer

Case study material of actions taken by Cockburn and Canning Councils in WA and Mornington Peninsula Council in Victoria was provided in conference session handouts and is included in Appendices C, D, E and F of this paper. A review of the concil material indicates that there is:

- A significant commitment to action
- A substantive emphasis on solar and wind powered electricity and with excellent outcomes
- Limited action specific to individual Council settings
- Limited action specific to leisure and recreation
- Something of a focus on "showpiece" initiatives
- Potential for a more structured approach to climate change action and crisis preparedness, perhaps in keeping with the framework recommended earlier
- Limited apparent action on evaluating outcomes.

Local case study from:

Amy Gregorovich, Energy Resilient Communities Officer, Sustainable Environment & Facilities, Yarra Ranges Council. Material prepared for the PLA Conference workshop is included in the pdf of the Workshop Powerpoint presentation paper that accompanies this paper.

6. Workshop and discussion topics

Break into groups, discuss *and report back* on these or <u>other added topics</u>.

1. What specific real-world climate and weather change issues have you and your Council/ organisation faced or expect to face? What actions have you taken or need to take? What resources/skills/information are needed to deal with them? Draw up a three column chart so you can report back: Issue/Actions taken/Actions needed or reason/barriers for inaction

2. How could the framework for action be improved or added to? Is your organisation neglecting some areas? List the elements for improvement, suggested improvement & additional elements

3. Do you feel that PLA and other professional leisure associations could/should play a stronger role on climate and weather change? What strategies/actions could/should be taken, what are the priorities?

4. Are there <u>*other*</u> climate and weather change <u>topics</u> that need attention by leisure professionals? What are they and what actions are needed?

5. What can you learn from the Yarra Ranges experience? Discuss with Amy

Several of the key discussion points that emerged from the workshop were:

- A lot of Councils are doing work on quite a few of the seven components of action listed in section 4 of this paper (pp. 10-11). The material from the case study Councils endorses this.

[9] The Climate Council of Australia assisted by providing contacts with Councils and officers that are actively working on climate change initiatives. In this context, I wish to acknowledge the excellent assist and input from Dr Portia Odell, Director, and Elizabeth Gleeson, the Program Collaboration Coordinator of the Cities Power Partnership.

That said, it also seems that quite a few Councils appear to be doing "bits and pieces" and do not have a clear framework to guide their actions. It is hoped that the section 4 list of action components might prove to be either a useful guide to or a checklist of actions that have been or are yet to be taken, and

- Concern was expressed as to whether what we do as individuals will even contribute enough to addressing climate change. This view, which was expressed several times at the conference, reflected what at times seemed to be resignation re a looming global disaster. Of course what we do individually will not be enough. But if some of us are doing the detailed and essential "local" work, others can be doing the equally essential "global" work. To illustrate with reference back to the instalation of solar panels on stadium roofs: they are useless if the stadium gets washed away by floods or destroyed by falling trees. So we need to deal with floods and falling trees. But, of course, if we do not have the solar panels, we will never be able to abate the floods and falling trees! It would seem that just as humans have chipped away at the planet tree by tree, animal by animal, tribe by tribe and so forth, so we have to now do this in reverse. Anyone planting or saving a tree is making a positive contribution. As is anyone installing a solar panel. At least we now have the knowledge to know what to do, to know what is most urgent and to know what we can do fastest. Before, we didn't realise. Now we do.

7. Conclusions and strategies for action

The world's and our local and regional climates and weather conditions have already changed and unless we can act on the causes and the consequences, leisure as we know it will be a thing of the past. A lot is clearly happening and it is incumbent on the leisure and recreation profession to be directly involved and to help drive action for change, otherwise we will have failed our communities and we will start to lose resources. There is must-read material available from the Cities Power Partnership of the Climate Council and that is a great starting point. To date, Councils have tended to pick and choose easy options with these not necessarily being the most important locally or those which have the most impact. There has been something of a tendency to "greenwash" and this must stop. The evaluation of the outcomes of most actions does not occur and it may be that eventually, legislative regulations, guidance and assessments will be needed.

It is recommended that:

- Leisure professionals take action to encourage the adoption of the proposed framework or a revised version of it
- PLA initiates a process of strong advocacy for action on climate and weather change
- PLA members work together and with other agencies in the development and dissemination of action plan models, and
- PLA initiates a process to establish a "clearing house" of effective climate and weather change abatement initiatives.

Discussion of and responses to any of the issues and recommendations presented in this paper are invited. Similarly, anyone wishing to join a "working group" on the issues is invited to make contact. The author's contact details are provided at the end of the paper. Finally, readers are welcome to use any of the materials in the paper and the accompanying Powerpoint slide materials provided the source of the materials is acknowledged.

Appendix A:

The Partnership

Action Pledges

Participating councils who join the partnership will have 6 months to select 5 key actions from the options below.

Renewable Energy

1. Develop supportive planning laws to encourage residents and industry to adopt renewable energy.

2. Use council resources to support the uptake of renewable energy

3. Install renewable energy (solar PV and battery storage) on council buildings.

4. Support community facilities to access renewable energy through incentives, support or grants.

5. Power council operations by renewable energy, and set targets to increase the level of renewable power for council operations over time.

6. Provide incentives and/or remove barriers to encourage local businesses to take up solar power and battery storage.

7. Support local community renewable energy projects, and encourage investment in community energy.

8. Opening up unused council managed land for renewable energy.

9. Facilitate large energy users collectively tendering and purchasing renewable energy at a low cost.

10. Set minimum renewable energy benchmarks for new developments.

11. Electrify public transport systems and fleet vehicles and power these by 100% renewable energy.

12. Lobby electricity providers and state government to address barriers to local renewable energy uptake.

13. Identify opportunities to turn organic waste into electricity.

14. Implement landfill gas methane flaring or capture for electricity generation.

15. Create a revolving green energy fund to finance renewable energy projects.

Energy Efficiency

1. Set minimum energy efficiency benchmarks for all planning applications.

2. Adopt best practice energy efficiency measures across all council buildings, and support community facilities to adopt these measures.

3. Roll out energy efficient lighting across the municipality.

4. Provide incentives for energy efficient developments and upgrades to existing buildings.

5. Incentivise use of energy efficient heating and cooling technologies.

6. Create a green revolving energy fund to finance energy efficiency projects

Sustainable Transport

1. Ensure Council fleet purchases meet strict greenhouse gas emissions requirements and support the uptake of electric vehicles.
2. Provide fast-charging infrastructure throughout the city at key locations for electric vehicles.
3. Encourage sustainable transport use such as public transport, walking and cycling through council transport planning and design.
4. Ensure that new developments are designed to maximize public and active transport use, and support electric vehicle uptake.
5. Support cycling through provision of adequate cycle lanes, bike parking and end-of-ride facilities.
6. Reduce or remove minimum car parking requirements for new housing and commercial developments where suitable public transport alternatives exist.
7. Lobby state and federal governments to increase sustainable transport options.
8. Create disincentives for driving high emitting vehicles.
9. Convert council waste collection fleet to hydrogen or electric power.

Work Together and Influence

1. Set city-level renewable energy or emissions reduction targets.

2. Lobby state and federal government to address barriers to the take up of renewable energy, energy efficiency and/or sustainable transport.

3. Set up meetings and attend events to work with other cities on tackling climate change.

4. Develop education and behaviour-change programs to support local residents and businesses to tackle climate change through clean energy, energy efficiency and sustainable transport.

5. Lobby for state and federal support for a just transition away from coal-driven industry for local workers and the community.

6. Develop procurement policy to ensure that the practices of contractors and financers align with council's renewable energy, energy efficiency and sustainable transport goals.

7. Support the local community to develop capacity and skills to tackle climate change.

8. Support local community energy groups with their community energy initiatives.

9. Achieve 100% divestment from fossil fuel aligned investments at the earliest possible date.

Appendix B: Pledge Examples

Renewable energy

Action	Examples	Link
Install renewable energy (solar PV and battery storage) on council buildings	Bathurst Council installed solar systems across nine council buildings	https://www.bathurst.nsw.gov.au/ environment/energy-sustainability/ solar- power-on-council-buildings. html
Facilitate large energy users collectively tendering and purchasing renewable energy at a low cost.	The Melbourne Renewable Energy Project involves bringing together a number of large energy users to collectively tender for renewable energy.	https://www.melbourne.vic.gov.au/business/ sustainable-business/mrep/Pages/melbourne-renewable-energy-project.aspx

Energy efficiency

Action	Examples	Link
Roll out energy efficient lighting across the municipality.	Wingecarribee Shire Council - participation in Lighting the Way Streetlighting upgrade	http://media.wsc.nsw.gov.au/council-and- endeavour-energy-roll-out-street-light- upgrade/
Create a green revolving energy fund to finance energy efficiency projects	Penrith City Council Sustainability Revolving fund has supported 42 projects to the value of more than $1.5 million. Combined these projects result in savings of almost $600,000 each year, along with abatement of more than 3,100 tonnes of CO2e.	https://www.penrithcity.nsw.gov.au/ Documents/Waste-and-Environment/Sustainability-Revolving-Fund-Guidelines/

Sustainable transport

Action	Examples	Link
Ensure Council fleet purchases meet strict greenhouse gas emissions requirements and support the uptake of electric vehicles.	Charge Together initiative	https://www.chargetogether.com/about-the- program
Provide fast-charging infrastructure throughout the city at key locations for electric vehicles.	Regional 3 Council Program Waverley, Woollahra & Randwick Councils	http://www.waverley.nsw.gov.au/top_link_ pages/news_and_media/council_news/ news/a_nsw_first_for_electric_vehicle_ owners

Work together and influence

Action	Examples	Link
Set city-level renewable energy or emissions reduction targets.	Darebin has set a target of zero net carbon emissions across Darebin by 2020 and released the first ever Climate Emergency Plan.	https://www.bathurst.nsw.gov.au/ environment/energy-sustainability/solar-power-on-council-buildings.html
Support the local community to develop capacity and skills to tackle climate change	Hepburn Shire and ZNet Hepburn Shire created the 10 year Community Transition Plan	https://z-net.org.au/hepburn/

Appendix C:

CITY OF CANNING

Aquatic leisure centres:

The City of Canning operates two aquatic leisure centres, both of which have geothermal systems and 80kW solar arrays, the latter providing approximately 8 % of electricity consumed. The City is keen to expand the solar systems, however the venues have unbundled contestable energy contracts with very low consumption tariffs. This makes it difficult to provide a reasonable return on investment, particularly when the centres are already procuring green energy.

The green energy procured by the aquatic leisure centres comes via the $85 m. WA Local Government Association (WALGA) Sustainable Energy Project. This entails moving to 100% renewable energy for contestable supplies. Developed by the WALGA, the agreement sources all renewable energy locally from wind farms at Albany, Emu Downs and Collgar wind farm. As of late 2021, 48 WA Councils - well over one third of WA Councils - had signed up.

The City of Canning aquatic leisure centres have undertaken various sustainability projects over the years, including converting lighting to more efficient LED, and use BMS to optimise operational systems. Both are accredited Gold Waterwise Aquatic Centres, as part of the joint Water Corporation and Leisure Institute of WA Aquatics Waterwise Aquatic Centre Program.

Wider climate initiatives by the City of Canning:

Climate initiatives undertaken by the City of Canning more widely across the organisation include:

- Signing up as one of the founding members of the Climate Council's Cities Power Partnership
- Measuring and monitoring the City's energy, water and fuel consumption
- Installation of solar panels on major Council buildings, including community facilities
- Undertaking energy audits and energy efficiency improvement projects for City facilities
- Purchase of green electricity for high consuming sites through the WALGA Sustainable Energy Project, including for community facilities
- Developing a baseline operational carbon footprint (14,300 tCO_2-e for 2019/20)
- Inclusion of a selection of electric vehicles and hybrid vehicles in the City fleet
- Optional staff salary deductions to help fund the offsetting of personal vehicle and/or household greenhouse gas emissions
- Investigating the transition to a 100% electric fleet
- Setting a Net Zero by 2030 target for City operations
- Facilitating regular Reuse Markets at the City's waste transfer station to divert resources from landfill
- Planning to initiate Repair Labs in the near future, to run alongside the Reuse Markets and further support the diversion of resources from landfill
- Implementation of an Urban Forest Strategy to increase urban canopy
- Best practice nutrient management on sports turf to minimise fertiliser and irrigation requirements
- Conversion of sports lighting to LED
- Upgrade of stormwater drainage infrastructure to improve community accessibility and amenity as public open space

The City of Canning is currently in the process of developing a Climate Change and Energy Transformation Strategy, with community engagement currently underway to develop a shared vision for what a climate resilient Canning would look like.

Rachel Williams
Leader Sustainability Development
Rachel Williams <rachel.williams@canning.wa.gov.au>

Appendix D:

Mornington Peninsula Shire Council
Climate Change action: 2020 - 2023

The Mornington Peninsula Shire council adopted Our Climate Emergency Response in 2020 in response to declaring a climate emergency in 2019. This plan provides clear priorities across seven summits and twenty-one actions steps to guide the Peninsula towards net zero carbon emissions by 2040, including several other co-benefits for the Shire.

The Plan has the following interim goals:

- By 2025 reduce community emissions by 30%
- By 2030 reduce community emissions by 65%

Other key targets on the Plan include:

- By 2030, 200 MW of renewable electricity will be generated locally
- By 2025, the resilience of our community will be strengthened by maximising social connections and meaningful engagement to increase understanding of the local impacts and risks of climate change
- By 2030, 1 million tonnes of carbon will be sequestered through terrestrial and aquatic plantings

See our Climate Emergency Progress Report here

Recreation and Leisure Centres

The Shire has also adopted an ESD Policy for Council Buildings and Civil Works in September 2020. Together with Our Climate Emergency Response, these policies provide ambitious targets and guidance for all aquatic and recreation centres, sports pavilions as well as sports grounds and precincts.

Council operates three aquatic centres, and two recreation centres. The following Environmentally Sustainable Design elements have been included in the buildings:

- YAWA Aquatic Centre (see the media release here: There's more to YAWA than meets the eye :
    - Built to align with Council's ESD Policy and Climate Emergency Plan
    - Largest solar PV system of all the Shire's building assets, with 916 panels totalling 375 kW, reducing emissions by approximately 406 tonnes per year
    - Rainwater harvesting system connected to the pool filtration system to reduce potable water
    - High levels of insulation, double glazing and thermal shell in conjunction with an advanced air pressurisation system to provide warm air to the pool area and cool air in the gym and café
    - Energy efficient plant, equipment and lighting

- Pelican Park Recreation Centre
    - 99 kW solar PV system, saving approximately $13,000 and 123 tonnes of CO2 per year
    - Planning and design underway to replace gas boilers with efficient heat pump technology

- Somerville Recreation Centre
    - 100 kW solar PV system
    - 3 x Tesla Powerwall batteries, providing battery backup of 40kWh power to the building when the sun isn't shining

- Civic Reserve Recreation Centre
    - 100 kW solar PV system

In addition to the achievements at our major facilities detailed above, the Shire is progressively rolling out energy efficiency and sustainability upgrades across the peninsula to benefit all sporting clubs and community groups. These include:

- Upgrading inefficient lighting to LED in 2020 and 2021

- Installing efficient split systems and heat pumps
- Upgrading kitchens and appliances to the most efficient electric options
- Disconnecting from natural gas, and purchasing 100% renewable energy at Shire-managed facilities
- Reducing water use through efficient irrigation and turf selection at sports fields
- Improving stormwater management, flooding risk and biodiversity outcomes
- Supporting climate resilience to future extreme weather events and supporting community adaptation efforts

Community Resilience

- Thirteen tenants participating in our new Solar incentivisation program, which will provide 160 kw of solar capacity across these Shire tenanted buildings
- Launched our Save Energy: Save Money program which provides free efficient hot water heat pumps to vulnerable or low-income households. So far, sixteen homes have been upgraded with heat pumps
- Partnered with community renewable energy group Repower who have grown their membership to 115 paid members and 550 residents on their mailing list
- Trained twenty-four Energy Heroes to provide free energy advice to residents on how to best make their homes energy efficient. See more here
- Awarded a total of twenty-four climate action grants totalling $180,611 to community- led initiatives.
- Commissioned Jesuit Social Services and RMIT to develop a report into the climate change risk to community health and wellbeing. The investigation looked at the physical impacts of climate change, vulnerable populations, current community services and factors that influence an individual's exposure to climate change. See summary here
- Supported 205 business energy upgrades undertaken through the Small Business Energy Saver program, resulting in $175,847 annual savings to business and avoiding 628 tonnes of annual emissions. See Case Study here
- Partnered with the then Department of Environment, Land, Water and Planning (DELWP) on the Energy Savvy Upgrades Program with the aim to assist householders experiencing energy stress. Upon completion of the program, 89 Victorian Energy Efficiency Scorecard assessments were completed and a total of 73 households received 79 upgrades. This resulted in an increased star rating of .74 and annual combined GHG emission savings of 56,641 kg.
- Facilitated local businesses to borrow over $2 million through Environmental Upgrade Finance for investment in energy efficiency upgrades and renewables resulting in a saving of $279,888 and an annual reduction of 1,695 tonnes of CO2-e

Emission Reductions

- Installed 1.28 MW of solar PV on Shire operated buildings and 0.3 MW on tenanted buildings
- Abolished gas from eleven facilities and replaced all gas assets with electric equivalents. This includes the installation of hot water heat pumps, efficient reverse cycle air conditioners and solar PV systems.
- Facilitated a community Solar and Energy Bulk Buy which resulted in the installations of forty solar arrays (including two solar and battery) and twenty-eight hot water heat pumps and reverse cycle air conditioners. These upgrades are estimated to reduce carbon dioxide emissions by 437 tonnes per year, or more than 8,700 tonnes over a 20-year period.
- Upgraded 112 streetlights to energy efficient LED lights, with 4000 more planned for upgrade next financial year
- Increased the Shire's fleet to eight electric vehicles, with eight more on order. We have also reduced our total fleet by 41% (88 vehicles) since 2020 and installed seven electric charges for Shire fleet cars.
- The shire has facilitated public fast charging services at three sites with a fourth in planning
- Created 95 hectares of biolinks and 23,000 trees and shrubs planted, helping to sequester carbon and deliver on the objectives in our Biodiversity Conservation Plan (2018)

Coastal Management

- The Shire developed three new Coastal and Marine Management Plans for Flinders, Mount Eliza and Portsea
- The Shire developed a Masterplan for Hasting's foreshore and implementation has commenced

Integrated Water Management

- Adoption of the Shire's Integrated Water Management Plan

Contact

Nicci Tsernjavski
Climate Change Partnerships Officer
Mornington Peninsula Shire
Nicci.Tsernjavski@mornpen.vic.gov.au
Ph. (03) 5950 1297

Appendix E:

CITY OF COCKBURN, WESTERN AUSTRALIA

Climate Risk Assessment, Climate Change Strategy, Coastal Adaptation

KEY ELEMENTS:

Renewable energy

• extent of renewable energy action: more than 5700 photovoltaic panels on over 25 community buildings
. At the time of installation, the Cockburn ARC 1MW solar PV system was the largest in WA by local government and provides approximately 45% of the facilities electricity needs. The total installed solar provides between 15-25% of the City's own electricity requirements

• the city has EV charging stations, uses geothermal energy for public pool heating and has a partnership for methane gas extraction at Henderson Waste Recovery Park

• the city has wide-ranging energy efficiency measures, e.g., LED lighting upgrades, sensor and timer lighting, HVAC (heating, ventilation and air conditioning) upgrades

• the City has a Renewable Energy Systems Policy to guide residents and businesses on the installation and operation of wind and solar systems. It provides guidelines and standards to minimise impacts on streetscapes, nearby properties and the environment

• the City undertook a feasibility study into producing green hydrogen energy at its waste recovery park to fuel waste collection trucks and light vehicles

• the City is part of the WALGA Energy Procurement Project, in June 2022 the City commenced a new 3-year electricity contract that includes purchasing renewable energy for contestable sites. Under the 3 year contract the City's 47 highest consuming sites will consume renewable electricity produced from WA wind farms.

Reducing emissions and adapting to climate change

The Climate Change Strategy 2020-2030 has 7 mitigation and 7 adaptation objectives with the following targets:

- Net zero corporate emissions by 2030
- Net zero community emissions by 2050
- 100% renewable energy by 2030
- 100% of non-hazardous waste diverted from landfill by 2030
- Maintain a zero emission fleet

Coastal vulnerability in Cockburn

Council is part of a 7 Council Coastal Adaption Plan which:

• tracks shoreline movements and beach and coastal asset conditions
• Initiates periodic sand replenishment
• prepare detailed designs and response strategies at specific sites
• ensures appropriate planning schemes and controls
• engages with the community and stakeholders to raise awareness of hazards and the adaption plan, and
• contributes to Cockburn Sound Coastal Alliance between Cockburn, Fremantle, Kwinana, Rockingham and Perth region Natural Resource Management (NRM) group

City of Cockburn Urban Forest Plan 2018-2028

• the Urban Forrest (UF) Plan aims to create a healthy, diverse and thriving forest that contributes to the health and wellbeing of the Cockburn community. It has 6 strategic objectives and targets and 30 actions designed to achieve a thriving forest. UF is defined as shrubs and trees on private and Council-managed land

• Benefits:
Healthy and well-managed urban forests have been shown to provide a wide range of social, economic, and environmental benefits to urban communities including:

- Improving the health and wellbeing of residents
- Enhancing biodiversity and providing ecological corridors
- Lowering maximum summer temperatures in urban areas
- Reducing household energy costs (up to 8%) and
- Increasing amenity and property values (up to $17,000)
- Reducing urban-heat-island-effect

The urban heat island effect occurs when vegetation is replaced with surfaces that absorb and retain heat (eg bitumen, concrete and brick buildings). Unshaded roads and buildings absorb heat during the day and radiate that heat into the surrounding air. As a result, unshaded urban areas tend to be several degrees hotter than vegetated areas, particularly in summer.

Urban forests are an effective contributor to mitigating the urban heat island effect. Trees provide shade and cool the surrounding air helping to reduce maximum summer temperatures.

How to help

- Request a tree to be planted on your verge
- Conserve existing trees on private property
- Attend a community planting day
- Take advantage of the native plant subsidy scheme

WEBSITES:
https://www.cockburn.wa.gov.au/Environment-and-Waste/Climate-Change/Renewable-Energy

Climate Risk Assessment, Climate Change Strategy, Coastal Adaptation, and other associated information. https://www.cockburn.wa.gov.au/ClimateChange and the Urban Forest Plan here: https://www.cockburn.wa.gov.au/Environment-and-Waste/Street-Trees-and-Verges/Urban-Forest

Julia Christensen
Coordinator Sustainability and Climate Change and Environment
Julia Christensen <jchristensen@cockburn.wa.gov.au>

RESOURCES AND LINKS

Plans and Strategies
Council Plan 2021 – 2025 - www.yarraranges.vic.gov.au/Council/Corporate-documents/Policies-strategies/Council-Plan-and-Budget

Environment Strategy 2015 - 2025 - www.yarraranges.vic.gov.au/Council/Policies-strategies/Environment-Strategy-2015-2025

Liveable Climate Plan & Action Plan 2020 – 2030 - www.yarraranges.vic.gov.au/Council/Corporate-documents/Policies-strategies/Yarra-Ranges-Liveable-Climate-Plan

Initiatives and Research
Victorian Energy Collaboration - www.veco.org.au
Solar Savers – www.solarsavers.org.au
Microgrid Feasibility Studies - www.yarraranges.vic.gov.au/Environment/Sustainable-communities/Microgrid-Projects

CONTACTS – Yarra Ranges Council Climate Action Team

Sarah Bond
Climate Action Lead
s.bond@yarraranges.vic.gov.au

Amy Gregorovich
Energy Resilient Communities Officer
a.gregorovich@yarraranges.vic.gov.au

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Koppen, W, 1936, *Handbuch der Klimatologie, Band 1, Teil C, Das geographische System der Klimate,* Gebruder Borntraeger, Berlin. See also Kottek, M., Grieser, M., Beck, C.,Rudolf, B. and Rubel, F., 2006, "World Map of the Koppen-Geiger Climate Classification Updated," *Meteorologische Zeitschrift*, 15 (3): 259-263

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Marriott, Ken, 2021b, "It's Time for Leisure and Recreation Planners and Providers to Get Cracking on Climate Change", *Australasian Leisure Management*, September

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Welche, T., 2023, "Auckland floods: even stormwater reform won't be enough – we need a 'sponge city' to avoid future disasters", *The Conversation*, January 29, 2023

Further Reading (provided by paper reviewers and not yet reviewed):

Cocolas, et. al., 2016, "Behavioural adaption to climate change among winter alpine tourists", *Journal of Sustainable Tourism*

Miller, et. al., 2022, "Climate change and recreation in the western United States: Effects and opportunities for adaption, *Journal of Forestry*, vol. 120, no. 4

Shaw and Loomis, 2008, "Frameworks for analyzing the economic effects of climate change on outdoor recreation", *Climate Research*, vol. 36

Wagner, et. al., 2019, "Conflicts about urban green spaces in metropolitan areas under conditions of climate change", *Urban Science*, vol. 3, no. 1

Dr Ken Marriott
PO Box 141
Williamstown VIC 3016
0418 178 788
ken.oz@me.com