Chapter 8

Health, education, social services, recreation and tourism

8.1 This chapter considers the implications of climate change for buildings and infrastructure relied on in a wide range of areas, including health care, aged care, education, tourism and public recreation.

Health care, aged care and emergency services

8.2 The evidence received during this inquiry about the implications of climate change for health-related services can be grouped in the following three categories:

- direct risks to buildings used for these services, such as inundation from sea-level rise;
- infrastructure required for these services becoming less reliable, such as electricity outages and damage to transportation infrastructure; and
- services being overwhelmed due to health risks associated with climate change.

8.3 These three categories are related. The Australian Medical Association (AMA) submitted:

> Human health is ultimately dependent on the health of the planet and its ecosystem. Consequently, climate change poses a myriad of direct and indirect risks to human health. These health impacts manifest inequitably, both within and between countries, with some groups being particularly vulnerable. The impact of climate change on the health system is twofold as extreme weather events increase the demand on health services whilst impeding the capacity of health systems to provide even the most basic care.[1]

8.4 It was also highlighted that during extreme weather events, health systems can come under substantial pressure relatively quickly. The AMA noted:

> As the intensity and frequency of extreme weather events increase, the consequences cascade and manifest in unpredictable ways. It is clear that there are vulnerabilities in the Australian system. Hurricane Katrina and the 2003 San Diego wildfires are tangible examples of the complex and volatile challenges that extreme weather events present, and a sobering reminder that even the most developed healthcare systems can struggle under sustained environmental pressure.[2]

---

1 Australian Medical Association (AMA), *Submission 34*, p. 2.

2 AMA, *Submission 34*, p. 4.

Direct threats to buildings and infrastructure

8.5 Health and emergency services buildings and infrastructure in high-risk coastal areas face the same climate challenges as other buildings located in these areas. Sustainable Business Australia submitted that, by 2100, a 1.1 metre sea-level rise would 'place $266 billion of coastal infrastructure at risk, including 258 police, fire and ambulance stations as well as 75 hospitals and health services'.[3]

8.6 Extreme events such as flooding and bushfires also disrupt normal health services, including to the point of shutdown. In addition, to disrupting facilities, these events can also damage or contaminate equipment and supplies.[4]

8.7 Health and emergency services rely on other infrastructure, such as transportation and energy networks, and disruption to these networks can have significant consequences. Energy implications are particularly significant. The AMA noted that hospitals and community health centres 'are dependent on a secure and stable energy supply'. For hospitals, the AMA highlighted that 'the consequences of even momentary disruptions to electrical circuits are catastrophic'.[5] The AMA provided the following observations about recent energy reliability issues to demonstrate the potential for future risk:

> Hospitals can utilise backup power generators to accommodate for temporary lapses in power supply, however in recent years there have been a number of instances in which extreme weather events have also disrupted the functionality of backup power systems, leading to failure of critical medical equipment and emergency patient evacuations.
>
> In late 2016, a number of hospitals in South Australia lost power, after generators failed during a state-wide blackout which was caused by an extreme weather event. At Flinders Medical Centre, as a result of the power outage, patients requiring ventilation had to be evacuated to a neighbouring medical facility, and a number of embryos awaiting transfer were tragically destroyed. The human toll of this power outage was likely minimised due to the availability of the nearby medical facility with capacity to accept these patients. However, if future power outages were to occur in the midst of a mass casualty event or in a more remote part of Australia, the feasibility of such evacuations is drastically reduced.[6]

3 Sustainable Business Australia, *Submission 52*, p. 11.

4 Australian Health Economics Society, *Submission 23*, pp. 4–5.

5 AMA, *Submission 34*, p. 3.

6 AMA, *Submission 34*, p. 3 (citations omitted). See also Australian Health Economics Society, *Submission 23*, pp. 4–5.

8.8 Disruption to transportation infrastructure can affect the ability of staff to report for work, as well as the ability to transport patients and to undertake community or home-based visits.[7]

8.9 During a previous inquiry, the committee also was advised that there is a direct relationship between higher temperatures and hospital staffing and budgets. Mr Andrew King from Stormwater South Australia gave the following evidence on this issue:

> Hospitals have a key temperature in the high thirties where they put on extra staff, and the cost to the health service every year of that cut-off point is hundreds of millions of dollars. They budget that they are going to get five or six of those days a year. That is budgeted in. If we raise our city temperatures by 10 degrees and those five or six days become 12, even doubling it, you have hundreds of millions.[8]

Increases and changes in demand for services

8.10 Evidence regarding health and aged care services being required to cope with increased demand focused on how climate change is expected to result in heatwave events occurring more frequently. However, other factors are also evident, such as:

- that any increase in the frequency of natural disasters would place pressure on emergency support; and
- with ageing populations, there is 'likely to be increased pressure on social services to support people to age in place and to utilise social support infrastructure'.[9]

8.11 Nevertheless, heat stress is considered to be 'the primary climate change driver of increased demand for social and health services'.[10] As noted by the AMA, 'heatwaves kill more Australians than any other type of natural disaster'. The AMA argued that climate change 'is no longer a projection of what is to come, but rather the present reality for which Australia's healthcare system remains ill prepared'.[11]

8.12 The AMA commented on the 2009 heatwave event as well as other heatwaves to demonstrate the pressure these events are already placing on the health system. On the 2009 event, the AMA submitted:

> The January 2009 heatwave was an indicator of what Australia confronts should global warming patterns continue on current trajectories. Some parts

---

7 Australian Health Economics Society, *Submission 23*, pp. 4–5.

8 Senate Environment and Communications References Committee, *Stormwater management in Australia*, December 2015, pp. 17–18.

9 Lake Macquarie City Council, *Submission 29*, p. 5.

10 Lake Macquarie City Council, *Submission 29*, p. 5.

11 AMA, *Submission 34*, pp. 1, 2.

> of Australia experienced unseasonable periods of temperatures above 43 degrees for three consecutive days, whilst overnight lows failed to yield their usual reprieve. Ambulance services were quickly overwhelmed as they became inundated with calls for help from patients experiencing cardiac arrests, heatstroke, exacerbation of pre-existing conditions and other heat-related conditions. Emergency departments struggled to make room for the influx of patients.[12]

8.13 The AMA explained that the excess mortality of 374 deaths (that is, 374 excess deaths over what would otherwise be expected)[13] attributed to the heatwave overwhelmed the conventional storage capacity of the mortuary 'and temporary refrigeration systems had to be brought in to accommodate the unprecedented amount of fatalities'.[14]

8.14 The AMA also commented on a severe heatwave that affected southeast Australia in 2014. In Victoria, that heatwave 'resulted in a 24 per cent increase in mortality and a 97 per cent increase in cardiac emergencies'.[15]

8.15 In considering heatwave events, it was noted that the elderly are particularly vulnerable. Hobsons Bay City Council advised that in the 2014 heatwave, the number of aged care clients admitted to hospital increased by 250 per cent.[16]

8.16 In addition, it was suggested that consideration needs to be given to the implications of heatwave events for maternal and child health. Hobsons Bay City Council advised that maternal and child health nurses are 'already rescheduling checkups and immunisation appointments for parents who do not wish to take their infants out and expose them to extreme weather'. The Council highlighted that 'low income families are particularly impacted as they are less likely to have an air conditioned car to safely transport their child to and from appointments during heatwaves'.[17]

Suggested responses

8.17 When considering the impacts of climate change under different emissions scenarios, the health system's impact on climate change was highlighted. The Australian Health Economics Society noted that 'health systems in developed countries typically generate between 4 and 8% of national greenhouse gas emissions'.

---

12 AMA, *Submission 34*, p. 2.

13 Department of Human Services (Victoria), *January 2009 Heatwave in Victoria: an Assessment of Health Impacts*, 2009, www2.health.vic.gov.au/Api/downloadmedia/%7B959CCD3C-8285-4938-872E-62E15AA62C62%7D (accessed 3 January 2018), p. iv.

14 AMA, *Submission 34*, p. 2.

15 AMA, *Submission 34*, p. 2.

16 Hobsons Bay City Council, *Submission 7*, p. 10.

17 Hobsons Bay City Council, *Submission 7*, p. 10.

The Society argued that the 'continued imperative to reduce emissions through effective design and planning of health infrastructure therefore remains critical to climate change mitigation efforts'.[18]

8.18 CSIRO suggested that the health system would be supported by measures to address some of the heat-related health risks people face due to urban and building design (this evidence was discussed in Chapters 4 and 6). For example, CSIRO identified that, due to the reduction in urban heat that would result, doubling Melbourne's vegetation coverage 'would reduce heat-related mortality by 5 to 28 per cent'.[19]

8.19 This report has already examined research indicating that inefficient building design has serious implications for human health during heatwave events. As noted in Chapter 6, a study of the 2009 Melbourne heatwave concluded that upgrading building energy ratings would have a significant impact on related mortality. Assuming that the occupants of 0.9 energy star houses were the victims of the 2009 heatwave event, if all Melbourne homes had at least a 1.8 star energy rating, the number of excess deaths from a 2009 type heatwave is projected to reduce to around 240. This would reduce further to 37 if all houses can be upgraded to a minimum of 5.4 stars.[20]

8.20 It is also projected that increases in the energy efficiency of dwellings would result in declining rates of ambulance calls, emergency department presentations and after hours doctor consultations. Therefore, addressing heat stress in housing could lead to potential savings from reduced demand for these services.[21]

8.21 The Australian Health Economics Society also noted that other variables in the future demand for health services need to be taken into account, such as population ageing, changing disease burdens, risk factors (such as obesity) and changing medical technologies.[22] Nevertheless, it was recognised that there are

---

18 Australian Health Economics Society, *Submission 23*, p. 6.

19 CSIRO, *Submission 45*, p. 16.

20 Centre for Sustainable Infrastructure, Swinburne University of Technology, *Submission 9*, pp. 3–4.

21 Dr Morshed Alam, Senior Research Fellow, Swinburne University of Technology, *Committee Hansard*, 15 March 2018, p. 7; Centre for Sustainable Infrastructure, Swinburne University of Technology, *Submission 9*, pp. 3–4. For example, in 2015–16, the average cost associated per admitted acute separation is $5,194 and is $652 for each emergency department presentation. Independent Hospital Pricing Authority, *National Hospital Cost Data Collection Cost Report: Round 20 Financial Year 2015-16*, February 2018, www.ihpa.gov.au/sites/g/files/net4186/f/publications/nhcdc_cost_report_round_20_financial_year_2015-16_0.pdf (accessed 24 April 2018), p. 7.

22 Australian Health Economics Society, *Submission 23*, p. 4.

'a range of more direct impacts of climate change on health care infrastructure that can be identified for adaptation'.[23]

8.22 To help manage risks to facilities, Regional Development Australia – South West argued that emergency services infrastructure and hospitals 'should not be located within the vicinity of "at risk" areas or where disaster events could be reasonably believed to impact on transport, communications or energy infrastructure'.[24] Similarly, the Australian Health Economics Society suggested that the resilience of health care infrastructure could be maximised by robust site selection; that is 'avoiding the siting of facilities in high-risk locations altogether, and minimising site-specific risks where they cannot be completely eliminated'.[25]

8.23 The Climate and Health Alliance added that the design of new health facilities and the maintenance of new and existing facilities should be subject to mandatory standards that prioritise resilience to direct and indirect climate risks.[26]

8.24 In addition, the Australian Health Economics Society outlined several other suggestions for improving the resilience of health services infrastructure in the face of climate change. These include:

- designing 'for maximum passive cooling capability during hot conditions'—it was suggested that more traditional building designs are superior to lightweight modular buildings in terms of managing the risk of overheating;
- designing and maintaining 'for maximum resilience of IT and communications infrastructure';
- ensuring 'back-up and/or redundant supplies of key utilities (e.g. electricity, water)';[27]
- developing and maintaining effective business continuity plans and undertaking exercises for extreme weather events; and
- ensuring 'access to "surge" capacity to deal with peak demand during extreme weather events—this could include 'opening normally closed wards, or going as far as some US states who, in response to lessons from Hurricane Katrina, maintain "shuttered" hospitals as reserve capacity to be staffed by personnel whose home facility has had to be evacuated'.[28]

---

23 Australian Health Economics Society, *Submission 23*, p. 4.

24 Regional Development Australia – South West, *Submission 15*, p. 5.

25 Australian Health Economics Society, *Submission 23*, p. 5.

26 Climate and Health Alliance, *Submission 16*, p. 7.

27 On the need for reliable electricity supplies, the Climate and Health Alliance suggested that investments 'in secure technological innovations and knowledge management systems for health services to withstand power interruption' should be undertaken. Climate and Health Alliance, *Submission 16*, p. 7.

28 Australian Health Economics Society, *Submission 23*, pp. 5–6.

8.25 Outreach strategies and further research relating to vulnerable populations was suggested. For example:

- On maternal and child health, Hobsons Bay City Council referred to research into how maternal and child health services 'could be effectively delivered despite climate change pressures'. The Council argued that 'further research and sharing of this research is needed'.[29]
- It was argued that pressures on the health system could be reduced if new migrants receive support to learn to adapt to Australian climatic conditions.[30]

8.26 The AMA argued that a national strategy for climate change and human health is required. The AMA envisaged that the strategy would seek to enhance healthcare preparedness to 'safeguard the provision of healthcare services in the context of an increasingly volatile climate'. The AMA also argued that consideration should be given to ensuring that the health sector 'is adequately resourced to meet the significant demands of extreme heat events'.[31]

8.27 Other submitters pointed to international initiatives and strategies that could support the Australian health care system to adapt. For example:

- Doctors for the Environment Australia suggested that the Australian Government should adopt the World Health Organization's 'Health in all Policies' framework, in recognition 'that policy decisions in non-health arenas such as infrastructure can have profound effects on population health'. It was argued that doing so would help identify 'potential synergies for health and environmental protection'.[32]
- The Climate and Health Alliance argued that the Australian Government should work with the state and territory governments to expand and promote the Global Green and Healthy Hospitals initiative.[33]

29 Hobsons Bay City Council, *Submission 7*, p. 10.

30 Hobsons Bay City Council, *Submission 7*, p. 11.

31 AMA, *Submission 34*, p. 3.

32 Doctors for the Environment Australia, *Submission 41*, p. 4.

33 Climate and Health Alliance, *Submission 16*, p. 7. The Global Green and Healthy Hospitals initiative is an international network of hospitals and other health care facilities and organisations that seek to reduce the carbon footprint of the health system, become more climate resilient, and help societies transition to a low carbon energy future. The initiative is a project of Health Care Without Harm, a US based organisation. See Global Green and Healthy Hospitals, www.greenhospitals.net/who-we-are; and www.greenhospitals.net/about-hcwh (accessed 5 April 2018).

8.28 On heat stress risks, representatives from the City of Melbourne and the South East Councils Climate Change Alliance drew the committee's attention to the Victorian Government's Healthy Homes Program.[34] Under that program, up to 1000 vulnerable and low income Victorians who live with complex healthcare needs can seek energy efficiency upgrades for their house. However, the program is limited to two geographic regions (Melbourne's western suburbs and the Goulburn Valley) and is focused on improving indoor temperatures in winter.[35]

8.29 Finally, it was noted that further research could assist with better understanding the costs and benefits associated with minimising climate-related health risks. For example, the researchers who studied the 2009 Melbourne heatwave advised that they are considering undertaking a more detailed cost–benefit analysis to quantify the extent that measures to improve the energy efficiency of housing could reduce costs in the health system.[36]

Education

8.30 The main point made in submissions regarding the implications of climate change for school infrastructure is that, as with other buildings, schools could be at risk from climate change-related flooding, inundation and extreme weather events. Higher temperatures will also place pressure on operating budgets due to increased expenses associated with cooling.[37]

8.31 It was also emphasised that children 'are particularly vulnerable to extreme heat'. In addition, it was noted that many school buildings are not well suited to extreme weather conditions. Hobsons Bay City Council explained:

> There are no design standards to ensure that schools, childcare centres and other related facilities protect them from extreme heat. Many school buildings were designed and built with no or minimum insulation, poor airtightness and inefficient heating and cooling systems. School playgrounds are not typically designed to protect children from a range of elements including extreme heat.[38]

---

34 Ms Dominique La Fontaine, Executive Officer, South East Councils Climate Change Alliance; Mr Gavin Ashley, Team Leader, Climate Resilience, City of Melbourne, *Committee Hansard*, 15 March 2018, pp. 29–30.

35 Sustainability Victoria, 'Victorian Healthy Homes Program', www.sustainability.vic.gov.au/About-Us/Grants-and-Funding/Victorian-Healthy-Homes-Program (accessed 24 April 2018).

36 Dr Morshed Alam, Senior Research Fellow, Swinburne University of Technology, *Committee Hansard*, 15 March 2018, p. 7.

37 Lake Macquarie City Council, *Submission 29*, p. 5.

38 Hobsons Bay City Council, *Submission 7*, p. 9.

8.32 Hobsons Bay City Council argued that indoor and outdoor facilities used for children 'need to be designed with climate impacts, specifically extreme heat, in mind'.[39]

8.33 On school design, Williamstown High School was highlighted as an example of efficient and sustainable design which could be followed elsewhere. Green Building Council Australia submitted that in 2005, an $11 million project to redevelop the school resulted in 5 Star Green Star certification. In addition to efficiency and sustainability benefits, Green Building Council Australia argued that green schools can support student performance; it submitted that research indicates green schools can improve 'progression by 20 per cent in mathematics and 26 per cent in reading, while improving student health by 41.5 per cent'.[40]

8.34 School finish times also attracted comment. Hobsons Bay City Council noted that schools 'often finish at around 3 pm, which, in summer, is often the hottest part of the day'. The Council provided the following overview of the possible implications of this:

> Many students use active transport, such as walking and cycling, to get home. An increase in temperatures may increase the risk of heat stress. In addition to this, transport congestion during term time may increase due to extreme weather events. Similarly, students who catch the train home can also find their mode of transport impacted by extreme weather.[41]

8.35 To address this risk, the Council argued that schools and families 'need the capacity to plan for and manage the risk posed to students by a range of extreme weather events during this commute'.[42]

Tourism and public recreation

8.36 Australia's national parks, tourism assets, public recreation areas and sporting facilities face a diverse range of challenges due to climate change. For example:

- as with other coastal assets, assets in coastal regions can be at risk of inundation and damage from storm surges and, in some areas, cyclones;
- Australia's snowfields are expected to be significantly affected by climate change, with modelling undertaken by a CSIRO researcher indicating that, by 2050, snow cover in the Victorian Alps could decrease by up to 80 per cent from current levels;[43] and

39 Hobsons Bay City Council, *Submission 7*, p. 9.

40 Green Building Council Australia, *Submission 50*, p. 9.

41 Hobsons Bay City Council, *Submission 7*, p. 9.

42 Hobsons Bay City Council, *Submission 7*, p. 9.

43 Sustainable Business Australia, *Submission 52*, p. 11.

- areas such as the Blue Mountains could face increased bushfire risk.[44]

Overview of climate change risks

8.37 In a 2018 report on the implications of climate change for tourism, the Climate Council of Australia concluded that the top five attractions for international visitors—beaches, wildlife, the Great Barrier Reef, wilderness areas and national parks—are all 'at risk from climate change'.[45]

8.38 Although a common theme in submissions around the country is that coastal areas are relied on for tourism, the potential consequences for Queensland were particularly highlighted. The Queensland Tourism Industry Council (QTIC) submitted that the coast is 'fundamental to the attractiveness and competitiveness of a large number of destinations across Queensland'.[46]

8.39 On extreme weather events, the QTIC submitted:

> Extreme weather can render resorts, hotels or facilities unusable, creating stranded assets and causing financial losses to investors thereby making Queensland a less attractive investment state. Further consequences of extreme weather events on tourism infrastructure are additional costs associated with protecting assets. A large proportion of Queensland is now deemed at flood and/or cyclone risk resulting in high insurance premiums and creating a more challenging business environment for operators.[47]

8.40 Tropical cyclones, which are projected to increase in intensity due to climate change, have caused extensive damage to tourism infrastructure and assets in the past. For example, Cyclone Debbie caused in excess of $10 million in damage to natural park infrastructure across the Whitsunday Islands. Reduction in visitor numbers following the cyclone also affected local businesses reliant on tourism.[48]

8.41 The implications for tourism from coral bleaching of the Great Barrier Reef are also widely recognised. The committee examined this in the detail in 2017 as part of its inquiry into the impacts of climate change on marine fisheries and biodiversity.[49]

---

44 Sustainable Business Australia, *Submission 52*, p. 11.

45 Climate Council of Australia, *Icons at risk: climate change threatening Australian tourism*, 2018, www.climatecouncil.org.au/tourism-2018 (accessed 21 February 2018), p. 31.

46 Queensland Tourism Industry Council, *Submission 10*, p. 6.

47 Queensland Tourism Industry Council, *Submission 10*, pp. 7–8.

48 Queensland Tourism Industry Council, *Submission 10*, p. 7.

49 See Senate Environment and Communications References Committee, *In hot water: the impacts of climate change on marine fisheries and biodiversity*, December 2017.

8.42 Coastal councils provided examples of issues facing their region for public recreation and tourism. For example, Hobsons Bay City Council explained that:

- aerial photos show there has been significant loss of low lying coastal parklands in its jurisdiction, particularly around Altona Coastal Park and the Ramsar-listed Cheetham Wetlands; and
- the cost associated with protecting, upgrading and repairing assets such as coastal tracks, which already have to be replaced or relocated due to storm surge damage, 'is expected to increase with climate change and sea level rise'.[50]

8.43 Lake Macquarie City Council noted that an increase in relative sea level of 0.9 metres in its jurisdiction could result in permanent inundation of over 93 hectares of residential land, which includes public foreshore land. This would reduce public access to the foreshore and result in the 'damage or loss of sensitive foreshore ecosystems'.[51]

8.44 Climate change will also have implications for public recreation and sporting facilities, with higher temperatures and heatwave events of particular concern. The implications of climate change for public recreation has been recognised for some time, an example being the Western Australian Government's 2007 publication intended to assist organisations to understand how climate change could affect sport and recreation activities.[52]

8.45 How heat affects stadiums is a clear example of climate risk, with a striking case being the Ashes test cricket series in 2017–18 where, during the Sydney test match, the temperature reached 43.4°C.[53] The Australian Open tennis tournament has also experienced heatwaves in previous years.

---

50 Hobsons Bay City Council, *Submission 7*, p. 6.

51 Lake Macquarie City Council, *Submission 29*, p. 2.

52 Department of Sport and Recreation (WA), *Climate change: Climate change is no longer a just a concept—how climate change could affect sport and recreation now and in the future*, www.dsr.wa.gov.au/docs/default-source/file-about-us/file-plan-for-the-future/climate-change.pdf?sfvrsn=0 (accessed 24 April 2018).

53 The 43.4°C reading was recorded at the Observatory Hill Bureau of Meteorology station on 7 January 2018. Media reports indicate that at the Sydney Cricket Ground, a heat stress tracker, which measures environmental factors such as wind and humidity to produce a 'feels like' temperature, recorded 57.6°C. See A Wu, 'Ashes 2017/18: SCG Sunday roast fries players and 33,285 fans on 'hottest day of Test cricket in Australia', *Sydney Morning Herald*, 7 January 2018, www.smh.com.au/sport/cricket/ashes-201718-scg-sunday-roast-fries-players-and-33285-fans-on-hottest-day-of-test-cricket-in-australia-20180107-h0eodw.html (accessed 19 January 2018).

Possible responses

8.46 When considering the impacts of climate change on tourism and public recreation infrastructure, it is important to note that, as with other areas discussed in this chapter such as the health system, tourism is dependent on other infrastructure which could be disrupted due to climate change. The Northern Territory Government submitted:

> Many tourism and recreational experiences across the Territory are dependent on road, rail, marine and air transport. Climate change disruption to transport networks may therefore also impact on recreation and tourism infrastructure and facilities.[54]

8.47 There are also particular challenges associated with areas of particular natural beauty or ecological or cultural significance, such as world heritage sites. The QTIC observed that there is a likelihood of such areas being closed more frequently due to increases in various risks such as temperature, fire risk and extreme weather events. Adaptive actions in response can be more challenging than in other areas; this is because 'each natural park site is unique, adaptive actions are expensive, contentious, and often one-off experiments that come with the risk of losing the very asset that is trying to be protected'.[55]

8.48 In response to the threats presented by climate change, it was suggested that for coastal parklands, 'foresight, planning and regulation' would be required. In particular, it was argued that 'the most effective method of protection is to leave room for coastal retreat particularly along waterways'. More generally, the need for government support 'to assist coastal communities to manage the loss or relocation of these assets and to prepare their local economies' was also highlighted.[56]

8.49 Local governments that are dependent on tourism are also constructing infrastructure in response to climate risks. The committee was informed that the Gold Coast City Council is currently undertaking a project to build a 16-kilometre seawall to protect the City's beaches.[57]

8.50 The design of stadiums could also be reassessed. In an article published in *The Conversation*, Dr Paul Govind, a lecturer at Macquarie University, argued that greater consideration needs to be given to sustainable and climate-adaptable stadium design due to Australian summers becoming more prone to extreme heat conditions.[58]

---

54 Northern Territory Government, *Submission 17*, p. 10.

55 Queensland Tourism Industry Council, *Submission 10*, p. 7.

56 Hobsons Bay City Council, *Submission 7*, p. 13.

57 Mr Alan Stokes, Executive Director, Australian Coastal Councils Association, *Committee Hansard*, 15 March 2018, p. 25.

58 See P Govind, 'We need to "climate-proof" our sports stadiums', *The Conversation*, 17 January 2018, https://theconversation.com/we-need-to-climate-proof-our-sports-stadiums-90020 (accessed 19 January 2018).