HEALTH POLICY | ARTICLE
https://doi.org/10.1071/AH23129

Australian Health Review

Gathering the evidence: health and aged care carbon inventory study

Sharon Desmond[A,*] (*BA (Hons), GradDip (History), GradCertHealth Services Management, MBA, Masters of Professional Practice (Business), Group Manager, Caring for People and Planet*), Jenny Smith[A] (*B Comp (Computer Science, Accounting, Information Systems), MBA, CPA, GAICD, Executive Director, Strategy, Planning and Major Projects*), Jessica Hogg[B] (*MEng(Hons), GSAP, Associate, Sustainability*), Jo Walton-Hespe[B] (*BA, BSc (Hons), Senior Consultant, Environment and Sustainability*) and Jo Gardner-Marlin[B] (*BEng, BArch, GSAP, Sustainable Buildings Designer*)

For full list of author affiliations and declarations see end of paper

***Correspondence to:**
Sharon Desmond
Mercy Health, Level 2, 12 Shelley Street, Richmond, Vic. 3121, Australia
Email: SDesmond@mercy.com.au

Received: 29 June 2023
Accepted: 22 September 2023
Published: 10 October 2023

Cite this:
Desmond S *et al.* (2023)
Australian Health Review
47(6), 634–640. doi:10.1071/AH23129

ABSTRACT

Objective. This study aimed to calculate the baseline carbon inventory of Mercy Health, a provider of health and aged care services in Australia, across emission Scopes 1, 2 and 3. The carbon inventory has clarified the baseline environmental impact, identified carbon hotspots and will inform emissions reduction interventions and a decarbonisation trajectory. **Methods.** A hybrid carbon footprinting methodology was devised. Established carbon footprinting standards provided methodological guidance. A consulting firm with health service carbon accounting experience provided expertise, rigour and objectivity to the work. **Results.** In the 2020–21 financial year, the carbon footprint of Mercy Health was 102.96k tCO2-e. Scope 1 emissions accounted for 11.07% (11.40k tCO2-e), followed by Scope 2 with 29.80% (30.68k tCO2-e) and Scope 3 with 59.13% (60.88k tCO2-e). The largest carbon impost group was Building energy (42.01%; 43.25k tCO2-e), followed by Food and catering (9.42%; 9.70k tCO2-e) and Business services (7.74%; 7.97k tCO2-e). Mercy Health's Health Services, Aged Care and Support Services divisions contributed 49.16, 47.81 and 3.03% (50.61k, 49.23k and 3.12k tCO2-e) of total greenhouse gas emissions respectively. **Conclusions.** Mercy Health's Health Services division and Aged Care division each comprised around half of total organisation carbon emissions. Building energy dominated emissions, particularly electricity. The study discovered meaningful differences in the composition of carbon emissions in operational divisions of the organisation, indicating tailored interventions will be required to meet carbon abatement targets. The study demonstrates the benefit of conducting carbon footprinting within individual organisations, and the importance of studies within the Australian context.

Keywords: aged care, carbon footprint, environmental sustainability, health services, health services research, health systems, hospitals, sustainability.

Introduction

Health care is a carbon intensive enterprise that contributes significantly to environmental degradation which negatively affects human health.[1] The global healthcare carbon footprint has been quantified at 4.4% of global net emissions.[2] In Australia, health care comprises 7% of national emissions.[3] The United Kingdom's (UK) National Health Service (NHS) leads healthcare carbon footprinting.[4] Carbon footprinting studies measure the carbon dioxide equivalent emissions (CO2-e) attributable to an activity, including those conducted by an organisation.[5] CO2-e is a standard measure that takes account of the global warming potential of greenhouse gases and expresses the effect in a common unit.[6] Benchmarking of Australian health provider emissions across Scope 1 (direct energy), Scope 2 (indirect energy) and Scope 3 (all other indirect emissions)[6] is

not possible due to a lack of comprehensive studies. In Australia in 2020–21, expenditure on health care equated to $220.9 billion, with 70.6% provided by governments.[7] The federal government spend on aged care was also significant, at $25.1 billion.[8] In the Australian context, there is a dearth of published information regarding emissions associated with health and/or aged care services.

Objective

The objective of the Carbon Inventory study was to determine the full carbon emission footprint of an Australian health and aged care provider. Mercy Health already had a robust understanding of Scope 1 and 2 emissions via the Australian Government's Clean Energy Regulator National Greenhouse and Energy Reporting Scheme.[9] The organisation had not quantified Scope 3 (primarily supply chain) emissions, found elsewhere to contribute up to 70% of emissions.[2,4] Mercy Health is a Catholic organisation, employing 10 000 people across four states in Health Services and Aged Care divisions. Health Services delivers publicly funded health care. Aged Care operates residential aged care homes, senior's independent living units and home care. Support Services provide corporate functions. Mercy Health's *Caring for People and Planet* strategy endorses transformational organisational change for progress towards net zero emissions by 2030.[10]

Methods

A hybrid carbon footprinting methodology was devised via 'top-down' economic calculations using environmentally extended input–output databases and a 'bottom-up' process-based approach. The Climate Active Carbon Neutral Standard for Organisations was selected to provided methodological guidance, as it is the only government accredited carbon neutral certification scheme in Australia.[6] Climate Active is a voluntary standard that aligns with the Greenhouse Gas (GHG) Protocol Corporate Standard[11] and international carbon accounting standards ISO 14064 and ISO 14040.[12,13] This approach ensured best practice regarding relevance, completeness, consistency, transparency and accuracy in the Australian context.[6] A consulting firm with carbon accounting expertise (Arup) was appointed to provide rigour and objectivity. Independent Climate Active validation and certification was not sought as a part of this study.[6]

The emissions boundary was determined on the basis of an operational control approach, where the organisation is to report on 100% of operations over which it can implement the GHG Protocol Corporate Standard's operating policies.[11] The 2020–21 financial year (FY21) was selected as the most recent full year for which data was available on study commencement, noting this was a non-typical, coronavirus disease 2019 (COVID-19) pandemic year. Identified data were collected at Mercy Health and provided to the Arup team to review, collate and analyse. Data were converted into kilograms of CO_2 equivalents (kgCO2-e) via established emissions factors. Climate Active was the preferred emissions database.[6] If an emission factor was unavailable via Climate Active, alternative sources were used, for example the World Input–Output database.[14] Emissions factors convert a unit of activity into its carbon emissions equivalent.[6] All Scope 1 and 2 emissions were included. For Scope 3, a materiality assessment was undertaken using the GHG Protocol Relevance Test criteria.[11] A small number of emission sources were deemed relevant but were non-quantified due to being immaterial (contributing $<1\%$ total emissions, up to 5% cumulatively).[11]

Multiple reporting categories were devised to allow for analysis. The emission categorisation frame utilised by the NHS carbon footprint, comprising key categories of Delivery of care, Supply chain, Personal travel and Commissioned heath services was considered useful (albeit offering limited utility for direct benchmarking between the NHS and Mercy Health due to key differences in the size, role, service mix, energy grid orientation, etc.).[4] These four groupings formed the basic structure of the analysis, and were termed Category 1. Additional granular emission detail was provided in a classification group labelled Category 2. Whilst beyond the minimum boundaries specified by GHG Protocol Corporate Standard,[11] emissions generated via Personal travel to and from sites were included, as Mercy Health may have some influence over these emissions. Assumptions were made when data were not available. For example, Personal travel utilised COVID check-in application data for FY21, which provided numbers of staff, patients and visitors accessing service sites. Commuting distances and transport mode were not collected, and travel assumptions were made with reference to Climate Active.[6] 'Working from home' was added as an additional field, with Climate Active guidance.[15] The reporting categories utilised for the Carbon Inventory study are provided in Table 1.

A sensitivity analysis on all non-Climate Active factors used closest-fit Climate Active emission factors to ensure no major variability in results.[6] By demonstrating impacts to results of the carbon account were negligible, the data sources were deemed appropriate and the study sufficiently reliable. Data were imported into an analytical digital data platform.

Results

Mercy Health (all of organisation total)

In FY 2020–21, the carbon footprint of Mercy Health was 102.96k tonnes of carbon dioxide equivalent (tCO2-e). Scope 1 emissions accounted for 11.07% (11.40k tCO2-e), Scope 2 29.80% (30.68k tCO2-e) and Scope 3 approximately

Table 1. Mercy Health carbon footprint reporting categories (adapted from Tennison *et al.*).[4]

Division	Business unit	Category 1	Category 2	Category 3	Scope
Aged Care	Business Unit Code and Name	Supply chain	Pharmaceuticals and chemicals Medical Equipment Business services Other procurement Food and catering Non-medical equipment	Additional granular detail on emissions source (e.g. electricity, gas, car, accommodation, cleaning etc.)	Scope 3
Health Services					
Support Services					
		Delivery of care	Building energy Fleet and business travel		Scope 1 and 2
			Water and waste Medical gases and metered dose inhalers Working from home		Scope 1 and 3
		Personal travel	Patient travel Staff commute Visitor travel		Scope 3
		Commissioned	Commissioned health services		Scope 3

two-thirds of total emissions (59.13%; 60.88k tCO2-e). At Category 1, Delivery of care accounted for 51.29% (52.80k tCO2-e), Supply chain 32.92% (33.89k tCO2-e), Personal travel 10.88% (11.20k tCO2-e) and Commissioned health services 4.91% (5.06k tCO2-e) of total emissions. In the NHS in 2019, these categories contributed 24, 62, 10 and 4% respectively. The largest Category 2 carbon imposts were for Building energy (42.01%; 43.25k tCO2-e), Food and catering (9.42%; 9.70k tCO2-e) and Business services, such as maintenance and consultant fees (7.74%; 7.97k tCO2-e). In FY21, 87% of Mercy Health emissions were accrued in Victoria, where most sites are located. Mercy Health's average carbon emissions per bed day was 96.70 kgCO2-e (normalising factor kgCO2-e/admitted length of stay + aged care occupied bed days). Mercy Health's full carbon footprint is provided in Fig. 1.

Health Services, Aged Care and Support Services account for 49.16, 47.81 and 3.03% (50.61k, 49.23k and 3.12k tCO2-e) of greenhouse gas emissions, respectively, with notable differences in the emission composition of the two largest divisions.

Health Services

Health Services emissions were: Scope 1 11.02% (5.58k tCO2-e), Scope 2 29.47% (14.92k tCO2-e) and Scope 3 59.51% (30.12k tCO2-e). The top three carbon impost categories in Health Services were Building energy (38.81%; 19.64k tCO2-e), Pharmaceuticals and chemicals (8.95%; 4.53k tCO2-e) and Medical equipment (7.88%; 3.99k tCO2-e). Health Services' average carbon emissions per occupied bed day was 260.39 kgCO2-e, compared to 125 kgCO2-e in the NHS.[4]

Aged Care

Mercy Health's Aged Care emissions were composed of 11.78% Scope 1 (5.80k tCO2-e), 31.36% Scope 2 (15.43k tCO2-e) and 56.86% Scope 3 (27.99k tCO2-e) emissions. The top three carbon impost categories in Aged Care were Building energy (47.25%; 23.26k tCO2-e), Food and catering (15.41%; 7.59k tCO2-e) and Water and waste (6.46%; 3.18 tCO2-e). The average carbon emissions per Aged Care occupied bed day (residential aged care and seniors living) was 49.52 kgCO2-e; approximately five times lower in carbon impost compared to Health Services.

Occupied bed days normalising factors demonstrate the differences in intensity between Mercy Health's acute health care and aged care service delivery. One of the most significant findings of this study was that Health Services and Aged Care divisions had comparable total emissions. Prior to the study, there had been an assumption (based on relative care intensity) that Mercy Health's Health Services had a total higher carbon footprint. This study has confirmed that Mercy Health's Health Services and Aged Care divisions require equal emission reduction attention. Mercy Health's

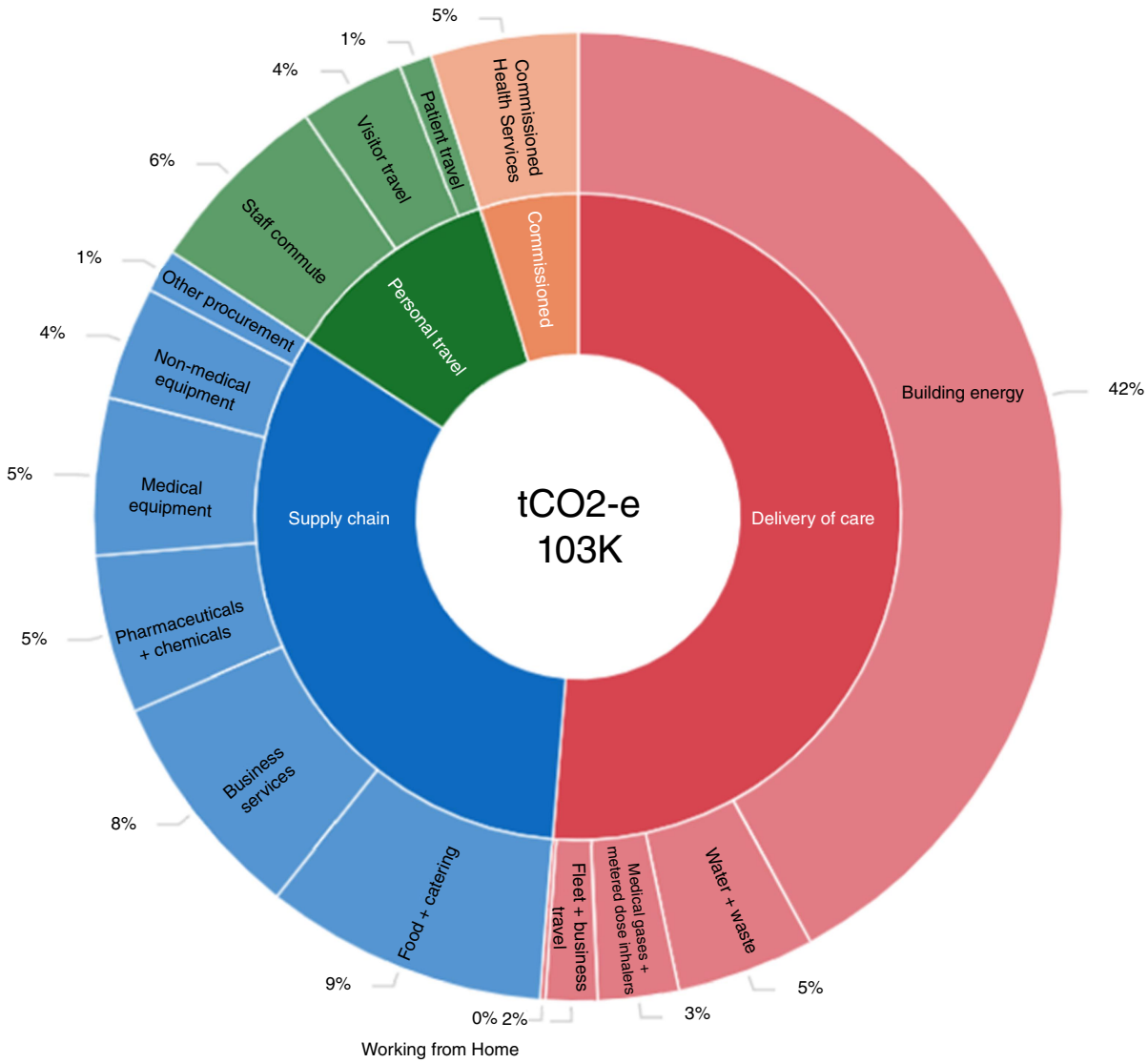

Fig. 1. Mercy Health carbon footprint by key category, for FY21 (adapted from Tennison *et al.*).[4]

full carbon footprint composition and division profile is provided in Table 2.

Other notable findings are presented below.

Building energy

That 42.01% of all emissions were for Building energy is an important learning for Australia. The majority of these emissions were attributed to electricity (78.67%; 34.03k tCO2-e). In contrast, Building energy in the NHS accounted for 10.04% of emissions; the result of a 64% reduction in building energy from 1990 to 2019 that was assisted by decarbonisation of the UK energy system (see supplementary material in reference 4).[4] Energy source has been previously noted to significantly affect carbon emissions[16] and is evidenced by this study. Victoria has the highest indirect Scope 2 electricity emission factor in Australia (0.85 kgCO2-e per kilowatt).[5] The Australian national average is 0.68 kgCO2-e per unit.[5] Meanwhile, the Scope 2 electricity emission factor in the UK is 0.19 kgCO2-e per unit.[17]

Food and catering

Food and catering was the second largest emissions source at 9.42% (9.79k tCO2-e) of emissions. In Aged Care, Food and catering was responsible for 15.41% of emissions (7.59k tCo2e), and in Health Services, 4.16% of emissions (2.10k tCo2e).

Medical gases and metered dose inhalers

Medical gases and metered dose inhalers contributed 5.63% of Health Services emissions. Medical gases accounted for 89.26% of emissions (Scope 1) in this category.

Table 2. Mercy Health's Health Services carbon footprint by key category and impact, FY21.

Category 1	Category 2	All Mercy Health category 2 impact (%)	Health Services category 2 impact (%)	Aged Care category 2 impact (%)
Delivery of care	Building energy	42.01	38.81	47.25
	Water and waste	4.61	3.06	6.46
	Medical gases and metered dose inhalers	2.77	5.63	0.00
	Fleet and business travel	1.71	0.63	2.63
	Working from home	0.19	0.00	0.06
Supply chain	Pharmaceuticals and chemicals	5.29	8.95	1.71
	Medical equipment	5.23	7.88	2.78
	Business services	7.74	7.06	5.35
	Other procurement	1.45	1.60	1.26
	Food and catering	9.42	4.16	15.41
	Non-medical equipment	3.79	2.78	4.09
Personal travel	Patient travel	1.09	2.20	0.01
	Staff commute	6.29	6.52	6.41
	Visitor travel	3.51	6.21	0.95
Commissioned health services	Commissioned health services	4.91	4.52	5.62

Pharmaceuticals and chemicals

Pharmaceuticals, cleaning chemicals and laundry materials contributed 5.29% of emissions (5.44k tCO2e). Pharmaceuticals dominated here, with 78.96% of the organisation's total emissions in this category.

Water and waste

Water and waste accounted for 4.61% (4.75k tCO2-e) of emissions; the split being 84.54% waste and 15.46% water. This percentage split was mirrored in both key divisions; however, water and waste consituted a higher proportion of total emissions in Aged Care (6.46%) than Health Services (3.06%).

Fleet and business travel

Fleet and business travel was 1.71% of all emissions (1.76k tCO2-e); with 85.07% of these related to petrol (1.50k tCO2-e). Health Services had a lower percentage allocated to this category (0.63%; 0.32k tCO2-e) compared to Aged Care (2.63%; 1.30k tCO2-e), with the majority of Aged Care contributions (79.18%) accrued via home care services. Air travel contributed only 0.02% to all Mercy Health emissions, with flights reduced due to travel restrictions in FY21.

Other procurement

Other procurement accounted for only 1.45% of total emissions in FY21 (1.50k tCO2-e). There were no new building developments in the study year.

Personal travel

Personal travel by staff, patients/residents and visitors contributed 10.89% to total emissions (11.20k tCO2-e) and the Health Services' allocation (14.93%; 7.56k tCO2-e) was higher than for Aged Care (7.37%; 3.63k tCO2-e).

Discussion

This study has evidenced key carbon hotspots for pursuit in reducing Mercy Health's carbon emissions in the Australian context. The Global Road Map for Health Care Decarbonization framework[18] proposes seven high impact actions for healthcare decarbonisation. These resonate with the findings of this study.

Power health care with 100% clean, renewable electricity

In the 3 years to 2018–19, only 2.3% of public hospital energy use in Australia was sourced from renewables.[19] The Australian electricity grid has not yet decarbonised; however, significant developments are underway. The Victorian Government has pledged that all government operations, including hospitals, will be powered by 100% renewable electricity from 2025.[20] It is anticipated that Australia's electricity supply will be 100% renewable sources by 2032.[21] Emissions in this organisation could be reduced by 33.06% from the FY 2020–21 baseline by transitioning to 100% renewable electricity.

Invest in zero emissions buildings and infrastructure

Review of energy efficiency across all buildings is required, e.g. increasing thermal insulation and upgrading heating, ventilation and air-conditioning plant with high efficiency equivalents. Outside of electricity, decoupling from other fossil fuel energy sources requires investment. Natural gas accounted for 7.67% of emissions. New infrastructure will be 100% electric, and as gas powered infrastructure requires replacement, electrification will be preferred.

Transition to zero emissions, sustainable travel and transport

Greening fleet via electric vehicles, combined with renewable energy procurement will quash fleet emissions. Emissions associated with Personal travel will be influenced by implementing more sustainable models of care (e.g. virtual models, closer to home).[22] Greater utilisation and electrification of public transport, and the uptake of electric vehicles by citizens, will stem travel emissions.[23]

Provide healthy, sustainably grown food and support climate-resilient agriculture

Food waste audits conducted in New South Wales found that up to 3.5 kg of food waste is generated for every aged care resident, every week.[24] Food waste audits will now be enacted in Mercy Health's Aged Care sites. Other opportunities to reduce food emissions include the high emissions related to animal products such as beef, poultry and dairy.

Incentivise and produce low-carbon pharmaceuticals

Many health services have made positive gains in reducing the use of the anaesthetic gas Desflurane in recent years.[25] Emerging evidence from the UK and Australia demonstrates significant nitrous oxide waste via leaks from cylinders, pipework and values.[25,26] An audit of nitrous oxide piped systems to determine leaks and remedial actions is planned.

Implement circular health care and sustainable healthcare waste management

Waste was of higher percentage emissions impost in Aged Care, compared to Health Services. Reasons for this may include less mature waste and recycling systems, processes and staff engagement with sustainability. The emissions impact of personal protective equipment (PPE) utilised during the COVID-19 pandemic and the mode of disposal (e.g. infectious versus general waste) will be gained in future carbon accounting exercises. There are many opportunities to reduce waste, including single-use items that are discarded as waste, e.g. instruments and PPE.[27]

Establish greater health system effectiveness

Reducing demand and intensity of care via patient empowerment and self-care, prevention, lean service delivery and lower carbon alternatives, and a service planning approach to model of care review will improve sustainable value for patients, providers and system funders.[28,29] Implementation of sustainable models of care has the potential to significantly reduce care delivery emissions.

Conclusion

This study has gathered evidence pertaining to Mercy Health's baseline carbon emissions footprint. It is probable that anomalies will be discovered, and refinements made in subsequent inventories, which will facilitate time-series analyses. Opportunities to update and improve upon the methods utilised in the FY 20–21 baseline will be embraced.[4] Any method changes will be documented transparently, to allow stakeholders to understand factors driving any emissions variation.[6] The impact of the COVID-19 pandemic on the findings of Mercy Health' FY20–21 carbon footprint will be revealed in later iterations. As detailed herein, this study, the first for a health and aged care provider, has important learnings for health and aged care services and funders regarding methodology, emissions imposts, composition intensity and evidence based interventions in Australia and beyond. Benchmarking will be of interest, once other local carbon footprinting studies are available.

References

1 Lenzen M, Malik A, Li M, Fry J, Weisz H, *et al.* The environmental footprint of health care: a global assessment. *Lancet Planet Health* 2020; 4: e271–9. doi:10.1016/S2542-5196(20)30121-2.
2 Health Care Without Harm & Arup. Health care's climate footprint: How the health sector contributes to the global climate crisis and opportunities for action. 2019. Available at https://noharm-global.org/sites/default/files/documents-files/5961/HealthCaresClimateFootprint_092319.pdf [accessed 4 May 2023].
3 Malik A, Lenzen M, McAlister S, McGain F. The carbon footprint of Australian healthcare. *Lancet Planet Health* 2018; 2(1): 27–35. doi:10.1016/S2542-5196(17)30180-8.
4 Tennison I, Roschnik S, Ashby B, Boyd R, Hamilton I, Oreszczyn T, *et al.* Health care's response to climate change: a carbon footprint assessment of the NHS in England. *Lancet Planet Health* 2021; 5: e84–92. doi:10.1016/S2542-5196(20)30271-0.
5 Commonwealth of Australia Department of Climate Change, Energy, the Environment and Water. Australian National Greenhouse Accounts Factors: For individuals and organisations estimating greenhouse gas emissions. February. 2023. Available at https://www.dcceew.gov.au/climate-change/publications/national-greenhouse-accounts-factors-2022 [accessed 5 May 2023].
6 Climate Active. Climate Active Carbon Neutral Standard for Organisations. 2020. Available at https://www.climateactive.org.au/sites/default/files/2022-07/climate-active-carbon-neutral-standard-organisations.pdf [accessed 1 May 2023].
7 Australian Institute of Health and Welfare. Health expenditure Australia 2020-21: Summary. 2022. Available at https://www.aihw.gov.au/reports/health-welfare-expenditure/health-expenditure-australia-2020-21/contents/summary [accessed 4 May 2023].
8 Australian Government. Productivity Commission, Report on Government Services 2023, 14. Aged Care Services. 2023. Available

at https://www.pc.gov.au/ongoing/report-on-government-services/2023/community-services/aged-care-services [accessed 4 May 2023].
9 Australian Government Clean Energy Regulator. The NGER Scheme. 2023. Available at https://www.cleanenergyregulator.gov.au/NGER [accessed 22 May 2023].
10 Mercy Health. Caring for People and Planet. 2020. Available at https://www.mercyhealth.com.au/wp-content/uploads/sites/61/2021/12/Mercy-Health-Care-for-People-and-Planet-online-1.pdf [accessed 22 May 2023].
11 World Business Council for Sustainable Development & World Resources Institute. Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition). 2015. Available at https://ghgprotocol.org/corporate-standard [accessed 4 May 2023].
12 International Organization for Standardization. Greenhouse gases – Part 1: Specification with guidance at the organisation level for quantification and reporting of greenhouse gas emissions and removals. ISO 14064-1:2018. 2018. Available at https://www.iso.org/standard/66453.html [accessed 5 May 2023].
13 International Organization for Standardization. Environmental Management – Life cycle assessment Principles and framework. ISO 14040-1:2006. 2022. Available at https://www.iso.org/standard/37456.html [accessed 5 May 2023].
14 World Input-Output Database. The WIOD Project. 2016. Available at https://www.rug.nl/ggdc/valuechain/wiod/?lang=en
15 Climate Active. Technical Guidance Manual. 2022. Available at https://www.climateactive.org.au/sites/default/files/2022-08/Technical% 20Guidance% 20Manual.pdf [accessed 23 May 2023].
16 McGain F, Muret J, Lawson C, Sherman JD. Environmental sustainability in anaesthesia and critical care. *Br J Anaesth* 2020; 125(5): 680–92. doi:10.1016/j.bja.2020.06.055.
17 United Kingdom Government, Department for Energy Security and Net Zero and Business, Energy & Industrial Strategy. Government conversion factors for company reporting of greenhouse gas emissions: Greenhouse Gas reporting conversion factors. 2022. Available at https://www.gov.uk/government/collections/government-conversion-factors-for-company-reporting [accessed 26 June 2023].
18 HCWH & Arup. Global Road Map for Health Care Decarbonization: A navigational tool for achieving zero emissions with climate resilience and health equity. 2021. Available at https://healthcareclimateaction.org/roadmap [accessed 6 May 2023].
19 Burch H, Anstey MH, McGain F. Renewable energy use in Australian public hospitals. *Med J Aust* 2021; 215(4): 160–3.e1. doi:10.5694/mja2.51197.
20 State of Victoria Department of Environment, Land, Water and Planning. Cutting Victoria's emissions 2021–2025 Whole of Victorian Government emissions reduction pledge. 2020. Available at https://www.climatechange.vic.gov.au/victorian-government-action-on-climate-change/Whole-of-Victorian-Government-sector-pledge-accessible.pdf [accessed 5 May 2023].
21 Nadolny A, Cheng C, Lu B, Blakers A, Stocks M. Fully electrified land transport in 100% renewable electricity networks dominated by variable generation. *Renewable Energy* 2022; 182: 562–77. doi:10.1016/j.renene.2021.10.039
22 Desmond S. Health service planning and sustainable development: considering what, where and how care is delivered through a pro-environmental lens. *Aust Health Rev* 2018; 42: 140–5. doi:10.1071/AH16217.
23 Rowe H. Thinking beyond EVs to decarbonise Australia's transport sector. Climate Works Centre. 24 May. 2023. Available at https://www.climateworkscentre.org/news/thinking-beyond-evs-to-decarbonise-australias-transport-sector/ [accessed 22 June 2023].
24 Maggie Beer Foundation. Hungry for change: tackling food waste in aged care. 2020. Available at https://maggiebeerfoundation.org.au/news/hungry-for-change-tackling-food-waste-in-aged-care/ [accessed 25 May 2023].
25 Gynther A, Pearson F, McGain F. Nitrous oxide use on the labour ward: Efficacy and environmental impact. *Australas Anaesth* 2021; 193–202. https://search.informit.org/doi/10.3316/informit.218018729128516.
26 Seglenieks R, Wong A, Pearson F, McGain F. Discrepancy between procurement and clinical use of nitrous oxide: waste not, want not. *Br J Anaesth* 2022; 128: e32–4. doi:10.1016/j.bja.2021.10.021.
27 Davies JF, McGain F, Francis JJ. Consensus on Prioritisation of Actions for Reducing the Environmental Impact of a Large Tertiary Hospital: Application of the Nominal Group Technique. *Int J Environ Res Public Health* 2022; 3978: 1–15. doi:doi.org/10.3390/ijerph20053978
28 Mortimer F. The Sustainable Physician. *Clin Med* 2010; 10(2): 110–1. doi:10.7861/clinmedicine.10-2-110.
29 Mortimer F, Isherwook J, Wilkinson A, Vaux E. Sustainability in quality improvement: redefining value. *Future Healthc J* 2018; 5: 88–93. doi:10.7861/futurehosp.5-2-88

Data availability. The data that support this study will be shared upon reasonable request to the corresponding author.

Conflicts of interest. The authors declare no conflicts of interest.

Declaration of funding. This research did not receive any specific funding.

Author affiliations
[A]Mercy Health, Level 2, 12 Shelley Street, Richmond, Vic. 3121, Australia.
[B]Arup Australia Pty. Ltd., Barrack Place, L5 151 Clarence Street, Sydney, NSW 2000, Australia.