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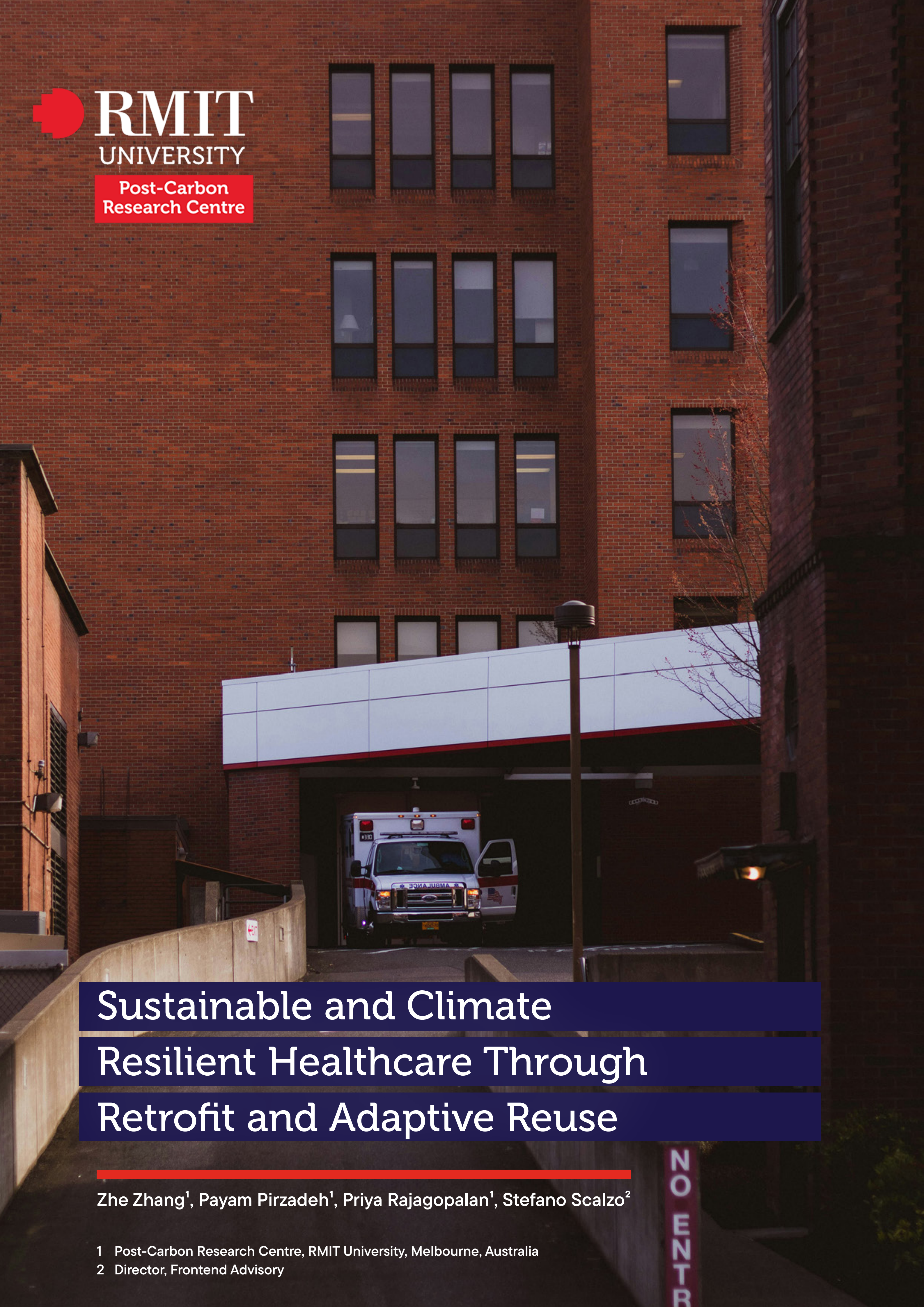

Sustainable and Climate Resilient Healthcare Through Retrofit and Adaptive Reuse

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Key Takeaways

→ **Australia's healthcare estate is large, energy-intensive and undergoing major renewal** – Publicly available data suggest healthcare-related assets across major jurisdictions exceed AUD 70 billion, while hospitals and health facilities remain significant energy and emissions reduction opportunities.

→ **New construction decisions should be compared against retention, upgrade and repurposing options** – Retaining, upgrading or repurposing existing assets can preserve embodied carbon, reduce construction waste, lower disruption and unlock broader public value, particularly where primary structures remain viable.

→ **Case studies show that retrofit and adaptive reuse can deliver multiple forms of value** – International and Australian examples demonstrate benefits across environmental performance, quality of service, operational cost reduction, functionality, social value, heritage conservation, housing supply, urban regeneration and community revitalisation. They also show that retrofit decisions rarely involve one objective alone; energy upgrades, for example, can simultaneously reduce emissions and costs while improving comfort, service conditions and community outcomes.

→ **Adaptive reuse can turn surplus or obsolete healthcare buildings into assets for broader public value** – Former healthcare facilities can be repurposed for housing, education, community infrastructure or innovation hubs, helping to unlock land value, reduce embodied carbon, avoid demolition waste and support urban regeneration. Case study evidence also shows that disused hospitals have been converted into affordable or supported housing while retaining existing structures and delivering social, environmental and community benefit

→ **Non-hospital and community healthcare facilities offer scalable retrofit opportunities** – Primary healthcare clinics, community health centres, aged-care and support facilities, and Aboriginal community health services can often be upgraded through targeted measures such as HVAC improvements, lighting upgrades, energy management systems, accessibility improvements and internal reconfiguration. These projects are generally less complex than major hospital campuses and can deliver practical benefits for energy performance, comfort, service delivery and community access.

→ **Healthcare retrofit decisions are complex and multi-dimensional** – Effective decision-making must balance environmental performance, clinical functionality, service continuity, whole-life cost, social value, cultural safety, governance, urban regeneration, compliance and risk.

- **Community and Aboriginal community-controlled health infrastructure require specific attention** – Many Aboriginal Community Controlled Organisation (ACCO) and Aboriginal Community Controlled Health Organisation (ACCHO) facilities are ageing or not fit for contemporary health and wellbeing services, making retrofit and adaptive reuse relevant to health equity, cultural safety and continuity of care.

- **Existing Australian policy and assessment frameworks provide useful direction but remain fragmented** – Current policy and guidance establish expectations for sustainability, climate resilience, net zero, NABERS performance, safety and infrastructure appraisal, but do not yet provide an integrated decision-support framework tailored to healthcare retrofit and adaptive reuse.

- **A structured decision-support framework is needed** – Such a framework would help health authorities, infrastructure managers and governments compare retrofit, adaptive reuse, partial retention, redevelopment and replacement options before demolition or disposal becomes the default decision.

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Why retrofit healthcare facilities?

Healthcare facilities are long-life, high-dependency public assets. The healthcare sector faces rising pressure to expand capacity and upgrade facilities to meet increasing service demands and stricter sustainability targets. Victoria's 30 years Infrastructure Strategy proposed "Invest in maintenance, upgrades and expansions of community health facilities" as one of the recommendations. Decisions around health infrastructure development carry long-term environmental, financial, and social implications. For example, 'replace-new' pathways can impose substantial embodied carbon, construction waste, and service disruption risks. In comparison, retrofitting healthcare buildings can deliver combined benefits for emissions reduction, climate resilience and clinical service quality, while also addressing ageing assets at lower cost and disruption than replacement.

Retaining existing structures can significantly reduce whole-life environmental impacts compared with demolition and new build, particularly when the primary structure is preserved and retrofit is targeted to major energy and carbon drivers (William et al., 2020).

Globally, the health sector is a significant and under-recognised contributor to climate change, accounting for around 4.4% of national greenhouse gas emissions across many developed countries (OECD, 2025a). In Australia, healthcare was estimated to be responsible for approximately 7% of the national carbon footprint, highlighting hospitals and health facilities as critical leverage points for decarbonisation (Malik et al., 2018). In the context of Australia's legislated commitment to achieve net zero emissions by 2050, accelerating healthcare facility retrofit and adaptive reuse is essential to aligning core public services with national climate and resilience objectives.

Healthcare facilities are among the most energy-intensive building types. In the United States, for example, healthcare facilities accounted for over 10% of total commercial building energy consumption while representing less than 5% of commercial floor area, driven by continuous operation HVAC loads and energy-intensive medical equipment (Bawaneh et al., 2019). In Australia, hospitals are recognised as among the most energy-intensive facility types, using at least twice as much energy per square metre as typical commercial office buildings (Davis Langdon, 2011), and government energy benchmarking similarly treats hospitals as a high-energy-intensity building class (Pitt & Sherry et al., 2012, p. 1).

It is acknowledged, however, that hospitals are not the only energy-intensive building typology. Data centres, for example, can exhibit substantially higher electricity intensity due to continuous IT loads and cooling requirements (IEA, 2025). Yet, hospitals remain a critical retrofit priority because their energy intensity is coupled with continuous clinical operation, vulnerable occupants, stringent safety and infection-control requirements, and essential public service obligations. This makes healthcare retrofit a distinct challenge within the broader landscape of energy-intensive buildings.

Healthcare facilities often represent a critical yet untapped potential for decarbonisation, climate adaptation, and broader public value creation. At the system level, decarbonising health infrastructure is also a public-health strategy – the healthcare sector's estimated 5% contribution to global greenhouse gas emissions indicates that improving energy performance and clean energy adoption in facilities can have material mitigation impact while delivering local air-quality co-benefits (Or & Seppänen, 2024).

Australian public hospitals currently source only a small fraction of their energy from renewables (about 2–3% across 2016–2019), which means efficiency and electrification retrofits are a major lever for decarbonisation (Burch et al., 2021) when combined with local and system-level renewable energy sources.

In addition, older hospitals typically have inflexible layouts, poor envelopes and outdated plant, limiting their capacity to support modern models of care and digital health technologies without substantial upgrade, and maintaining old health assets consumes a substantial budget each year (Infrastructure NSW, 2012).

Australia's healthcare estate is not only substantial in scale but also subject to ongoing expansion, renewal, and reinvestment, reinforcing the importance of strategic approaches to managing existing assets. Across major jurisdictions, publicly available data indicate that the value of healthcare-related assets exceeds AUD 70 billion, although this represents only a partial estimate of the national total due to variations in reporting frameworks and asset classifications. This figure should therefore be interpreted as indicative.

Beyond the existing asset base, there is clear evidence of sustained government commitment to expanding and upgrading healthcare infrastructure. Significant capital investment programs have been announced across multiple states and territories, supporting new facility delivery, hospital upgrades, and asset renewal initiatives. As summarised in Table 1, data compiled from official government reports highlight the scale and economic significance of the sector.

Table 1
Summary of Healthcare Estate Data across Australian States and Territories

State / Territory	Healthcare Estate Value	Interpretation and Remarks	Resource
New South Wales (NSW)	NSW Health's net assets at 30 June 2025 are $31.2 billion. This is made up of total assets of $39.5 billion, netted off by total liabilities of $8.3 billion. The net assets are represented by accumulated funds of $17.7 billion and an asset revaluation reserve of $13.4 billion (NSW Health, 2025a, p. 165).	Represents total health system assets, including non-building components; may overestimate physical estate value.	NSW Health Annual Report in 2024-25, NSW Health Department
Queensland (QLD)	Queensland Health is responsible for maintaining hospitals and related assets valued at $19 billion. It is also responsible for planning for future needs, constructing new hospitals, and expanding existing ones (Queensland Audit Office, 2026).	One of the closest representations of healthcare estate value; explicitly refers to hospital infrastructure.	Financial Audit Report – Health 2025: Report 9:2025-26, Queensland Audit Office

State / Territory	Healthcare Estate Value	Interpretation and Remarks	Resource
Victoria (VIC)	According to asset and financial outlook of Victoria, the Victorian Government has committed approximately AUD 15.9 billion in capital investment across healthcare infrastructure projects currently in planning and delivery in 2025-26 (Department of Health Victoria, 2025). A significant proportion of these initiatives focus on renewal, replacement, and upgrade of existing assets, such as Engineering Infrastructure Replacement Program, Medical Equipment Replacement Program, Mental Health Capital Renewal Fund (Department of Health Victoria, 2025). Victoria Department of Health reported buildings at fair value of AUD 836.8 million, assets under construction of AUD 3.68 billion, and total property, plant and equipment of AUD 5.32 billion in 2024–25 (Victoria State Government, 2025).	These figures indicate substantial health infrastructure assets and a large capital works pipeline, but they should be interpreted as departmental asset disclosures rather than a consolidated valuation of the entire Victorian healthcare estate.	Strategic Plan 2023-27 (2025 update), Department of Health, Victoria State Government Department of Health Annual Report 2024-25, Department of Health, Victoria State Government
Western Australia (WA)	Total assets: AUD 4.44 billion; property, plant and equipment (PPE): AUD 2.64 billion (Government of Western Australia South Metropolitan Health Service, 2025).	Represents a major metropolitan health service rather than the entire state; provides indicative scale of healthcare estate assets. Similar to other states, evidence from Western Australia indicates that healthcare assets are substantial in scale and continue to grow over time (PPE value has increased from $2.19 to $2.64billion), with increasing capital investment and expanding asset bases observed at the health service level.	Annual Estimates FY 2025/26, Government of Western Australia South Metropolitan Health Service
South Australia (SA)	Total assets: AUD 1.07 billion (Department for Health and Wellbeing, 2025).	Represents departmental-level assets only; healthcare infrastructure assets are distributed across multiple Local Health Networks, resulting in fragmented reporting and lack of consolidated valuation.	Department for Health and Wellbeing 2024-25 Annual Report - Financial performance, Department for Health and Wellbeing, Government of South Australia
Tasmania (TAS)	Total assets: AUD 2.996 billion; Property, Plant and Equipment: approx. AUD 2.32 billion (Department of Health, Tasmania, 2025)	Total assets include financial and non-physical assets, while PPE provides a closer proxy for healthcare estate value; no breakdown of building value or replacement costs available.	Annual Report 2024-25, Department of Health, Tasmanian Government
Australian Capital Territory (ACT)	Total assets: AUD 2.44 billion; PPE: approx. AUD 2.28 billion (Canberra Health Services, 2025).	High proportion of physical assets, making PPE a strong proxy for healthcare estate value; limited data on replacement or maintenance requirements.	Annual Report 2024-25, Canberra Health Services, ACT Government
Northern Territory (NT)	Housing Choices Australia	One of the few jurisdictions explicitly reporting building-level asset values; provides a close proxy for healthcare estate, though replacement and maintenance data are not detailed.	NThealth Annual Report 2024-25, Department of Health, Northern Territory Government

Note Data are compiled from publicly available government reports. Variations in reporting scope, asset definitions, and accounting frameworks exist across jurisdictions; figures should be interpreted as indicative rather than directly comparable.

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Collectively, these trends suggest that alongside new construction, the effective management, upgrade, and retrofit of existing healthcare assets will play an increasingly critical role in meeting future healthcare demands and sustainability goals at a national scale. This raises an important question regarding how existing healthcare assets should be managed and upgraded in a cost-effective and sustainable manner.

This issue is strategically significant because decisions made now about ageing, surplus and transitioning healthcare assets will shape long-term environmental, social, financial and public-value outcomes. Across Victoria and other Australian jurisdictions, major hospital replacement and redevelopment programs are creating, or will soon create, a growing portfolio of existing healthcare assets whose future must be carefully considered. For example, the opening of the new Footscray Hospital means the former Gordon Street hospital site is no longer required for hospital use and is being considered for future redevelopment, with demolition and site preparation expected to commence in the second half of 2026 (Victoria State Government, 2026). Similarly, the Warrnambool Base Hospital redevelopment includes a new multi-storey clinical services building (VHBA, 2026), while planning for the Queen Elizabeth II Hospital involves a major redevelopment and expansion of the existing Maroondah Hospital (VHBA, 2023). These projects highlight a broader policy and asset-management challenge: when healthcare functions are replaced, relocated or substantially upgraded, what should happen to the existing buildings, structures and sites?

Several Victorian healthcare assets illustrate the practical relevance of this issue, including:

- the old Warrnambool Base Hospital inpatient unit tower,
- several abandoned or underused buildings at the former Repatriation Hospital in Heidelberg,
- the old Maroondah Hospital (with considerations of developing a new asset underway)
- the old Main Ward Block at Box Hill Hospital,
- the old Nurses Quarters Building, Royal Park Hospital
- the old Nurses Quarters Building, Austin Hospital, and
- the disused Tuberculosis Sanatorium at Hamilton Hospital.

In addition, as care models continue to shift away from long-stay institutional models towards more integrated, ambulatory, community-based and digitally enabled care, many metropolitan sub-acute sites may need to be reimagined rather than simply demolished. Sites such as Caulfield Hospital, Royal Talbot Hospital, Bundoora Extended Care Centre and Peter James Hospital may therefore become important test cases for deciding whether existing healthcare assets should be retrofitted, repurposed, partially retained, integrated into new precincts, or released for alternative public-value uses.

These examples demonstrate the need for a structured decision-support framework that can help asset owners and policy makers evaluate options before demolition or disposal becomes the default pathway. Such a framework would support early assessment of environmental value, embodied carbon, service functionality, heritage and social value, financial implications, urban regeneration potential, and compliance risks. In this sense, healthcare retrofit and adaptive reuse should be understood not only as a sustainability strategy, but also as a practical tool for guiding the future of ageing, surplus or transitioning healthcare assets.

From sustainability perspective, retrofitting existing healthcare facilities is increasingly recognised as a high-leverage pathway to decarbonise the built environment while preserving critical public assets, aligning them with contemporary service standards. Compared with demolition and new construction, retrofit and/or reuse-led approaches can avoid a substantial share of upfront (embodied) impacts locked into existing structures and materials, while enabling staged upgrades that align with operational constraints and funding cycles. Evidence consistently shows that adaptive reuse and retrofit can reduce embodied energy and embodied greenhouse gas emissions relative to new construction alternatives, particularly where the primary structure is retained (GBCA and thinkstep-anz, 2021; C. A. Langston et al., 2018; Wang et al., 2025).

Although public hospitals achieved an average NABERS rating of 4.1 stars for energy in Victoria[1] (NABERS energy ratings of Victorian public hospitals in 2022-2023 shown in Table 2), health services are still categorised as operations energy-intensive facilities which offer significantly greater potential for energy and emissions reduction than other operational categories such as offices. According to Victoria Department of Health Annual Report 2023-24, healthcare services consumed approximately 3,746TJ of energy, which is nearly 500 times higher than office buildings, and generated around 787,039 tonnes of CO2-e emissions, which is 200 times the emissions associated with offices. This disparity highlights healthcare facilities as a critical leverage point for energy and emissions reduction strategies.

Table 2
NABERS energy and water ratings of Victorian public hospitals in 2022-23
(from the Environmental performance reporting machine-readable dataset (Victoria Department of Health, 2025))

NABERS star rating	1	2	3	4	5	6	Total
Number of NABERS public hospitals (energy)	3	14	32	49	30	3	143
Change to: Number of NABERS public hospitals (water)	8	9	27	40	29	13	143

At the same time, sustainability challenges and gaps have been highlighted by the government reports on current healthcare infrastructure, especially in Australia, as outlined in Table 3:

Table 3
Evidence of practice gaps from government reports on healthcare infra-structure in Australia

Government practical report	Gap *What needs to be addressed but is not yet systematically resolved*	Challenge *Constraints and barriers limiting implementation*
NSW Health Infrastructure – Draft Net Zero Roadmap (2023–2030) Victorian Health Building Authority (VHBA) – Sustainability Guidelines for Capital Works (2021)	Sustainability, energy efficiency, electrification readiness and climate risk assessments are not yet consistently embedded in early decision-making stages (e.g. master planning, business cases and early project planning), necessitating new mandatory requirements. Carbon considerations, particularly embodied carbon, are not systematically integrated into design option selection and early engineering decisions, despite their significant influence on long-term emissions outcomes.	Existing healthcare buildings face technical, spatial and operational constraints that limit immediate electrification and decarbonisation, requiring staged or preparatory approaches rather than full implementation. Reducing embodied carbon in healthcare retrofit is constrained by material availability, clinical performance requirements, supply-chain readiness and risk-averse procurement practices.
AusHFG / AHIA – Electrification Guide for Healthcare Facilities (2024)	A consistent, sector-wide decision framework to guide when, how and to what extent electrification should be pursued in existing healthcare facilities is still emerging.	Electrification in healthcare settings is challenged by critical loads, backup requirements, infrastructure capacity, risk management considerations and uncertainty around future energy supply and maintenance capability.

1 In NABERS ratings, 1 star = making a start, 2 stars = below average, 3 stars = average, 4 stars = good, 5 stars = excellent, 6 stars = market leading.

Government practical report	Gap *What needs to be addressed but is not yet systematically resolved*	Challenge *Constraints and barriers limiting implementation*
AusHFG / AHIA – Climate Resilience and Adaptation Guidance (2024)	Climate risk considerations are not yet systematically integrated into healthcare asset strategy and early retrofit decision-making across jurisdictions.	Addressing climate risks in existing healthcare buildings is constrained by asset age, location-specific hazards, retrofit feasibility and the need to maintain uninterrupted clinical services.

Additionally, healthcare infrastructure faces increasing pressure from:

1. Ageing building stock with typical lifespans of 50-60 years:
   A large proportion of healthcare facilities are characterised by ageing building stock, with typical service lives of 50-60 years and, in some historical hospital precincts, substantially longer operational periods. Many of these assets were designed to meet past clinical models, environmental standards and energy prices, making them increasingly misaligned with contemporary performance expectations (OECD, 2020; Victorian Auditor-General's Office, 2021);

2. Rising service demand and higher expectations for environmental comfort:
   Healthcare systems are experiencing rising service demand driven by population growth, ageing demographics and increased prevalence of chronic conditions, alongside higher expectations for environmental comfort, indoor air quality and patient-centred care. These demands place additional pressure on building services systems that already operate continuously and at high intensity, further constraining the ability of existing facilities to adapt without strategic intervention (OECD, 2025b; World Health Organization, 2023);

3. Climate-related risks such as heatwaves, flooding, and extreme weather:
   Extreme heat events, flooding, bushfires and other forms of extreme weather increasingly threaten the operational continuity, safety and resilience of health facilities, particularly those located in vulnerable urban or regional contexts. Evidence from recent climate risk assessments indicates that many existing healthcare assets were not designed to withstand the frequency and severity of climate hazards now projected under future climate scenarios (Australian Government, 2025; NSW Health, 2025b);

4. Government commitments to net zero targets:
   These pressures are further intensified by government commitments to economy-wide decarbonisation. In Victoria, for example, legislated targets require net zero greenhouse gas emissions by 2045, placing clear expectations on public health infrastructure to contribute to emissions reduction through improved energy performance, electrification and low-carbon asset strategies. However, translating these policy commitments into practical, asset-level decisions remains a significant challenge, particularly for existing facilities operating under clinical, technical and financial constraints (Climate Action Act 2017, 2017; Victorian Health Building Authority, 2021).

Peter MacCallum Cancer Centre, VIC
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Healthcare retrofit can be considered as a sustainable solution to address these pressures through two key pathways:

1 Healthcare-to- healthcare retrofit
Upgrading existing hospitals and health facilities to improve energy efficiency, reduce carbon emissions, enhance resilience, and improve operational performance and service quality and capacity.

2 Healthcare-to-non-health adaptive reuse
Repurposing surplus or obsolete healthcare assets into alternative uses such as housing, education, community facilities, or innovation hubs – unlocking land value, reducing embodied carbon, and supporting urban regeneration.

Both pathways contribute to decarbonisation and public value but involve distinct objectives, considerations, and decision criteria, which necessitate differentiated assessment frameworks.

Retrofitting hospitals and healthcare facilities (Pathway 1) can deliver benefits through targeting high-impact levers including HVAC optimisation, controls/commissioning, envelope improvements, layout changes, heat recovery, efficient medical and support equipment, and electrification, which often deliver measurable performance gains, including:

– Energy and emissions reduction potential: Technical guidance for healthcare retrofits and hospital design targets commonly uses approximately 30% energy savings as a practical benchmark for 'good practice' performance uplift in smaller hospitals and healthcare facilities (Hendron et al., 2013). Some retrofit studies and modelling show that specific system upgrades can deliver much larger savings in particular contexts (e.g., ventilation/air-handling system strategies), highlighting that savings potential is strongly baseline-dependent (William et al., 2020).
– Operational cost reduction and reinvestment capacity: Energy savings translate into recurrent budget relief that can be redirected to care delivery and asset renewal (Chen-Xu et al., 2024; Psillaki et al., 2023; Victorian Auditor-General's Office, 2021).
– Clinical and staff outcomes via better indoor environmental quality (IEQ): Retrofit can improve thermal comfort, ventilation effectiveness and controllability which are the factors increasingly linked to service quality, staff performance and patient experience (Psillaki et al., 2023).
– Climate resilience and continuity: Upgrading passive and mechanical systems can improve 'passive survivability' and reduce heat-stress risk during heatwaves and disruptions which is an issue emphasised in resilience-oriented building guidance (World Health Organization, 2020).

Likewise, adaptive reuse of healthcare facilities (Pathway 2) can deliver a set of benefits including:

– Avoided embodied carbon and waste: Reuse of structures reduces demolition waste and avoids a portion of new-build embodied impacts supported by life-cycle approach (William et al., 2020);
– Urban regeneration and public value: Converting obsolete facilities into housing, education, or community infrastructure can support place-making and social value outcomes, with social life-cycle research highlighting community-level benefits in reuse projects (Hama Radha, 2023);
– Portfolio optimisation: Reuse can unlock land/building value and redirect capital into priority healthcare delivery or new clinical infrastructure which is commonly discussed in public net zero healthcare transition projects (Australian Government Department of the Environment and Heritage, 2004).

Decision-making around healthcare building retrofit and adaptive reuse is inherently complex and multi-dimensional, as it needs to deal with changes happening fast and in an unpredictable way, such as epidemiological trends, the advancements of medical technology and processes or evolving sustainability policy, social and economic needs (Scialpi & Declercq, 2023). Unlike new construction, such decisions are made within the constraints of existing building fabric, operational continuity, regulatory requirements, and long-term service delivery needs. Decision-makers are required to balance a wide range of considerations, including capital and life-cycle costs, operational energy and carbon performance, climate resilience, patient safety and comfort, clinical functionality, heritage value, and broader community, social and urban outcomes (Chen et al., 2018; Geraedts, 2016; C. Langston & Shen, 2007; Mashallahi et al., 2022; Pascale & Achour, 2024; William et al., 2020).

It is also noteworthy that the relevance of retrofit and adaptive reuse also extends beyond hospitals to Aboriginal Community Controlled Organisations (ACCOs) and Aboriginal Community Controlled Health Organisations (ACCHOs), which provide culturally safe, community-led health and wellbeing services. Recent report by Infrastructure Victoria and VACCHO (2025) highlights that many ACCO facilities in Victoria are ageing, unsuitable or operating from buildings not originally designed for contemporary community health functions. The assessment found that 82% of Victorian health and wellbeing ACCO buildings will require replacement or substantial repair within the next 15 years, 52% are already at the end of their useful life, and 42% of total floor space is in critical condition. Hence, with regard to ACCO facilities, retrofit and adaptive reuse decisions are not only an environmental or asset-management issue, but also a matter of health equity, self-determination, cultural safety and continuity of care for Aboriginal communities.

Despite the growing recognition of retrofit and adaptive reuse as critical strategies for healthcare building transform, there is currently a lack of comprehensive, structured frameworks specifically tailored to healthcare buildings. This gap creates uncertainty and risk for asset owners, policy makers, health authorities and project teams and missed opportunities for achieving long-term environmental, social and operational benefits.

The following section outlines the key considerations that should inform retrofit and adaptive reuse decision-making for healthcare buildings.

2
What are the key considerations for healthcare retrofit?

Healthcare buildings are complex systems, i.e. they operate continuously, provide critical services, support vulnerable users, and must remain functional under conditions of uncertainty, including climate extremes, service surges, and evolving care models. Therefore, healthcare retrofit decisions require a multi-dimensional evaluation framework that extends beyond energy performance alone.

Based on a review of international literature, Australian policy guidance, and observed gaps in current practice, the key considerations for healthcare retrofit and adaptive reuse are divided into seven interrelated domains. These domains are not independent. They present interacting factors that shape whether, when and how retrofit or adaptive reuse pathways can deliver long-term value.

2.1 Environment and resource performance

Environmental and resource performance remains a foundational driver for healthcare retrofit, particularly in the context of national and state net zero commitments. Hospitals are among the most energy- and carbon-intensive building types, driven by 24/7 operation, high ventilation rates, infection control requirements, and energy-intensive medical equipment. Consequently, retrofit interventions targeting operational energy demand reduction, electrification, and renewable integration represent some of the highest-leverage decarbonisation opportunities within the public building stock (Bawaneh et al., 2019; Malik et al., 2018).

However, focusing on operational energy performance alone provides limited sustainability benefits. Embodied carbon associated with demolition, new construction, and material replacement is increasingly recognised as a critical component of whole-life environmental impact, particularly for long-life assets such as healthcare facilities. Retaining primary structures and adapting existing fabric can significantly reduce upfront embodied emissions and construction waste, especially where retrofit strategies prioritise "build less" principles and selective intervention (GBCA and thinkstep-anz, 2021; C. A. Langston et al., 2018).

In parallel, indoor environmental quality (IEQ)—including thermal comfort, indoor air quality, daylight, and acoustics—must be considered as both an environmental and clinical issue. Evidence links improved IEQ in healthcare settings to staff wellbeing, patient outcomes, and service quality, reinforcing the need to align energy-saving measures with human-centred performance rather than treating them as competing objectives (Hama Radha, 2023; Psillaki et al., 2023).

Climate resilience further extends the environmental performance domain. Retrofit strategies increasingly need to enhance passive survivability and system robustness under heatwaves, power outages, flooding, and other climate hazards. International and Australian guidance emphasise that resilience-oriented upgrades — such as improved envelopes, passive cooling, and diversified energy supply — are essential to maintaining healthcare continuity under future climate scenarios (Mashallahi et al., 2022; World Health Organization, 2020).

2.2 Service functionality

Unlike many other building types, healthcare facilities cannot easily suspend operations to accommodate major refurbishment. Retrofit decisions must therefore prioritise service functionality, spatial suitability, and continuity of care throughout planning and implementation phases. Functional layouts, circulation efficiency, accessibility, and compliance with contemporary clinical standards directly influence whether an existing facility can viably support ongoing healthcare delivery or should be considered for alternative reuse.

Older hospitals frequently exhibit rigid layouts, undersized plant rooms, and limited adaptability, reflecting historical care models that no longer align with current clinical practice or digital health integration. As a result, retrofit feasibility is often constrained not by energy performance potential alone, but by spatial programmability and the capacity to accommodate evolving healthcare models over time (Scialpi & Declercq, 2023).

Minimising service disruption during retrofit is a critical operational consideration. Staged upgrades, decanting strategies, and temporary services are commonly required, adding complexity, cost, and risk. These operational constraints reinforce the importance of early decision-making that integrates technical, clinical, and asset management perspectives, rather than deferring feasibility assessment until detailed design stages.

2.3 Financial aspect

Financial considerations in healthcare retrofit extend beyond upfront capital expenditure. Public health infrastructure decisions increasingly require a whole-life perspective that considers operational savings, maintenance burden, asset longevity, and reinvestment capacity. Energy efficiency and electrification upgrades can deliver recurrent cost savings, which may be redirected towards clinical services, workforce investment, or deferred maintenance backlogs (Chen-Xu et al., 2024; Victorian Auditor-General's Office, 2021).

However, retrofit projects often face capital constraints, fragmented funding models, and competing priorities within health systems. The challenge is therefore not simply whether retrofit is cost-effective in principle, but whether value is realised within institutional budgeting frameworks and governance structures. Life-cycle cost analysis, combined with risk-adjusted assessment of performance and resilience benefits, is increasingly recognised as essential for informed decision-making (Pascale & Achour, 2024).

For adaptive reuse projects, financial evaluation must also account for opportunity cost, land value, and portfolio optimisation. Repurposing surplus or obsolete healthcare assets can unlock capital for reinvestment in priority services, while avoiding the environmental and social costs of demolition and vacancy (Australian Government Department of the Environment and Heritage, 2004).

2.4 Social impact

Healthcare buildings are deeply embedded in social systems, serving vulnerable populations and acting as anchors of community wellbeing. Retrofit and adaptive reuse decisions therefore carry significant social implications, including impacts on health equity, accessibility, patients' sense of dignity, recovery experience and psychological safety, as the design and quality of healthcare environments have been shown to influence patient outcomes, wellbeing, and recovery processes (Huisman et al., 2012; Ulrich et al., 2008).

Human-centred design considerations — such as privacy, daylight access, noise control, and cultural sensitivity — are increasingly recognised as integral to quality healthcare environments rather than optional enhancements. Retrofit provides an opportunity to address historical deficits in these areas, particularly in ageing facilities that were not designed with contemporary patient-centred care principles in mind (WHO, 2023).

Adaptive reuse projects further extend social impact considerations to community cohesion and access to essential services. Converting former healthcare facilities into housing, education, or community infrastructure can generate substantial social value, particularly when aligned with local needs and inclusive planning processes (Hama Radha, 2023). For Aboriginal communities, VACCHO emphasises that Aboriginal Community Controlled Health Organisations play a central role in delivering culturally safe health and wellbeing services.

2.5 Value management and governance

Effective healthcare retrofit requires robust governance and value management frameworks that align asset decisions with long-term healthcare system objectives. This includes clear decision criteria, transparent trade-offs, and coordination across clinical, technical, financial, and policy domains.

In Australia, multiple reports in Table 4 highlight that sustainability, electrification readiness, and climate risk are not yet consistently embedded in early-stage planning and business case development. As a result, opportunities for cost-effective and low-risk retrofit are often missed or constrained by late-stage decision-making (NSW Health, 2025b; Victorian Health Building Authority, 2021).

Governance arrangements also shape delivery models, including staged retrofits, public–private partnerships, and cross-sector collaboration. For adaptive reuse projects, governance complexity increases further, requiring coordination between health authorities, planning agencies, heritage bodies, and community stakeholders.

2.6 Urban regeneration

Healthcare facilities often occupy strategically located sites within urban and regional contexts. Decisions to retrofit, redevelop, or repurpose these assets can therefore influence broader patterns of urban regeneration, place identity, and economic activity.

Adaptive reuse of healthcare buildings has been shown to support neighbourhood revitalisation, heritage conservation, and local employment, particularly when projects are integrated with wider precinct planning and public realm improvements (Chen et al., 2018; Langston & Shen, 2007). Even healthcare-to-healthcare retrofits can contribute to place-based outcomes by improving accessibility, reducing environmental burdens on surrounding communities, and reinforcing the role of health precincts as civic anchors.

2.7 Compliance, safety, and risk management

Finally, retrofit and adaptive reuse decisions must address compliance, safety, and risk across regulatory, technical, and social dimensions. Healthcare buildings are subject to stringent building codes, fire safety requirements, infection control standards, and accreditation processes, all of which can constrain retrofit options.

Legacy risks — including hazardous materials, structural limitations, and contamination — are particularly prevalent in older healthcare assets and can significantly affect feasibility and cost. In adaptive reuse projects, additional risks may arise from planning approvals, stakeholder opposition, or displacement concerns, requiring careful risk identification and mitigation strategies.

2.8 Summary of key considerations

This section provided an overview of the key consideration associated with retrofit and reuse of healthcare assets. This highlights the complexity that stakeholders face when making decisions in relation to the healthcare retrofit and repurpose pathways. The early phases — problem definition and option identification — offer the greatest ability to reflect on these key considerations and ensure the achievement of desired outcomes. Table 4 outlines the summary of the considerations explained in this section.

Table 4
Pre-design scoping map for healthcare building retrofit and adaptive reuse

Key area of consideration	Issues to be scoped
1. Environment & resource performance	• Operational energy use and carbon emissions reduction opportunities (efficiency, electrification, renewables) • Embodied carbon implications of retention, demolition or replacement of structures and materials • Construction and demolition waste minimisation and material reuse potential Indoor environmental quality implications (ventilation, thermal comfort, daylight, acoustics) • Climate-related risks (heatwaves, flooding, extreme weather) and passive survivability of the building • Circular economy opportunities (reuse, refurbishment, design for disassembly)
2. Service functionality	• Functional suitability of existing spaces for current and future models of care • Spatial programmability, flexibility and capacity for adaptation over time • Circulation, accessibility and separation of patient, staff and service flows • Continuity of operations during retrofit, including staging, decanting and disruption management • Compatibility with digital health, medical technologies and evolving clinical requirements
3. Financial aspect	• Whole-life cost implications, including capital, operational, maintenance and renewal costs • Balance between upfront investment and long-term operational savings • Long-term asset performance, reliability and maintainability • Budget constraints, funding cycles and feasibility of staged investment
4. Social impact	• Impacts on patient experience, staff wellbeing and dignity • Accessibility, inclusivity and equity for vulnerable populations • Psychological safety, comfort and human-centred environmental quality • Community access to services and continuity of care during and after works • Cultural sensitivity and expectations of diverse user groups
5. Value management & governance	• Alignment with health service strategies, asset plans and net zero commitments • Timing and integration of sustainability, electrification and climate risk considerations in early planning • Delivery and procurement models appropriate to retrofit or adaptive reuse contexts • Roles, responsibilities and coordination across clinical, technical and financial stakeholders • Asset disposal, reinvestment and portfolio optimisation considerations
6. Urban regeneration	• Relationship between the healthcare asset and its surrounding urban or regional context • Heritage value, place identity and conservation considerations • Contribution to neighbourhood vitality, public realm and amenity • Employment, skills development and local economic impacts • Land-use change implications where adaptive reuse is considered

Key area of consideration	Issues to be scoped
7. Compliance, safety & risk management	• Regulatory compliance pathways for existing buildings and change-of-use scenarios • Fire and life safety requirements, particularly during staged works in occupied facilities • Infection prevention and control risks associated with construction and refurbishment • Legacy risks such as hazardous materials, contamination and unknown building conditions • Planning approvals, stakeholder concerns and reputational risks

The following sections build on these key considerations by examining how these aspects manifest in real-world case studies.

While these key areas of consideration are presented as distinct dimensions, in practice they rarely operate independently in retrofit decision-making processes. Environmental performance targets, service functionality requirements, financial constraints and governance priorities often interact in complex and context-specific ways, requiring trade-offs to be made across competing objectives. At present, there is limited guidance on whether these considerations should be addressed sequentially (e.g., compliance and service continuity as threshold criteria) or concurrently through integrated appraisal processes.

The relative importance or weight assigned to each decision dimension is also likely to vary across asset types, project scales and organisational priorities. Determining such weightings would typically require structured stakeholder input through qualitative or quantitative approaches (e.g., expert elicitation, multi-criteria decision analysis or Delphi-based methods), which are beyond the scope of the present whitepaper. However, this represents an important direction for future research, particularly in developing retrofit decision-support frameworks applicable to non-hospital and community healthcare assets within portfolio-level infrastructure planning contexts.

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3
Case studies – Australian and international

Evidence from international and Australian case studies, listed in Table 5, demonstrates that healthcare building retrofit and adaptive reuse can deliver substantial environmental, economic, and social benefits when guided by robust decision-making. These cases highlight that effective healthcare retrofit decisions require balancing environmental performance with clinical functionality, operational continuity, cost constraints, and broader social and organisational objectives.

Table 5
International and **Australian case studies of healthcare building retrofit and adaptive reuse**

Case	Project Description	Retrofit / Adaptive Reuse Design Summary	Benefits Summary
Historic Ashe Hospital, Jefferson, North Carolina (USA) (Policy Development and Research, n.d.)	Former county hospital built during the 1930s under the Works Progress Administration (WPA), located in Jefferson, NC (population ~1,420). The original hospital ceased operation in the 1970s and remained vacant for decades. The adaptive reuse project restored the historic building and added a new wing, creating 46 housing units for low-income seniors and people with disabilities. The project was completed in the late 2010s with funding from Low-Income Housing Tax Credits (LIHTC) and federal and state historic tax credits.	Adaptive reuse design: Conversion from a disused hospital to affordable and supported housing. Original hospital structure retained and refurbished; a new wing was added to increase capacity. Internal spaces were reconfigured into residential units, community room, library, and spaces for on-site social services. Energy Star standards were applied through building envelope upgrades, efficient systems, and reuse of the existing structure.	Social & community benefits: Provision of affordable and supported housing; protection of a historic community landmark; enhanced quality of life for elderly and disabled residents. Environmental benefits: Reduced embodied carbon through reuse of existing structure; improved operational energy efficiency. Economic benefits: Cost-effective redevelopment using tax incentives; contribution to rural community revitalisation.
Tuberculosis Hospital Conversion (USA) (Villardi, 2023)	Former tuberculosis hospital, originally designed for long-term institutional healthcare use, later rendered obsolete due to changes in medical practice. The building was converted into affordable and supportive housing, targeting vulnerable populations with integrated social and health support services.	Adaptive reuse design: Change of use from healthcare facility to supported residential housing. Spatial adaptation focused on converting wards into self-contained residential units, improving accessibility, and integrating shared facilities for community and support services. Original building form largely retained to minimise demolition.	Social benefits: Provision of stable housing and integrated support services for vulnerable groups; improved social inclusion and community reintegration. Environmental benefits: Avoidance of demolition-related emissions; reduced material consumption through reuse. Operational benefits: Lower operational costs compared to institutional healthcare use.

Case	Project Description	Retrofit / Adaptive Reuse Design Summary	Benefits Summary
Former Royal Cornhill Hospital, Aberdeen (UK) (Aberdeen City Council, 2014)	Large former hospital site located on Berryden Road, Aberdeen. The redevelopment includes partial demolition and partial reuse of existing hospital buildings. The project delivers approximately 323 residential units, including new houses, new-build flats, and 36 apartments converted from existing Upper Hospital buildings.	Mixed retrofit and adaptive reuse: Selective retention and conversion of existing hospital buildings into residential apartments, combined with new residential construction. Existing building fabric reused where feasible, while new blocks were introduced to meet housing demand and urban design requirements.	Urban regeneration benefits: Redevelopment of a brownfield healthcare site; increased housing supply including affordable housing. Environmental benefits: Reduced embodied carbon through partial reuse of existing structures. Social benefits: Improved urban connectivity, open spaces, and residential amenity.
May Day Hills Hospital (Beechworth), La Trobe University Campus (Australia) (Australian Government Department of the Environment and Heritage, 2004)	Former psychiatric hospital complex in Beechworth, Victoria, originally established in the 19th century. The site was adaptively reused as a La Trobe University campus and education/training facility, including accommodation and hospitality training functions.	Adaptive reuse design: Conversion from psychiatric healthcare facility to education and training campus. Heritage buildings were retained and refurbished; internal layouts adapted for teaching, accommodation, and administrative uses. The project emphasised conservation of cultural heritage while introducing new functions.	Cultural & social benefits: Preservation of a significant heritage site; support for regional education, employment, and tourism. Environmental benefits: Avoided demolition and new construction impacts; extended building life cycle. Economic benefits: Regional revitalisation and place-making.
Queensland Children's Hospital Retrofit – Net Zero Energy Case (Australia) (Wang et al., 2025)	The hospital is a major urban hospital located in subtropical Queensland, retrofitted to achieve net zero operational energy emissions. The project focused on upgrading building systems rather than change of use, within an operational hospital context.	Deep retrofit design: Retained healthcare function. Interventions included high-performance HVAC upgrades, on-site renewable energy generation, energy-efficient lighting, and advanced building management systems. Retrofit works were staged to maintain continuous hospital operation.	Energy & carbon benefits: Achieved net zero operational energy emissions; significant reductions in operational energy use and GHG emissions. Operational benefits: Improved system reliability and reduced long-term energy costs. Strategic benefits: Alignment with government net zero targets and leadership in sustainable healthcare infrastructure.
Peninsula University Hospital (formerly Frankston Hospital), VIC (Australia) (Victorian Health Building Authority, 2026)	The public hospital in Frankston, Victoria, originally established in 1941 and redeveloped as Peninsula University Hospital with a $1.1 billion investment. Main works completed and opened in 2026, including a 12-storey clinical services tower, expanded emergency, mental health, oncology, maternity and paediatric services.	Major redevelopment with sustainability focus: Entire facility rebuilt/expanded; all-electric design and integrated water & energy-saving technologies; rooftop solar capacity ~800 kVA; co-designed for wellbeing and environmental performance.	Environmental benefits: Estimated annual reduction of ~4,084 t CO_2e; ~23 % reduction in energy use across Peninsula Health sites; ~3 % water saving (2,896 kL) from design measures. Operational benefits: expanded clinical capacity; reduced patient wait times and improved service delivery; modern facilities enhancing staff and patient wellbeing. Social: improved access to healthcare for growing community and stronger local health

Case	Project Description	Retrofit / Adaptive Reuse Design Summary	Benefits Summary
John Hunter Hospital & NICU Sustainability Initiatives, NSW (Australia) (Climate and Health Alliance, 2024)	Major tertiary teaching hospital (~820 beds) in Newcastle, NSW. Sustainable healthcare initiatives include the Neonatal Intensive Care Unit (NICU) action group focusing on waste and carbon reduction.	Sustainable operational interventions: NICU waste reduction initiatives — recycling single-use plastic baby bottles into usable products; replacing high-plastic nappies with compostable alternatives; diverting decommissioned equipment for reuse and staff education programmes.	Environmental benefits: ~5 tonnes of plastic diverted from landfill; reduced waste decomposition time from ~500 yrs to ~45 days; lower carbon footprint for unit operations. Behavioural & social benefits: staff and parent education on sustainability; transferable practices for broader hospital sustainability planning.
Queensland Children's Hospital (CHQ), QLD (Australia) (Queensland Government, 2024)	Major pediatric hospital in Brisbane committed to embedding sustainability through organisational climate and environmental targets (CREST Plan 2025–2029), focusing on reducing emissions, waste, energy and water use.	Strategic sustainability integration: Infrastructure, carbon reporting, energy and water audits and renewable strategies integrated at system level across CHQ facilities; climate resilience and low-carbon care planning central to operations (not a single retrofit project but a whole-of-facility sustainable transition).	Operational environmental benefits: Diversion of ~500 t waste from landfill; significant reduction in paper use (~44 %); ongoing energy & water efficiency improvements. Strategic benefits: Climate resilience planning and low-carbon healthcare delivery institutionalised; benchmarking and emissions reporting advancing sector leadership.
Western Health Sustainability Initiatives, VIC (Australia) (Western Health, 2023)	Western Health network (Melbourne) with sustainability planning and operational interventions (including greenhouse gas emissions analysis and improved practices in clinical settings).	Sustainable operational interventions: Examples include changes to anaesthetic gases to reduce high-GWP agents; broader sustainability planning towards net zero emissions by 2050 via energy efficiency and resource interventions (institution-wide plan rather than singular retrofit project).	Environmental benefits: Reduced GHG emissions through lower-impact clinical practices; sustainability leadership driving future efficiency and emissions planning. Operational: Lower resource use; increased awareness and environmental practice adoption within clinical operations.
John Hunter Health & Innovation Precinct (JHH), NSW (Australia) (BVN, n.d.)	Expansion project for the John Hunter Health & Innovation Precinct incorporating sustainability in design for new Acute Services Building, including passive design and rainwater management.	Sustainable design features: Passive design optimisation for natural light and ventilation; water run-off management and rainwater harvesting; landscape integration to reduce environmental impacts.	Environmental benefits: Reduced energy demand through passive strategies; improved water management; enhanced patient experience through biophilic design. Functional: Modernised precinct supporting integrated healthcare and research operations.

Table 6, suggests that non-hospital and community-based healthcare facilities present particularly viable opportunities for retrofit and adaptive reuse interventions. Unlike large hospital campuses, which are typically capital-intensive and operationally complex, primary healthcare clinics, community health service centres and small-scale outpatient facilities offer more feasible and scalable upgrade pathways within existing asset portfolios.

The importance of community-scale healthcare retrofit is particularly evident in Aboriginal community-controlled health and wellbeing infrastructure. Infrastructure Victoria and VACCHO's joint report notes that many ACCO facilities are operating from buildings that are no longer fit for purpose, including buildings described as "hand-me down" assets that were not designed for current community health functions. This creates constraints for service delivery, staff wellbeing, cultural safety, accessibility and environmental performance and reinforces the need for retrofit and adaptive reuse frameworks that are sensitive to different healthcare settings.

The following case studies illustrate this potential across diverse contexts in Australia, including both retrofit and adaptive reuse of healthcare service facilities. Collectively, these examples demonstrate how targeted retrofit and adaptive design strategies can reduce operational energy use, improve indoor environmental quality and thermal comfort, lower upfront capital expenditure compared to new construction, and contribute to broader community and social benefits, and urban regeneration outcomes through the mitigation of urban blight, which align with the relative considerations outlined in Section 2.

Table 6
Non-hospital /community healthcare retrofit case studies

Case study (country / location/year)	Asset type	Retrofit / reuse approach	Key retrofit measures	Reported outcomes	Related considerations (mapped to Section 2 criteria)	Evidence source
Wanarn community healthcare clinic (Australia / WA, very remote), in 2022	Remote community primary healthcare clinic (non-acute)	Performance assessment → targeted upgrade options	Field monitoring + staff comfort surveys to quantify thermal environment; creation/calibration of performance evidence base to support selecting appropriate interventions for remote clinics (e.g., strategies to improve thermal comfort and reduce operational energy burden).	Evidence highlights seasonal thermal comfort challenges and the need for context-specific interventions in hot/arid remote settings; provides measured data useful for simulation and retrofit option testing.	Environment & resource performance; Service functionality; Social impact; Financial aspect; Compliance, safety & risk management	(Udom, 2022)
Better Health Network – Parkdale Community Health Site (Australia, VIC, retrofitted late-1990s)	Community health centre (former community hospital)	Adaptive reuse of former hospital buildings into community health service facilities	Interior reconfiguration for consulting rooms, dental services and allied health; compliance upgrades including sterilisation infrastructure	Enabled delivery of multiple community services; highlighted limitations of retrofitting ageing buildings to meet modern clinical standards	Service functionality; Compliance, safety & risk management; Financial aspect; Social impact; Value management & governance	(Hanna, 2025)
Gippsland Lakes Complete Health – Bairnsdale sites (Australia, VIC, ongoing upgrades reported 2024)	Community health service facilities	Adaptive reuse of existing small buildings (some former residential buildings) for community health services	Building adaptation for consulting spaces and service delivery areas; accessibility upgrades	Enabled provision of local health and social support services but also highlighted challenges of ageing building stock	Environment & resource performance; Compliance, safety & risk management; Service functionality; Financial aspect; Social impact	(Hanna, 2025)
Community health organisations in Victoria (multi-site infrastructure portfolio, Australia, reported 2024)	Network of community health centres (allied health, dental, counselling)	Ongoing refurbishment and infrastructure upgrades across ageing facilities	Maintenance upgrades, HVAC improvements, accessibility improvements and spatial upgrades to meet service requirements	Infrastructure condition directly affects service capacity; many facilities require upgrades to meet increasing demand	Service functionality; Financial aspect; Compliance, safety & risk management; Urban regeneration; Value management & governance; Social impact	(Hanna, 2025)

In addition, the following Table 7 presents a selection of projects funded under the Community Energy Efficiency Program (CEEP)(Department of Climate Change, Energy, the Environment and Water, n.d.). The CEEP was an Australian Government initiative aimed at improving the energy efficiency of community-scale facilities through targeted retrofit interventions. The program primarily focused on enhancing the operational energy performance of publicly accessible buildings, including community centres, health facilities, and other local service infrastructures. Given this community-scale focus, the CEEP projects provide useful precedents for retrofit strategies applicable to community-level healthcare buildings. Although many of the interventions were primarily energy-focused—such as lighting upgrades, HVAC improvements and building system optimisation—they demonstrate practical approaches for improving energy performance in existing community-serving facilities.

Table 7
Non-hospital healthcare building retrofit projects in CEEP program

Case study (country / location/year)	Asset type	Retrofit / reuse approach	Key retrofit measures	Reported outcomes	Related considerations (mapped to Section 2 criteria)	Evidence source
Merri Community Health Services – 93 Bell Street Coburg (Australia / VIC) in 2013	Community health service facility providing allied health + nursing (non-acute)	Implemented energy retrofit within broader refurbishment	HVAC replaced with energy-efficient VRF/ VRV system; lighting upgraded with occupancy sensors; envelope/ amenity works alongside (insulation, sealing, skylight/ roof rectification, blinds).	Reported reductions in energy use and cost-plus improved comfort; projected ~21% savings on baseline; post-commissioning period showed ~29% reduction in average daily electricity consumption (Oct–May comparison method described in report).	Environment & resource performance; Service functionality; Financial aspect; Social impact; Value management & governance	(Australian Government Department of Industry, 2013)
Raymond Terrace Community Care Centre (Australia, NSW, 2014 retrofit)	Community care / mental health service facility	Building energy retrofit of existing community service centre	Replacement HVAC units; building management system (BMS); system optimisation	Reduced electricity consumption and improved occupant comfort	Environment & resource performance; Financial aspect; Service functionality; Social impact; Value management & governance	(Australian Government Department of Industry, 2014)
UnitingCare Community Facilities (Australia, QLD, 2014 program)	Network of community care and support service buildings	Portfolio-level retrofit program across multiple facilities	Lighting upgrades, HVAC optimisation, energy management measures	Reduced electricity consumption and operational costs across facilities	Environment & resource performance; Financial aspect; Service functionality; Social impact; Value management & governance	(Australian Government Department of Industry and Science, 2014)

Case study (country / location/year)	Asset type	Retrofit / reuse approach	Key retrofit measures	Reported outcomes	Related considerations (mapped to Section 2 criteria)	Evidence source
Southern Cross Care sites (Australia, WA, 2014 program)	Aged-care and community support service facilities	Multi-site energy efficiency retrofit program	Lighting upgrades, HVAC improvements, building energy management	Improved energy performance and reduced operational energy costs	Environment & resource performance; Financial aspect; Service functionality; Social impact; Compliance, safety & risk management	(Australian Government Department of Industry and Science, 2015)
Nunkuwarrin Yunti Community Health Service (Australia, SA, 2014 retrofit)	Aboriginal community health service facility	Energy retrofit of existing community health service building	Lighting and HVAC efficiency improvements	Reduced electricity use and improved building energy performance	Environment & resource performance; Financial aspect; Service functionality; Social impact; Value management & governance	(Australian Government Department of Industry, 2015)

To better understand these decision drivers, each of the above case studies was reviewed and the key issues described in the project reports were mapped to the seven considerations identified in Section 2 of this paper. Where the reports explicitly described project objectives or outcomes, such as energy efficiency improvements, service delivery upgrades, funding mechanisms or community benefits, these were directly associated with the relevant considerations. In other instances, the considerations were inferred from the context of the project descriptions, for example when upgrades to HVAC systems were undertaken to improve indoor comfort for patients and staff (relating to both environmental performance and service functionality), or when government-funded retrofit programs aimed to reduce operational costs while maintaining community healthcare services (relating to financial, governance and social considerations).

Importantly, these considerations are rarely taken into account in isolation. The case studies suggest that retrofit interventions typically involve balancing multiple objectives simultaneously. For example, investments in energy efficiency measures may improve environmental performance while also reducing operating costs, enhancing service conditions and supporting broader community benefits. This indicates that the considerations identified in Section 2 are inherently interrelated and often influence each other during project planning and implementation.

However, while these dimensions are implicitly reflected in many retrofit projects, the reviewed reports do not present a structured decision-making framework that explicitly integrates these considerations or guides how trade-offs should be evaluated. This highlights a current gap in guidance for healthcare building retrofit and adaptive reuse, where stakeholders must often navigate complex and interrelated factors without a clearly defined framework for systematically considering them.

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4
What requirements and targets shape healthcare retrofit decisions in Australia?

While Section 2 outlined the essential considerations relevant to healthcare retrofit in general, this section focuses specifically on how these considerations may be framed, prioritised and operationalised within the context of the Australian policy frameworks, guidelines and regulatory expectations.

Australia does not currently prescribe uniform technical retrofit standards for healthcare buildings; however, several policy frameworks and guidelines shape expectations, such as:

- Victorian Health Building Authority (VHBA) sustainability guidelines and Net Zero Building Handbook
- NABERS energy and water performance ratings for public hospitals
- Infrastructure Australia Assessment Framework, which embeds sustainability and resilience as core evaluation criteria

In the Australian context, acceptable, compliant and value-for-money upgrade pathways for existing healthcare assets are shaped by a combination of state-level health infrastructure guidance, national infrastructure assessment frameworks, and sector-specific regulatory expectations. In practice, this means that healthcare retrofit projects in Australia are not guided by a single prescriptive code, but are instead influenced by a layered set of requirements that emphasise early planning, whole-of-life value, operational continuity and alignment with long-term public objectives such as net zero emissions and climate resilience. For public healthcare assets in particular, retrofit decisions must demonstrate consistency with government expectations for capital works, risk management and service delivery, rather than focusing solely on technical performance improvements. Accordingly, retrofit projects are required to be well scoped, justified and governed, and sustainability, resilience and service requirements should be formally embedded in early project stages.

4.1 Victorian Health Building Authority (VHBA) guidance: Sustainability Guidelines and Net Zero Building Handbook

In Victoria, the retrofit and refurbishment of public healthcare facilities is shaped by guidance issued by the Victorian Health Building Authority (VHBA). VHBA does not prescribe specific retrofit solutions; however, it establishes clear expectations regarding the issues that must be addressed across healthcare capital works, including upgrades, refurbishments and asset renewal projects.

The *Guidelines for Sustainability in Capital Works* (VHBA, 2021) set out mandatory sustainability considerations for public health infrastructure projects, explicitly covering both new developments and works to existing facilities. The guidelines emphasise that sustainability objectives—such as improved energy efficiency, reduced operational emissions, electrification readiness, and responsible material selection—should be integrated from the earliest planning and business case stages, rather than treated as optional or late-stage design enhancements.

Importantly for healthcare retrofit, the VHBA guidance adopts a whole-of-life perspective, recognising that decisions made during early scoping and option selection can lock in long-term operational costs, carbon impacts and maintenance burdens. This approach is operationalised through the use of recognised performance assessment tools. In particular, the guidance promotes the use of the National Australian Built Environment Rating System (NABERS) (NABERS, 2022) to assess and benchmark operational energy performance of healthcare facilities, and indicates that NABERS may be used as an assurance framework for many large capital projects. In addition, the NABERS Embodied Carbon tool (NABERS, 2026) is referenced to evaluate the upfront carbon impacts of building construction and retrofit options. Together, these tools provide practical mechanisms for integrating operational and embodied carbon considerations into healthcare infrastructure planning. The guidelines also align healthcare capital works with broader Victorian government commitments to emissions reduction and climate resilience, reinforcing expectations that existing health assets contribute to state-level net zero targets.

In addition, VHBA's sustainability guidance is supported by complementary net zero and performance monitoring initiatives, which frame retrofit projects as part of a longer-term transition of the healthcare asset portfolio. While these documents do not dictate how retrofit should be undertaken, they clearly establish what public healthcare projects are expected to demonstrate in terms of sustainability intent, performance alignment and accountability.

Additionally, the VHBA *Net Zero Building Handbook* (Victorian Health Building Authority, 2025) provides practical implementation guidance to support healthcare infrastructure projects in achieving net zero operational emissions. The handbook outlines design strategies and technical pathways for electrification, energy efficiency improvement, renewable energy integration, and transition away from fossil fuel–based systems. It also supports project teams in aligning capital works and retrofit decisions with Victoria's net zero targets by providing guidance on performance targets, system selection, and whole-of-life considerations for healthcare facilities.

4.2 Infrastructure Australia: whole-of-life value, resilience and governance expectations

At the national level, expectations for major public infrastructure investment—including healthcare asset upgrades—are influenced by the assessment principles set out by Infrastructure Australia. Although not healthcare-specific, Infrastructure Australia's *Assessment Framework* (Infrastructure Australia, 2021) provides an important reference point for how retrofit and redevelopment options are expected to be evaluated within Australian public decision-making.

Infrastructure Australia's Assessment Framework provides a nationally recognised process for evaluating major infrastructure proposals and establishing their strategic merit, economic value and broader social outcomes. The framework emphasises whole-of-life value, risk management and long-term outcomes rather than lowest upfront capital cost, and requires proponents to demonstrate how projects deliver net benefits over their lifecycle. In practice, the framework is intentionally high-level and sector-agnostic, providing general guidance applicable across infrastructure sectors rather than detailed technical requirements for specific asset types.

Nevertheless, sustainability and resilience considerations are embedded within the framework and supporting guidance. Infrastructure proposals are expected to consider greenhouse gas emissions, climate resilience and long-term environmental outcomes as part of the assessment process. For example, proponents are required to provide information on GHG emissions impacts and how these are accounted for in project evaluation, reflecting national emissions reduction commitments and the growing emphasis on decarbonisation in infrastructure planning. In addition, the framework encourages infrastructure planning that considers systemic risks, interdependencies and future climate conditions, recognising the need to strengthen resilience and long-term asset performance.

In the context of healthcare retrofit, these principles reinforce the importance of considering operational expenditure, lifecycle asset performance and climate resilience when evaluating upgrade options. However, similar to other national infrastructure guidance, the Assessment Framework remains largely principles-based, and does not provide detailed sector-specific guidance on how sustainability, resilience and decarbonisation objectives should be operationalised for existing healthcare assets.

While Infrastructure Australia does not define technical performance targets for healthcare buildings, its assessment principles shape how decisions are justified, prioritised and approved within public systems. As such, the framework provides an overarching context within which sustainability, service continuity and resilience considerations (identified in Section 2) must be articulated and balanced in Australian healthcare retrofit projects.

4.3 Australian guidelines and assessment frameworks landscape summary

Overall, the Australian context demonstrates that a range of policy frameworks, technical guidelines and performance assessment tools are available to inform healthcare infrastructure planning and upgrade decisions (shown in Table 8). These guidelines collectively address key priorities such as sustainability, climate resilience, net zero transition, infrastructure investment appraisal, and operational performance, and broadly align with international decarbonisation and health system resilience objectives as well as national and state policy targets in Australia.

However, these existing guidelines and assessment frameworks are largely developed for broader infrastructure planning, healthcare facility design, or sustainability performance evaluation, rather than providing detailed and integrated guidance specifically tailored to healthcare building retrofit and adaptive reuse decision-making. In particular, there remains a lack of comprehensive decision-support guidance that systematically integrates environmental, operational, economic, social and clinical considerations to support stakeholders in evaluating and prioritising retrofit strategies for existing healthcare assets. This gap highlights the need for structured decision-making frameworks to support healthcare building retrofit planning within the Australian context.

Many relevant national and state-level guidance indicates that sustainability, resilience and lifecycle performance considerations are increasingly embedded within healthcare infrastructure planning frameworks. While these documents originate from different domains, they collectively highlight a range of factors relevant to healthcare building retrofit and adaptive reuse. These include energy efficiency and environmental performance, greenhouse gas emissions reduction, climate resilience, lifecycle asset management, governance and quality improvement processes. The following Table 8 summarises key factors relevant to healthcare retrofit identified across the reviewed frameworks.

Table 8
Australian policy and technical frameworks shaping healthcare building retrofit decision-making

Framework / Guideline	Resource	Core Focus / Key Scope	Applicability	Relevant content to Healthcare Retrofit
Victorian Health Building Authority (VHBA) Sustainability Guidelines for Capital Works (Victorian Health Building Authority, 2021)	Victorian Health Building Authority (VHBA)	Sustainability requirements for healthcare capital works including energy efficiency, emissions reduction, water use, and environmental performance targets	New + Existing	Sustainability, lifecycle performance, energy efficiency, water efficiency, climate resilience
VHBA Net Zero Building Handbook (Victorian Health Building Authority, 2025)	Victorian Health Building Authority (VHBA)	Implementation guidance for achieving net zero emissions across asset lifecycle; electrification, energy demand reduction, renewable integration, lifecycle carbon assessment	New + Existing	Net zero, decarbonisation, low-carbon design, operational carbon, embodied carbon
Infrastructure Australia Assessment Framework (Infrastructure Australia, 2021)	Infrastructure Australia	National infrastructure appraisal framework covering problem definition, options analysis, cost–benefit evaluation, sustainability and resilience assessment	New + Existing infrastructure	Lifecycle value, sustainability, greenhouse gas emissions assessment, climate resilience, risk management
NABERS Energy and Water for Public Hospitals (NABERS, 2022)	NABERS (NSW Government / Australian Government collaboration)	Operational performance rating system based on measured energy and water consumption	Existing buildings only	Performance measurement, energy rating, water efficiency, benchmarking
Australasian Health Facility Guidelines (AusHFG) (Australasian Health Infrastructure alliance, 2007)	Australasian Health Infrastructure Alliance (AHIA)	National best-practice guidance for healthcare facility planning, spatial requirements, building services, infection control, safety and operational performance	New + Existing	Facility performance, environmental design, safety, patient wellbeing

Framework / Guideline	Resource	Core Focus / Key Scope	Applicability	Relevant content to Healthcare Retrofit
Healthcare Sustainability and Climate Resilience Module (Australian Commission on Safety and Quality in Health Care, 2025)	Australian Commission on Safety and Quality in Health Care	Governance framework for integrating sustainability and climate risk management into healthcare service delivery and infrastructure planning	New + Existing	Sustainability, climate resilience, environmental impact reduction measurement and quality improvement
National Safety and Quality Health Service (NSQHS) Standards (Australian Commission on Safety and Quality in Health Care, 2021)	Australian Commission on Safety and Quality in Health Care	Healthcare safety, quality and infection control requirements influencing facility design and operational environments	New + Existing facilities	Governance, safety, risk management, quality improvement

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5 Further research need and questions to be answered

Despite growing policy momentum, several gaps remain:

- How would decision-making frameworks explicitly distinguish between healthcare retrofit and adaptive reuse pathways?
- How should operational needs, embodied carbon, social value, climate resilience and financial considerations be weighted in different contexts? What data, tools, and benchmarks are needed to support evidence-based decision-making and project planning in relation to healthcare assets in Australia?
- What governance and financing models best support healthcare development or repurpose projects?
- How can healthcare retrofit strategies align with broader urban regeneration and housing objectives? And what methods could be used to address this?

Addressing these questions will be essential to scaling effective healthcare building retrofit programmes and maximising their contribution to decarbonisation, resilience, and public value.

The review of the existing literature and case study evidence in the previous sections highlight that making decisions about retrofit for healthcare requires a complex evaluation of numerous factors. In fact, justifying the business case and quantifying the value for money will involve considering a range of (mostly qualitative) factors and views of diverse stakeholders.

Despite the urgency and relevance, there is currently no integrated, evidence-based framework in Australia that systematically supports decision-making about retrofit, rebuild and new construction options for healthcare infrastructure. To address this gap, a project is defined at the Post Carbon Research Centre at RMIT to develop and validate a comprehensive decision-support framework to evaluate the suitability of retrofitting existing healthcare buildings or repurposing them for other uses. The framework will support strategic planning by healthcare authorities, infrastructure managers, and government agencies.

Such a framework would be particularly valuable for live and emerging asset-transition decisions, including former hospital sites, redundant inpatient buildings, underused heritage healthcare assets, and sub-acute facilities whose role may change as care models evolve. Rather than treating demolition, disposal or replacement as default outcomes, the framework would enable decision-makers to test whether retrofit, partial retention, adaptive reuse or precinct-level reintegration could deliver greater long-term environmental, financial, social, public, and community values.

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